CASE Laboratory & Shop Safety Home

CASE General Documents

CASE Safety Module Teacher Resources

CASE Laboratory and Shop Safety (LSS) is a module to help strengthen safety instruction for agricultural education classroom. Safety has three components: education, evaluation, and enforcement. The curriculum is designed as a supplemental tool to the education and evaluation of general shop and agriscience lab applications. Students inquire about general safety hazards and personal responsibilities through engaging strategies. Locally, a teacher should use additional instruction and assessments for equipment specific to shop equipment.

Unit 1 General Safety	**Lesson 1.1**	**Safety Starts with You**	**Teacher Notes**
	Lesson 1.2	**The Hazards Around You**	**Teacher Notes**
Unit 2 Shop Safety	**Lesson 2.1**	**Safe Setting**	**Teacher Notes**
	Lesson 2.2	**Understanding Safety by Doing**	**Teacher Notes**
Unit 3 Lab Safety	**Lesson 3.1**	**Lab Safety and Measurement**	**Teacher Notes**
	Lesson 3.2	**Food Safety**	**Teacher Notes**
Unit 4 SAE Safety	**Lesson 4.1**	**Safety in Your SAE**	**Teacher Notes**

CASE Copyright

Laboratory and Shop Safety Course Acknowledgements

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AgCentric, The National Council for Agricultural Education, and the staff of the Curriculum for Agricultural Science Education™ (CASE™) wish to acknowledge the significant contribution of the following team members in the development of this curriculum.

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Activity, Project, and Problem Modalities

CASE activities, projects, and problems (APP) are student-directed exercises written directly to the student that teach concepts through hands-on applications. CASE uses a series of inquiry approaches to develop student knowledge and skill in order to be able to solve real-world problems. All CASE APP include reflective conclusion questions to provide a summary and closure to each concept taught.

Activity

- Structured inquiry
- Develop skills and knowledge
- Apply across disciplines
- Predetermined outcomes

Project

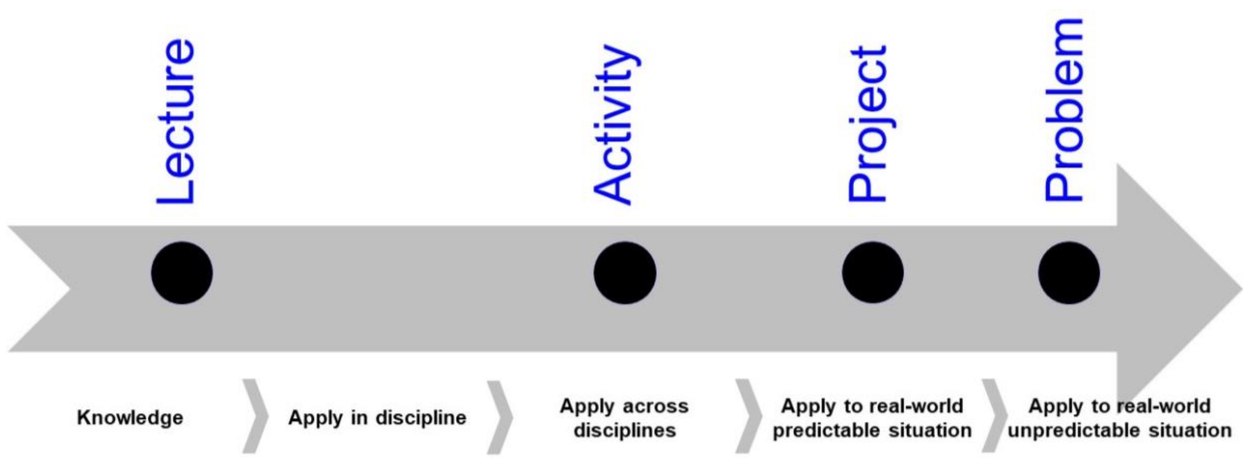
- Guided inquiry
- Apply skills and knowledge
- Apply to real-world predictable situation
- Predictable and variable outcomes

Problem

- Open inquiry
- Solve real-world problems
- Apply to real-world unpredictable situation
- Multiple outcomes

*A large body of research supports the use of **APP Modalities** to elevate learning experiences for students. The direct correlation with Daggett's (2005) Rigor/Relevance Framework® provides a clear understanding of how activities, projects, and problems **elevate the rigor** of student exercises, while at the same time **preserving the relevance** to the learner to **motivate full participation**.*

– CASE Lesson Development Philosophy



Knowledge Application Spectrum Adapted from Daggett's (2005) Rigor/Relevance Framework®

Activity, Project, and Problem Template Description

The following is an explanation of each section of an activity, project, or problem. For ease of discussion, the word "activity" will be used to represent all three styles.

Purpose

This section is written with the purpose of capturing student interest and excitement in completing the activity. In addition, information is provided that will guide students to learn key concepts and ideas through the completion of the activity that reflect the expectations of the lesson. The purpose section often sets up the inquiry for the activity that follows.

Materials

The materials section lists in bulleted format all equipment, materials, and supplies students will need in order to complete the activity successfully.

Procedure

The procedure is written directly to students and provides guidance on how to complete the activity. The procedure may be a step-by-step process if the purpose of the activity is to teach a particular skill to the student. It may give an open-ended, inquiry-based approach to the process or processes needed to complete the activity that is reflective of problem-based learning.

Conclusion

The Conclusion is a list of questions that will lead students to closure of the activity. These questions reflect back to the concepts, essential questions, and standards addressed in the lesson. As a result of answering these questions, students should see a direct connection between the activity and the lesson expectations. The teacher may choose to lead students through these questions as a group or have students work on the questions individually recording their responses in their Agriscience Notebooks. The teacher may consider using the questions as the basis for an end-of-lesson assessment.

CASE Lesson Development Philosophy

Curriculum for Agricultural Science Education (CASE) courses are developed using elements from pedagogical approaches that are recognized in educational literature as proven and effective modes of teaching and learning. This foundation ensures validity for CASE methodology and provides the recipe for the effectiveness of the CASE model. This paper presents the underlying philosophies that encompass the design elements employed by writers of CASE curricula. The CASE model is a careful blend of time tested instructional strategies used to guide students in their studies to meet the demands of post-secondary education and careers in the Agriculture, Food, and Natural Resources (AFNR) industries.

Building the CASE Foundation

Two primary works are the basis of influence for CASE pedagogy and are used predominately in the overall philosophy of CASE curricula design. *How People Learn* (Bransford, Brown, & Cocking, 2000) defines the audience of learners and epistemological considerations that CASE writers use to reach learners in an effective manner. The second text, *Understanding by Design* (Wiggins & McTighe, 2005) provides the road map used by CASE writers as they design specific lessons of instruction.

How People Learn examines the complexities of human thinking and ultimately provides a standard for designing learning environments. Because students learn in a multitude of ways, clear, discernable outcomes must be used to develop conceptual understandings with learners. Strategies are incorporated to help the learner organize information and properly situate knowledge in contexts that provide meaningful connections for the learner. Specifically, the strategies CASE uses include activities, projects, and problems crafted to address the cognitive, psychomotor, and affective domains of learners. More about activities, projects, and problems will be discussed in subsequent sections of this paper.

The CASE curriculum provides learners very focused and direct concepts set within a relevant context for the learner. This makes learning objectives very clear to students and ensures that previous misconceptions related to the subject matter are corrected and no new misconceptions are fostered. To accomplish this, the lesson design methodology that CASE uses originates from *Understanding by Design*. This writing prescribes a backward design curriculum approach focusing the instruction on specific goals related to the topic of study. The goals represent the knowledge the learner must know about a topic, or depending upon the intent of the goal, the deeper understanding that students must draw from the topic studied. CASE refers to the learning goals as “concepts” that students will know and understand after completing the lesson. The concepts are the intended learning outcomes of the lesson and provide the basis for assessing student performance based on clear and concise goals.

The concepts for CASE curricula are developed from brainstorming sessions involving expert teachers and industry representatives. Once developed and organized into a logical sequence of instruction, the second design element of *Understanding by Design* is implemented. The second stage prescribes the collection of evidence for student assessment. How do the student and teacher know that learning is taking place and that goals are being met? CASE writers determine the criteria that align with each concept. Essential questions are designed to guide students during instruction. These essential questions provide formative assessment that students can use to ensure they are on the right track toward learning the intended knowledge about the topic. Essential questions are crafted in a way to inspire deeper thought about a concept and elevate student thinking about a concept from knowing to understanding. Knowing facts and knowing how those facts fit together to create understanding is one element of learning. However, developing a deeper understanding allows a student to transfer the learning experience to other situations.

In the third and final phase, the scope of the exercises required to meet the demands of the concepts is determined. For CASE, this step begins to identify whether activities, projects, or problems are best suited to reach the learning goals defined by the concepts. At this point, important considerations are made to ratchet up the rigor of the content and instructional strategies used to teach the identified concept. Holding true to the traditions of agricultural education, a blend of knowledge and technical skills is situated within the relevant, real-life context of AFNR subject matter. Students are immersed into learning by doing through rigorous activity-, project-, and problem-based exercises that facilitate instruction related to each concept.

The CASE Mode of Delivery

Too many curriculum “packages” sell the idea of hands-on or inquiry-based learning, but in reality provide reams of didactic lecture that does not promote hands-on learning or inspire inquiry at the very sense of the word. Students must be motivated to become immersed in subject matter, and effective teaching must allow students to learn knowledge and practice skills in realistic settings (Dewey, 1916). Placing the learner in unpredictable, realistic environments elevates not only the relevance for the learner but also the rigor of the learning outcomes.

CASE adopted the Activity-, Project-, and Problem-Based (APPB) Modalities used by Project Lead The Way, Inc. (2006), as the modes of instructional strategies. The APPB Modalities are activity-, project-, and problem-based exercises that challenge the learner to develop specific skill, synthesize and create, and evaluate information to solve complex problems. These are the higher order cognitive skills that post-secondary institutions and industry are demanding from graduates, and are skills that teacher-directed, lecture-based instruction cannot deliver.

A large body of educational research supports the use of APPB Modalities to elevate the learning experiences for students. However, the direct correlation with the Rigor/Relevance Framework® (Daggett, 2005) provides a clear understanding of how activities, projects, and problems elevate the rigor of student exercises, while at the same time; preserve the relevance to the learner in order to motivate full participation.

Figure 1 depicts an illustration of the Rigor/Relevance Framework® developed by Daggett.

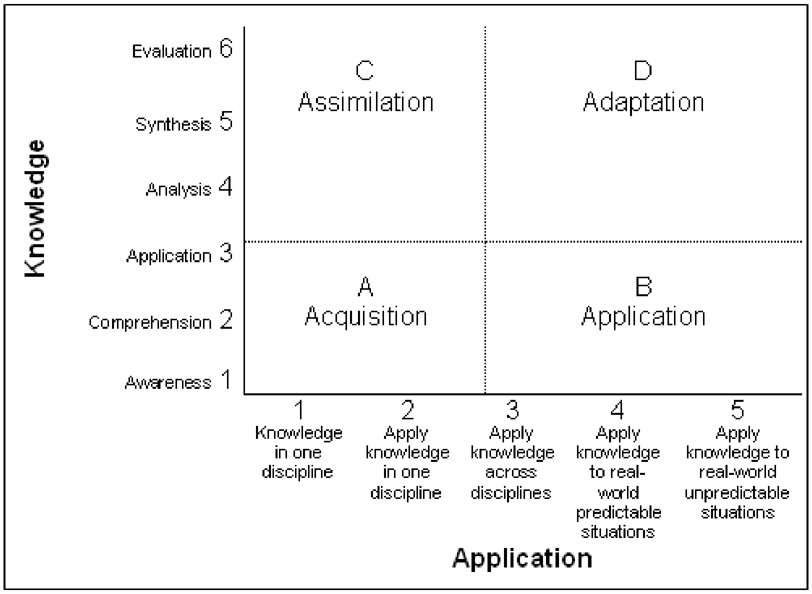


Figure 1. Rigor/Relevance Framework® (Daggett, 2005)

CASE *Activities* fit into the Daggett model shown in Figure 1, at the third level of the Application scale representing “Apply knowledge across disciplines.” Activities are designed to promote contextual application of agriculture, food, and natural resources content matter, while enhancing the natural connections with science, mathematics, and English language.

Projects in CASE curriculum align with level four of the Application scale. Projects provide students with learning experiences that teach real world skills and knowledge in a controlled way to ensure that students learn specific outcomes and concepts. Although constraints are provided to students during the course of a project, students are left with ample opportunities to develop creative strategies for completing the project.

According to the Rigor/Relevance Framework® in Figure 1, *Problems* used in CASE lessons apply knowledge to real-world unpredictable situations (level five on Application scale). This level is the most rigorous learning situation a student will endure and provides the richest connections with critical thinking and problem solving. Problems push students into quadrant D “Adaptation” of Figure 1. In this quadrant, students are challenged to answer tough questions as if they were in a real life situation that has multiple outcomes.

CASE employs the activity, project, and problem teaching modalities to promote rigor and relevance in lessons. A well-designed CASE course relies on a delicate combination of each modality to provide the knowledge base, technical skill, and eventually the cognitive reasoning required for solving complicated real life problems. By providing this balance of experiences, students are prepared for challenges of post-secondary education and future careers.

CASE Contributions to Core Academic Subject Matter

CASE provides alignment of lessons with academic standards for AFNR and core-academic subject areas for science, mathematics, and English language. In many situations, core academic standards are used in the development of lesson concepts when natural connections with science, mathematics, or English language elements are present in the context being addressed.

For example, when students conduct an inquiry-based activity involving seed germination, several science standards are incorporated for Unifying Concepts and Processes, Science as Inquiry, and Life Science. Mathematic standards are also addressed as students determine germination percentages and probability estimates. Students must communicate the results of their activity regarding seed germination by creating a written work sample explaining their procedures and findings, thus incorporating English language standards. At the same time, this activity is meeting AFNR content standards for Plant Systems.

Because CASE is a national curriculum for AFNR, national standards are aligned with CASE concepts. In 2009, The National Council for Agricultural Education released National AFNR Career Cluster Content Standards (The National Council for Agricultural Education, 2009). These standards define the student proficiency indicators related to knowledge and skills that students should reach when enrolled in AFNR courses. The AFNR content standards provide the validation of the contextual content for CASE lessons.

National standards for core academics are utilized from three primary sources, including National Science Education Standards (National Research Council, 1996), Common Core Mathematics, and Common Core English Standards (Common Core State Standards Initiative, 2012). These standards are universal across the nation, and although each state defines its own graduation standards, alignment to national standards can be accomplished rather easily.

CASE strives to ensure that core academics, such as science and mathematics are purposefully and properly taught during instruction rather than just identified in AFNR contexts. After specific lessons are identified that contain natural connections to core academic standards, two very important strategies are used to enhance science or mathematics objectives.

For science related exercises, CASE frames the activity, project, or problem using inquiry-based approaches. Colburn (2004) identified three types of inquiry-based approaches defined by the level of teacher involvement in the facilitation of a laboratory exercise. The three levels Colburn discusses are structured inquiry, guided inquiry, and open inquiry. These levels of inquiry align to the CASE modalities, respectively, with activities using structured inquiry, projects relying on guided inquiry, and open inquiry represented with problem-based learning experiences. Additionally, CASE provides students background knowledge and skills related to the use of science equipment and procedures necessary to collect evidence and scientifically measure various phenomena.

Recent studies for enhancing mathematics within Career and Technology Education (CTE) contexts, including agricultural education, have been conducted by the National Research Center for Career and Technical Education. A specific study by Stone et. al. (2006) examined the effectiveness of a model that identified a seven-step process to enhance mathematics within CTE context. The Seven Elements of a Mathematics Enhanced Lesson illustrated in Figure 2 was found to be an effective model for enhancing mathematics in a CTE context without sacrificing CTE content in the instructional process. CASE employs the use of the seven-element model when addressing instruction related to mathematics enhancement.

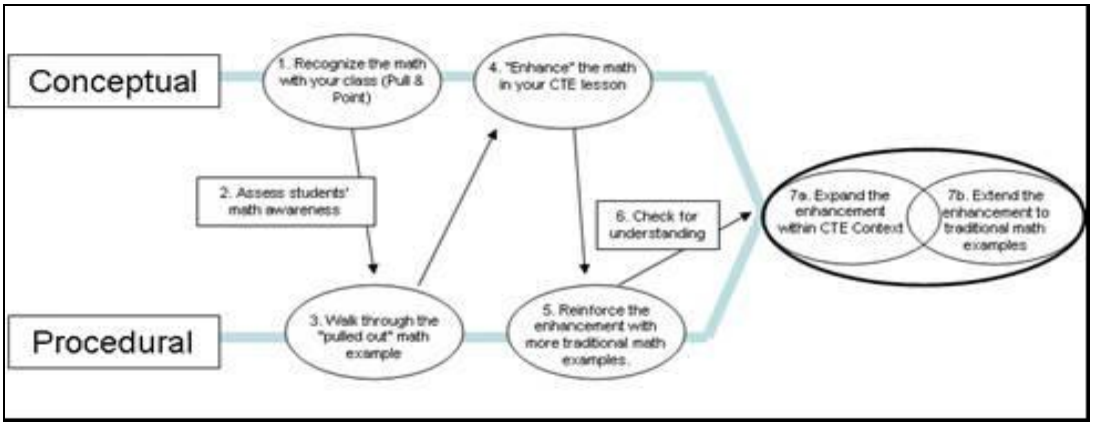


Figure 2. The Seven Elements of a Mathematics Enhanced Lesson (Stone, 2006)

The Three Circles of Agricultural Education

Agricultural education has a proud tradition of providing agriculture students a balanced approach to instruction. The three-circles of agricultural education (Figure 3) emphasize the importance of formal instruction (classroom), leadership and character education (FFA), and student-designed experiential learning (SAE). CASE recognizes the value of this proven method and incorporates each element throughout every lesson. Connections are provided as direct ties to the concepts of the lesson with extended opportunities for students to participate in FFA and SAE activities. Additionally, the use of E-Moments® (a component of LifeKnowledge® instructional resources) delivers effective and creative approaches for formative assessment and reinforcement of concepts.

Figure 3. Agricultural Education Model (Illustration is used with permission from the National FFA Organization, 2008)

Summary

CASE is based on solid instructional design that has been proven to have a positive impact on learners. The approaches presented in *How People Learn* and *Understanding by Design* provides the foundation for this curriculum, and the use of activity-, project-, and problem-based instructional strategies facilitate the student-directed learning process. Core-academic standards are enhanced during the instruction of lessons using inquiry-based techniques and the seven-element model for enhancing mathematics. These strategies are situated within agriculture, food, and natural resources contexts to provide rigor and relevance to the learner and prepare students for post-secondary and future careers in the AFNR industry. Careful design considerations are employed by CASE writers to incorporate all three dimensions of the agricultural education model to promote well-rounded experiences in CASE courses.

References

Bransford, J. D., Brown, A. L., & Cocking, R. R. (Eds.). (2000). *How people learn: brain, mind, experience, and school*. Washington, DC: National Research Council.

Colburn, A. (2004). Inquiring scientists want to know. *Educational Leadership, 62*(1), 63-67.

Daggett, W. R. (2005, September). *Achieving academic excellence through rigor and relevance*. Retrieved January 10, 2008 from http://www.daggett.com/pdf/Academic_Excellence.pdf

Dewey, J. (1916). *Democracy and Education*. New York, NY: The Free Press.

National Council for Agricultural Education. (2009). *National AFNR career cluster content standards*. Retrieved October 14, 2009 from http://www.teamaged.org/council/

Common Core State Standards Initiative. (2012). About the standards. Retrieved October 3, 2012, from http://www.corestandards.org/about-the-standards

National FFA Organization. (2008). *What is FFA?*. Retrieved September 4, 2008, from http://www.ffa.org/

National Research Council. (1996). *National science education standards*. Washington, DC: National Academy Press.

Project Lead The Way, Inc. (2006). *Activities-, project-, problem-based learning: A modality of teaching and learning*. Unpublished manuscript.

Stone, J. R., III, Alfeld, C., Pearson, D., Lewis, M. V., & Jensen, S. (2006). *Building academic skills in context: Testing the value of enhanced math learning in CTE* (Final study). St. Paul, MN: National Research Center for Career and Technical Education.

Wiggins, G. P, & McTighe, J. (2005). *Understanding by design*. Alexandria, VA: Association for Supervision and Curriculum Development.

CASE Major Concepts

Major Concepts

Concepts are the principles, theories, and recurring themes important to a student's understanding of a CASE™ course of study. Teachers use concepts to define what students are learning. In CASE curricula, each lesson has a list of concepts directly related to that lesson's major topics. Major concepts reach beyond a lesson and are emphasized in all CASE courses. The following major concepts are underlying themes throughout CASE curricula.

1. Agriculture, food, and natural resources systems produce the food, fiber, and fuel essential to daily life and contribute to the nation's economic wealth.
2. Individuals who pursue a program of study in agricultural education will benefit from leadership development, personal growth, and career exploration.
3. Agricultural science and engineering contribute to the development, improvement, and sustainability of living things.
4. Agricultural education establishes a relevant setting for applying mathematical practices and principles.
5. Effective interpersonal communication skills facilitate group processes and aid in solving complex problems and the achievement of common goals.
6. Reading and writing interpretation skills are necessary for educational and professional development.
7. Safety is an attitude of personal responsibility that students must practice in the agricultural classroom, laboratory, shop, greenhouse, and facilities.
8. Inquiry activities are essential in the practice of scientific processes and the world of research.
9. The use of technology and computer applications is critical to modern agricultural practices.
10. The ethical, environmental, social, and economic impacts of agricultural practices are essential to being a responsible, involved citizen.
11. Individuals involved with agricultural production processes must be proficient when performing technical skills.
12. Critical thinking involves using a variety of problem-solving techniques in real-life contexts.

Course General Documents

APP Modalities

APP Template Description

CASE Lesson Development Philosophy

CASE Major Concepts

Lesson Plan Template Description

CASE Safety Common Templates

Template	Word
Safety Standards Template	
Near Miss Report	
Tool Safety Checklist	
Tool Operation Template	

Employability Evaluation Rubric

Areas with Room for Improvement	Criteria	Areas that Meet or Exceed Expectations
	Productivity and Accountability Routinely uses time-management skills to overcome obstacles and complete assigned tasks on time, and to set standards. The student also helps classmates manage time, overcome obstacles, and develop a shared sense of accountability among classmates to deliver work meeting high standards.	
	Initiative and Self Direction Routinely exhibits initiative and self-direction when completing tasks, asking questions as needed, and keeping the teacher informed of progress. Uses knowledge of self-motivation and self-regulation to motivate others and lead by example to complete assigned tasks.	
	Interpersonal Skills Understands teamwork and works well with others while respecting individual differences. Exercises leadership skills to improve team morale and resolves conflicts while still completing the tasks on time.	
	Communication The student communicates verbally and actively listens to classmates and teacher. They comprehend written material and convey written and verbal information in a clear, concise manner.	
	Skill Applications Uses pre-taught reading, writing, and mathematical strategies to complete assigned tasks without teacher assistance. Independently applies scientific and engineering procedures when needed.	
	Equipment Use Uses tools and equipment for their intended purpose using safe procedures and teaches others how to use the equipment.	
	Safety Wears proper PPE and works with classmates to ensure they are always safe. Informs classmates and teachers of near misses and potential accidents.	

Name____

Safety Standards Evaluation Rubric

Areas with Room for Improvement	Criteria	Areas that Meet or Exceed Expectations
	Topic Description The students identify and thoroughly describe the topic in two or more sentences.	
	Questions The students write ten or more questions. Questions are easily answered, yes or no. The students write the questions so that a yes response is positive, and a no response requires action.	
	Addressing Safety Concerns Questions are appropriate and cover all safety concerns in the shop surrounding the assigned topic.	
	Relevancy All questions are relevant to the shop setting at school and the topic.	

Name____

Safety Standards Template

Topic

Description

Safety Standard	Yes	No
1.		
Recommendation if the answer is no.		
2.		
Recommendation if the answer is no.		
3.		
Recommendation if the answer is no.		
4.		
Recommendation if the answer is no.		

Safety Standard	Yes	No
5.		
Recommendation if the answer is no.		
6.		
Recommendation if the answer is no.		
7.		
Recommendation if the answer is no.		
8.		
Recommendation if the answer is no.		
9.		
Recommendation if the answer is no.		
10.		
Recommendation if the answer is no.		

CASE Safety Course Glossary

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A

Abrasion – A scraped spot or area resulting from rubbing or scuffing.

Accident – An undesirable or unfortunate happening that occurs unintentionally and usually results in harm, injury, damage, or loss; casualty; mishap.

Accident report – A document that details the facts about an accident in the facility.

Accuracy – The ability of a measurement to match the actual value of the quantity being measured.

Attitude – A manner, disposition, feeling, or position with regard to a person or thing; tendency or orientation.

B

Bending – To force an object from a straight form to a curved or angular one.

Biological hazard – A hazard in food that can cause illness from microbial growth, such as bacteria, viruses, or mold.

Bleach – A chemical, typically sodium or hypochlorite, used to whiten or sterilize material.

Boning knife – A type of kitchen knife with a sharp point and narrow blade used in removing bones of poultry and meat products.

Building code – A collection of regulations adopted by a city to govern the construction of buildings.

C

Career and Technical Education (CTE) – courses (high school level) and (college level) programs that focus on the skills and knowledge required for high-wage, high-skill careers.

Caution – Alertness and prudence in a hazardous situation; care; wariness.

Chef's knife – A large, general-purpose knife, usually eight to ten inches long.

Chemical hazard – A hazard in food that can cause illness from chemical poisonings, such as improperly stored food service chemicals or traces of chemicals on equipment.

Chlorine – Used to manufacture chlorine bleach, which can whiten and disinfect kitchen and bathroom surfaces.

Clean – To make an object free from dirt, grime, debris, etc. A process used to eliminate debris and some microbes from food manufacturing equipment.

Concentration – Removing a portion of water away from a product.

Contact Time – The time required by disinfectant products to have their effect. Will vary depending on product or method selected.

Current Good Manufacturing Practices (CGMPs) – General practices recommended by the Food and Drug Administration (FDA) to ensure product safety and quality.

D

Danger – Liability or exposure to harm or injury; risk; peril.

Data – Pieces of information, such as facts, statistics, or codes; an item of data.

Decibel (dB) – A unit of measurement of the volume of sounds.

Density – The mass per unit of volume.

Diagonal–cutting pliers – Pliers used to cut wire and light-gauge nails and bolts.

Disinfect – Kills almost all of the pathogens.

Disposal – To put in a particular or suitable place.

Distance – The amount of space between two things, points, lines, etc.

E

Ear canal cap – Canal caps resemble earplugs on a flexible plastic or metal band. Not all canal caps have tips that adequately block all types of noise.

Ear plugs – A device of pliable material for insertion into the outer opening of the ear (to keep out water or deaden sound).

Earmuffs – One pair of ear coverings connected by a flexible band and worn as noise protection.

Electrocute – To kill by electricity.

Emergency – A sudden, urgent, usually unexpected occurrence or occasion requiring immediate action.

Emergency Response Guide (ERG) – A reference used by first responders and hazardous materials technicians.

Environmental damage – Damage to the total of any or all the external conditions that may act upon an organism or community to influence its development or existence.

Experiment – A test, trial, or tentative procedure; an act or operation to discover something unknown or test a principle or supposition.

Extinguish – To put out (fire or light); put out the flame of something burning or lighted.

F

Fire blanket – A fireproof or flameproof material used for smothering small fires.

Fire extinguisher – A portable container, usually filled with special chemicals for putting out a fire.

Fire triangle – The three conditions, fuel, heat, and oxygen, that must be present to produce a fire.

First aid – Help for a victim immediately after an injury and before professional medical help arrives.

Foundational SAE – Conducted by all students in the agricultural education program consisting of Career Exploration and Planning, Employability Skills for College and Career Readiness, Personal Financial Management and Planning, Workplace Safety, and Agricultural Literacy.

Fuel – Any material that will burn.

G

Guard – A device, appliance, or attachment that prevents injury or loss.

H

Hazard – An unavoidable danger or risk, even though often foreseeable.

Hazardous material – A material capable of posing a health, safety, or property risk.

Health hazard – The likelihood of a material to cause, either directly or indirectly, temporary or permanent injury or incapacitation due to acute exposure by contact, inhalation, or ingestion.

Heat – The type of energy that causes the temperature of an object or environment to rise.

I

Immersion SAE – Allow students to build upon their foundational SAE activities by gaining real-world, hands-on experience within their chosen career path. The five types of immersion SAEs include: Placement/Internship, Ownership/Entrepreneurship, Research: Experimental, Analysis, or Invention, School-Based Enterprise, and Service Learning.

In-running nip points – Pinch points where machine parts move towards each other or when one part moves past a stationary object.

Injury – Harm or damage that is done or sustained.

International Building Code (IBC) – A model building code developed by the International Code Council.

L

Lockout – Removes a power source and installs a padlock that prevents the power from being turned on.

Lockout device – A lightweight enclosure that allows the lockout of a standard control device.

Lockout hasp – A is a multiple-lockout/tagout device.

Lockout Tagout (LOTO) – The practices and procedures necessary to disable machinery or equipment, thereby preventing the release of hazardous energy while employees perform servicing and maintenance activities.

M

Mass – The quantity of matter as determined by its weight.

Mercer Rules tool – A reference tool for culinary professionals for uniform cuts in food processing.

N

National Institute of Occupational Safety and Health (NIOSH) – A federal research agency focused on the study of worker safety and health and empowering employers and workers to create safe and healthy workplaces.

Near miss – An unplanned event that did not result in injury, illness, or damage – but had the potential to do

Noise duration – the time a person is exposed to the sound level.

Noise intensity – The decibel sound level.

Noise reduction rating (NRR) – A number assigned to hearing protection devices.

O

Observation – An act or instance of noticing or perceiving.

Occupational Safety and Health Administration (OSHA) – A federal agency that requires all employers to provide a safe environment for their employees.

Operating controls – A device for regulating and guiding a machine.

Oxygen – A colorless, odorless reactive gas that is one of the three ingredients necessary for a fire.

P

Pairing knife – A small knife for peeling or slicing fruits or vegetables.

Personal Protective Equipment (PPE) –Safety equipment worn for protection against safety hazards in the work area.

Petri dish – A shallow, circular, glass, or plastic dish with a loose-fitting cover over the top and sides for culturing bacteria and other microorganisms.

Petrifilm® – Used in many microbiology-related industries and fields to culture various microorganisms**.**

Physical hazard – A hazard in food that can cause illness due to physical objects such as a feather left in a chicken carcass or a metal shaving from food processing equipment in a candy bar.

Point of operation – Where work is performed on material**.**

Potato peeler – A special knife for peeling the skin from potatoes or other vegetables.

Procedure – One of a series of steps taken to accomplish an end.

Pull station – a manually operated device to initiate a fire alarm signal.

Punching – To strike or hit in operation.

R

Ready to eat (RTE) – Food ready to eat by the consumer without cooking or baking.

Reciprocating – To move alternatively back and forth.

Root cause – The most basic cause that can be reasonably identified.

Rotating – To turn around on an axis.

S

Supervised Agricultural Education (SAE) – A student-led, instructor-supervised, work-based learning experience that results in measurable outcomes within a predefined, agreed upon set of Agriculture, Food, and Natural Resources (AFNR) Technical Standards and Career Ready Practices aligned to a career plan of study.

Safety – The freedom from accidents.

Safety cabinet – A double-walled steel cabinet specifically designed for the storage of flammable liquid containers.

Safety can – A UL-approved container, not exceeding five gallons, that has a spring-padded lid on the spout to prevent the escape of explosive vapors but allow the relief of internal pressure.

Safety color – Color used as part of a standardized coding system according to which each color conveys a specific safety message.

Safety data sheet (SDS) – Printed documentation used to relay hazardous material information from the manufacturer, formerly known as material safety data sheet (MSDS).

Safety glasses – Glasses with impact-resistant lenses, reinforced frames, and side shields.

Safety goggles – Goggles that shield the eye against liquid or chemical splash, vapors, and fumes.

Sanitize – A process used to eliminate most microbes from food manufacturing equipment.

Serrated knife – A sharp-edge blade with saw-like teeth that enable cutting without damaging delicate or soft textures.

Shackle – A metal link, typically U-shaped, closed by a bolt, used to secure a chain or rope to something.

Shearing – To cut or clip with a sharp instrument.

Sodium hypochlorite – Used widely as the main component of cleaners with excellent bleaching and sterilizing effect.

Solution – A homogeneous mixture of one material is dissolved in another.

Sound level meter (SLM) – An apparatus for comparing sound-intensity levels, usually in decibels.

Standard Operating Procedure (SOP) – A set of written instructions that describes the step-by-step process that must be taken to perform a routine activity properly.

T

Tagout – Places a tag on the source of electrical power that indicates the equipment must only be operated once the tag is removed.

Tagout device – A prominent warning device, such as a tag and a means of attachment, which can be securely fastened to an energy-isolating device in accordance with an established SOP to indicate that the energy-isolating device and the equipment being controlled may not be operated until the tagout device is removed.

Temperature – A measure of the warmth or coldness of an object or substance with reference to some standard value.

Test strips – Measures total available chlorine in sanitizing solutions and gives PPM results in seconds.

Transversing – Movement in a straight, continuous line.

U

UL (Underwriters Laboratory Inc.) – An independent organization that tests equipment and products to verify conformance to national codes and standards.

V

Ventilate – To provide fresh air in place of air that has been used or contaminated.

Volume – The amount of space measured in cubic units that an object or substance occupies.

W

Warning – Something that serves to warn, give notice, or caution.

Course Inventory by Vendor

Amazon

Need	Qty/ 20	Qty/ 30	Unit	Item Specifications	Vendor
	10	14	Each	Chlorine test strips, 100ct, 2000 ppm	**Amazon** or local
	5	7	Each	Ear canal caps, semi-insert banded	Amazon or local
	5	7	Each	Ear plugs, custom molded	Amazon or local
	20	30	Pairs	Ear plugs, formable	Amazon or local
	5	7	Each	Ear plugs, pre-molded	Amazon or local
	5	7	Each	Earmuffs	Amazon or local
	10	15	Each	Electrical plug lockout device Fits most 110 and 220-volt plugs	**Amazon**
	10	15	Pair	Lockout hasp	**Amazon**
	1	1	Each	Lockout tagout 42-piece kit – Optional 6 lockout hasps 4 keyed different padlocks 1 ball-valve lockout 2 electrical plug lockouts 1 steel cable lockout 10 individual circuit breaker lockouts 16 tagout tags and zip ties	**Amazon**
	10	15	Pair	Padlock, keyed	**Amazon** or local
	80	120	Each	Zip tie, black, 6"	**Amazon** or local

American Technical Publishers

Need	Qty/ 20	Qty/ 30	Unit	Item Specifications	Vendor
	20	30	Each	*Agricultural and Technical Systems and Mechanics* textbook	American Technical Publishers

CASE Teacher Notes

Need	Qty/ 20	Qty/ 30	Unit	Item Specifications	Vendor
	1	1	Each	*Activity 1.1.1 Emergency Equipment Card*	CASE Teacher Notes
	1	1	Each	*Activity 1.1.4 Incident Cards*	CASE Teacher Notes
	10	15	Pair	*Activity 1.2.1 ERG Cards*	CASE Teacher Notes
	10	15	Pair	*Activity 1.2.3 Fire Extinguisher Cards*	CASE Teacher Notes
	20	30	Each	Activity 2.2.3 Lockout Tags	CASE Teacher Notes
	2	3	Each	*CGMP handwashing signs*	CASE Teacher Notes
	10	15	Pair	*ERG flowchart PDF*	CASE Teacher Notes
	20	30	Each	*MN CTE Safety Manual pg. 19-22*	CASE Teacher Notes
	20	30	Each	*Near Miss Report*	CASE Teacher Notes
	20	30	Each	*SDS form, ethanol*	CASE Teacher Notes
	20	30	Each	*SDS form, oil*	CASE Teacher Notes

Digital Application Store

Need	Qty/ 20	Qty/ 30	Unit	Item Specifications	Vendor
	10	15	Pair	*ERG 2020 digital application*	Digital application store

Lab-Aids

Need	Qty/ 20	Qty/ 30	Unit	Item Specifications	Vendor
	1	1	Each	Alcohol burner	Lab-Aids
	3	4	grams	Cumin	Lab-Aids
	1	1	Each	Dropper, plastic	Lab-Aids
	1	1	Bottle	Glo-Germ™ gel (white)	Lab-Aids or Ward’s
	1	1	Each	Petri dish	Lab-Aids
	1	1	Each	Pipet, 3ml	Lab-Aids
	1	1	Each	Test tube, plastic	Lab-Aids

Local

Need	Qty/ 20	Qty/ 30	Unit	Item Specifications	Vendor
	30	45	Each	*8½”x11” sheet of copy paper*	Local
	1	1	Each	Bleach, 8.25% sodium hypochlorite	Local
	5	7	Each	Calculator	Local
	2	3	Bunches	Cilantro	Local
	20	30	Each	Clipboard	Local
	20	30	Set	Colored pencils, assorted	Local
	-	-	-	Cool water source	Local
	5	8	Each	Cutting board	Local
	10	15	Each	Device with digital camera	Local
	20	30	Each	Device with Internet access	Local
	20	30	Each	Device with Internet access and word processing programs	Local
	10	15	Each	Device with word processing and presentation programs	Local
	5	7	Pair	Digital device (cell phone or Chromebook)	Local
	5	5	Each	Drill, hand, power	Local
	1	1	Each	Earplugs	Local
	1	1	Each	Emergency stop button	Local
	10	10	Each	Example workstations – See Teacher Notes	Local
	1	1	Each	Eye wash/shower station	Local
	1	1	Each	Face shield	Local
	1	1	Each	Fire alarm	Local
	1	1	Each	Fire blanket	Local
	1	1	Each	Fire extinguisher	Local
	1	1	Each	Fire-resistant shop coat	Local
	1	1	Each	First aid kit	Local
	1	1	Each	Flammable waste can	Local
	1	1	Pair	Gloves, foodservice	Local
	1	1	Pair	Gloves, leather	Local
	1	1	Pair	Gloves, nitrile	Local

	1	1	Pair	Gloves, rubber	Local
	1	1	Each	Hair ties	Local
	21	31	Each	Hairnet	Local
	5	8	Each	Hand soap	Local
	1	1	Each	Hard hat	Local
	10	15	Each	Highlighter	Local
	5	7	Each	Highlighter, green	Local
	5	7	Each	Highlighter, pink	Local
	5	7	Each	Highlighter, yellow	Local
	4	5	Box	Jell-O®, large	Local
	5	8	Each	Knife, chef	Local
	5	8	Each	Knife, paring	Local
	5	8	Each	Knife, serrated	Local
	1	1	Each	Leather chaps or apron	Local
	5	8	Each	Lime, food	Local
	10	15	Set	Markers	Local
	5	8	Each	Mercer rules tool	Local
	1	2	Each	Microwave	Local
	3	4	Each	Onion, red	Local
	1	2	Roll	Paper towel	Local
	25	40	Each	Paper, cardstock	Local
	10	15	Each	Paper, copier	Local
	3	4	grams	Pepper	Local
	5	8	Each	Pepper, jalapeno	Local
	10	15	Each	Permanent marker, black	Local
	5	7	Each	Petri dish or Petrifilm®, dirty	Local
	20	30	Each	PPE appropriate for each space	Local
	1	1	Each	Printer	Local
	1	1	Each	Respiration mask	Local
	20	30	Each	Ruler, metric	Local
	20	30	Each	Safety glasses	Local
	8	12	grams	Salt	Local
	20	30	Pair	Scissors	Local
	5	8	Each	Sink	Local
	5	8	Each	Spatula, silicone	Local
	20	30	Each	Spoon, plastic	Local
	4	6	Each	Stapler	Local
	3	5	Roll	Tape, masking	Local
	1	1	Roll	Tape, painter’s	Local
	1	1	Roll	Tape, transparent	Local
	5	7	Each	Timing device, electronic	Local
	15	24	Each	Tomato, roma	Local
	-	-	-	Water source	Local
	1	1	Each	Welding helmet	Local
	20	30	Each	Word processing software	Local
	1	1	Each	Work boots or leather closed-toed shoes	Local

Local – Tools

Need	Qty/ 20	Qty/ 30	Unit	Item Specifications	Vendor
	10	15	Each	Board,12’ 2”x4”, 3’ length	Local – Tools
	10	15	Each	Drill, hand, electric-powered	Local – Tools
	5	7	Each	Hammer, claw	Local – Tools
	35	49	Each	Nail, 4d	Local – Tools
	5	7	Each	Sander, powered	Local – Tools
	5	7	Each	Sandpaper	Local – Tools
	4	6	Each	Side cutters	Local – Tools
	5	7	Each	Tape measure, 100’	Local – Tools

Minnesota Dept. of Education

Need	Qty/ 20	Qty/ 30	Unit	Item Specifications	Vendor
	20	30	Each	*Minnesota Schools General Laboratory/Shop Safety Resource: Student Materials PDF*	**MN DOE CTE Safety**

Printed

Need	Qty/ 20	Qty/ 30	Unit	Item Specifications	Vendor
	2	2	Each	*Glo Germ™ Comparison Chart*	Printed
	1	1	Each	*CASE SDS Binder*	Printed
	20	30	Each	*Seven Common Accident Causes*	Printed

Vernier

Need	Qty/ 20	Qty/ 30	Unit	Item Specifications	Vendor
	1	1	Each	LabQuest	Vernier
	1	1	Each	Temperature sensor or Go Direct® temperature sensor	Vernier

Wards

Need	Qty/ 20	Qty/ 30	Unit	Item Specifications	Vendor
	5	7	Each	Beaker 1000mL	Ward’s
	20	30	Each	Beaker, 100ml	Ward’s
	4	6	Each	Beaker, 600ml	Ward’s
	1	1	Each	Burette clamp	Ward’s
	4	6	Each	Electronic balance	Ward’s
	84	124	Pair	Gloves, disposable, assorted sizes	Ward’s
	20	30	Each	Graduated cylinder, 100ml	Ward’s
	4	6	Each	Hot hand protector	Ward’s
	4	6	Each	Hot plate	Ward’s
	20	30	Each	Lab apron or coat	Ward’s
	20	30	Each	Lab coat, food	Ward’s
	1	1	Each	Microscope, compound	Ward’s
	1	1	Each	Ring stand	Ward’s

	20	30	Pair	Safety glasses	Ward’s
	20	30	Pair	Safety goggles	Ward’s
	20	30	Each	Stirring rod, glass	Ward’s
	1	1	Each	Support ring	Ward’s
	4	6	Each	Thermometer	Ward’s
	5	8	Each	UV light	Ward’s
	5	8	Each	Weighing dish, food	Ward’s
	21	31	Each	Weighing dish, 8.5×8.5×2.4 cm	Ward’s

Lesson Planning Documents

Lesson	Title	Lesson Plans		Glossary	Teacher Notes	Materials
Unit 1 General Safety						
Lesson 1.1	Safety Starts with You	**Word**	**PDF**	**Lesson 1.1**	**Lesson 1.1**	**Lesson 1.1**
Lesson 1.2	The Hazards Around You	**Word**	**PDF**	**Lesson 1.2**	**Lesson 1.2**	**Lesson 1.2**
Unit 2 Shop Safety						
Lesson 2.1	Safe Setting	**Word**	**PDF**	**Lesson 2.1**	**Lesson 2.1**	**Lesson 2.1**
Lesson 2.2	Understanding Safety by Doing	**Word**	**PDF**	**Lesson 2.2**	**Lesson 2.2**	**Lesson 2.2**
Unit 3 Lab Safety						
Lesson 3.1	Lab Safety and Measurement	**Word**	**PDF**	**Lesson 3.1**	**Lesson 3.1**	**Lesson 3.1**
Lesson 3.2	Food Safety	**Word**	**PDF**	**Lesson 3.2**	**Lesson 3.2**	**Lesson 3.2**
Unit 4 SAE						
Lesson 4.1	Safety in Your SAE	**Word**	**PDF**	**Lesson 4.1**	**Lesson 4.1**	**Lesson 4.1**

CASE Safety Module SAE for All Foundational Checksheet

By completing the *CASE Safety Module*, you have finished the *Workplace Safety* component of a **Foundational SAE** (https://saeforall.org/foundational-sae/). Complete the remaining *Foundational SAE Components* to complete a Foundational SAE.

Use the checksheet below to gather the documents proving your accomplishment. Then submit the checksheet and documentation to your instructor as evidence of your achievement.

Foundational SAE Components	Hands-on Performance Objective	Documentation
Career Exploration and Planning	• •	• •
Workplace Safety	• Prepare an emergency first aid booklet. • Develop a standard set of safety requirements for an agricultural shop.	• *Activity 1.2.5 Plan of Action* • First aid booklet • *Project 2.1.2 Setting the Standard* • *Safety Standard Template*
Employability Skills for College and Career Readiness	• •	• •
Personal Financial Management	• •	• •
Agricultural Literacy	• •	• •
Authentic Experience	• •	• •

Course Inventory by Vendor

Amazon

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	10	14	Each	Chlorine test strips, 100ct, 2000 ppm	**Amazon** or local
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	5	7	Each	Ear plugs, custom molded	Amazon or local
	20	30	Pairs	Ear plugs, formable	Amazon or local
	5	7	Each	Ear plugs, pre-molded	Amazon or local
	5	7	Each	Earmuffs	Amazon or local
	10	15	Each	Electrical plug lockout device Fits most 110 and 220-volt plugs	**Amazon**
	10	15	Pair	Lockout hasp	**Amazon**
	1	1	Each	Lockout tagout 42-piece kit – Optional 6 lockout hasps 4 keyed different padlocks 1 ball-valve lockout 2 electrical plug lockouts 1 steel cable lockout 10 individual circuit breaker lockouts 16 tagout tags and zip ties	**Amazon**
	10	15	Pair	Padlock, keyed	**Amazon** or local
	80	120	Each	Zip tie, black, 6”	**Amazon** or local

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CASE Teacher Notes

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	10	15	Pair	*ERG flowchart PDF*	CASE Teacher Notes
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	20	30	Each	*Near Miss Report*	CASE Teacher Notes
	20	30	Each	*SDS form, ethanol*	CASE Teacher Notes
	20	30	Each	*SDS form, oil*	CASE Teacher Notes

Digital Application Store

Need	Qty/ 20	Qty/ 30	Unit	Item Specifications	Vendor
	10	15	Pair	*ERG 2020 digital application*	Digital application store

Lab-Aids

Need	Qty/ 20	Qty/ 30	Unit	Item Specifications	Vendor
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	3	4	grams	Cumin	Lab-Aids
	1	1	Each	Dropper, plastic	Lab-Aids
	1	1	Bottle	Glo-Germ™ gel (white)	Lab-Aids or Ward's
	1	1	Each	Petri dish	Lab-Aids
	1	1	Each	Pipet, 3ml	Lab-Aids
	1	1	Each	Test tube, plastic	Lab-Aids

Local

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	5	7	Each	Calculator	Local
	2	3	Bunches	Cilantro	Local
	20	30	Each	Clipboard	Local
	20	30	Set	Colored pencils, assorted	Local
	-	-	-	Cool water source	Local
	5	8	Each	Cutting board	Local
	10	15	Each	Device with digital camera	Local
	20	30	Each	Device with Internet access	Local
	20	30	Each	Device with Internet access and word processing programs	Local
	10	15	Each	Device with word processing and presentation programs	Local
	5	7	Pair	Digital device (cell phone or Chromebook)	Local
	5	5	Each	Drill, hand, power	Local
	1	1	Each	Earplugs	Local
	1	1	Each	Emergency stop button	Local
	10	10	Each	Example workstations – See Teacher Notes	Local
	1	1	Each	Eye wash/shower station	Local
	1	1	Each	Face shield	Local
	1	1	Each	Fire alarm	Local
	1	1	Each	Fire blanket	Local
	1	1	Each	Fire extinguisher	Local
	1	1	Each	Fire-resistant shop coat	Local
	1	1	Each	First aid kit	Local
	1	1	Each	Flammable waste can	Local
	1	1	Pair	Gloves, foodservice	Local
	1	1	Pair	Gloves, leather	Local
	1	1	Pair	Gloves, nitrile	Local

	1	1	Pair	Gloves, rubber	Local
	1	1	Each	Hair ties	Local
	21	31	Each	Hairnet	Local
	5	8	Each	Hand soap	Local
	1	1	Each	Hard hat	Local
	10	15	Each	Highlighter	Local
	5	7	Each	Highlighter, green	Local
	5	7	Each	Highlighter, pink	Local
	5	7	Each	Highlighter, yellow	Local
	4	5	Box	Jell-O®, large	Local
	5	8	Each	Knife, chef	Local
	5	8	Each	Knife, paring	Local
	5	8	Each	Knife, serrated	Local
	1	1	Each	Leather chaps or apron	Local
	5	8	Each	Lime, food	Local
	10	15	Set	Markers	Local
	5	8	Each	Mercer rules tool	Local
	1	2	Each	Microwave	Local
	3	4	Each	Onion, red	Local
	1	2	Roll	Paper towel	Local
	25	40	Each	Paper, cardstock	Local
	10	15	Each	Paper, copier	Local
	3	4	grams	Pepper	Local
	5	8	Each	Pepper, jalapeno	Local
	10	15	Each	Permanent marker, black	Local
	5	7	Each	Petri dish or Petrifilm®, dirty	Local
	20	30	Each	PPE appropriate for each space	Local
	1	1	Each	Printer	Local
	1	1	Each	Respiration mask	Local
	20	30	Each	Ruler, metric	Local
	20	30	Each	Safety glasses	Local
	8	12	grams	Salt	Local
	20	30	Pair	Scissors	Local
	5	8	Each	Sink	Local
	5	8	Each	Spatula, silicone	Local
	20	30	Each	Spoon, plastic	Local
	4	6	Each	Stapler	Local
	3	5	Roll	Tape, masking	Local
	1	1	Roll	Tape, painter’s	Local
	1	1	Roll	Tape, transparent	Local
	5	7	Each	Timing device, electronic	Local
	15	24	Each	Tomato, roma	Local
	-	-	-	Water source	Local
	1	1	Each	Welding helmet	Local
	20	30	Each	Word processing software	Local
	1	1	Each	Work boots or leather closed-toed shoes	Local

Local – Tools

Need	Qty/ 20	Qty/ 30	Unit	Item Specifications	Vendor
	10	15	Each	Board,12’ 2”x4”, 3’ length	Local – Tools
	10	15	Each	Drill, hand, electric-powered	Local – Tools
	5	7	Each	Hammer, claw	Local – Tools
	35	49	Each	Nail, 4d	Local – Tools
	5	7	Each	Sander, powered	Local – Tools
	5	7	Each	Sandpaper	Local – Tools
	4	6	Each	Side cutters	Local – Tools
	5	7	Each	Tape measure, 100’	Local – Tools

Minnesota Dept. of Education

Need	Qty/ 20	Qty/ 30	Unit	Item Specifications	Vendor
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Printed

Need	Qty/ 20	Qty/ 30	Unit	Item Specifications	Vendor
	2	2	Each	*Glo Germ™ Comparison Chart*	Printed
	1	1	Each	*CASE SDS Binder*	Printed
	20	30	Each	*Seven Common Accident Causes*	Printed

Vernier

Need	Qty/ 20	Qty/ 30	Unit	Item Specifications	Vendor
	1	1	Each	LabQuest	Vernier
	1	1	Each	Temperature sensor or Go Direct® temperature sensor	Vernier

Wards

Need	Qty/ 20	Qty/ 30	Unit	Item Specifications	Vendor
	5	7	Each	Beaker 1000mL	Ward’s
	20	30	Each	Beaker, 100ml	Ward’s
	4	6	Each	Beaker, 600ml	Ward’s
	1	1	Each	Burette clamp	Ward’s
	4	6	Each	Electronic balance	Ward’s
	84	124	Pair	Gloves, disposable, assorted sizes	Ward’s
	20	30	Each	Graduated cylinder, 100ml	Ward’s
	4	6	Each	Hot hand protector	Ward’s
	4	6	Each	Hot plate	Ward’s
	20	30	Each	Lab apron or coat	Ward’s
	20	30	Each	Lab coat, food	Ward’s
	1	1	Each	Microscope, compound	Ward’s
	1	1	Each	Ring stand	Ward’s

	20	30	Pair	Safety glasses	Ward’s
	20	30	Pair	Safety goggles	Ward’s
	20	30	Each	Stirring rod, glass	Ward’s
	1	1	Each	Support ring	Ward’s
	4	6	Each	Thermometer	Ward’s
	5	8	Each	UV light	Ward’s
	5	8	Each	Weighing dish, food	Ward’s
	21	31	Each	Weighing dish, 8.5×8.5×2.4 cm	Ward’s

CASE Safety Manual

Working in the laboratory and shop presents many hazards to address with proper instruction. The following are safety concerns all students should be informed and reminded of when working with laboratory supplies and equipment.

General Safety Rules

1. Students need to be aware of clean up procedures for each activity they complete. The laboratory must remain clean at all times.
2. Students need to know the safety features of the classroom, such as fire exits, fire extinguishers, first aid kit, Safety Data Sheet (SDS) information, wash station, and telephone.
3. Students must know the proper way to report accidents. Report all accidents according to local school district policy.
4. Any unsafe behavior exhibited by students may result in their removal from laboratory/shop activities. Ensure that students are aware of classroom policies and the consequences of risky behavior.

Laboratory/Shop Safety Features

Ensure a safe environment by implementing the following recommended minimum safety items in the laboratory area. Additional details for each course are listed throughout the course.

Minimum Features:

- Eyewash station
- Fire extinguishers
- Fire blanket
- First aid kit
- Flammable waste can
- SDS binder
- Sharps container
- Spill kits – acid and base
- Flammable storage cabinet
- Flammable waste container

Additional recommended items:

- Chemical shower
- Goggle sanitizer
- Biosafety cabinet
- Broken class receptacle

Personal Protective Equipment

When working in a laboratory or shop, personal protective equipment (PPE) should be a routine and a habit. Require students to wear proper PPE at all times. Minimum PPE requirements include safety glasses and a laboratory apron or shop coat. Additional equipment, such as chemical goggles and heat resistant gloves, may be needed for specific activities. Consider requiring a dress code for days of laboratory experimentation or shop work, including pants and close-toed shoes with any long hair tied back.

First Aid Kit

A first aid kit must be available in every laboratory and school facility in case of minor medical injuries. A body fluids spill kit should be available. Follow precautions to clean up and dispose of bodily fluids. Most school districts have bloodborne pathogen training for district employees but not students. The teacher needs to inform students of the potential risk of coming into contact with bodily fluids.

Chemicals

Exposure to chemicals will be an issue for students. Students will need detailed instructions for handling and using chemicals. The teacher will also be responsible for the disposal of chemicals according to school district policy. Also, all chemicals used in the laboratory must have a current SDS on file and available for students and emergency personnel to access.

For some corrosive and caustic chemicals, all students and teachers must have the following personal protective equipment available.

- Safety glasses and goggles for eye protection
- Aprons
- Gloves
- Spill kit

Any injury resulting from chemical exposure must be treated immediately by medical personnel. Follow the school district policy for handling chemical-related injuries.

SDS Records

A safety data sheet (SDS) is available for all hazardous chemicals. SDS contains information about emergency precautions in case of spills, ingestion, or other accidental uses. Every SDS uses a specific format so users can find information readily. Keep a set of SDS for all items stored or used in the work area available at all times. Most items ordered from vendors are shipped with SDS; be sure to save and file appropriately. For chemicals purchased locally, many SDS can be found online at **http://www.ilpi.com/msds/** and printed for inclusion in the SDS folder.

Chemical Spill Kits

In the occurrence of a chemical spill, proper cleanup materials and procedures are critical to health and safety. Refer to the SDS for any item spilled to review proper cleanup methods. The minimum components to include in a spill kit are sand, an absorbing agent, and neutralizers. Absorbing agents may be kitty litter, fire blankets, or absorbent pads. Be sure to have both acid and base neutralizers. Always wear proper personal protective equipment while cleaning the spill.

Chemical Storage

Store all items used in the laboratory or shop in a dedicated and organized storage area. Glassware and other commonly used equipment should be stored where it is accessible to students when needed, but placed in a safe and secure area, such as a cabinet or drawer, when not in use. Organize chemicals by category in a secure, locked area designed for chemical storage with proper ventilation and temperature control. Keep work areas clear and free of unnecessary equipment or materials.

Chemical Disposal

Dispose of all materials according to procedures outlined in the SDS. Some chemicals may be diluted or neutralized to a safe level for disposal in trash or sink, but always check the label and SDS first.

Allergies

Students will be exposed to many substances, both natural and chemical. Some of the materials that may trigger allergic reactions are:

- Food substances
- Chemical indicators
- Latex gloves

Be aware of any physical symptoms, including:

- Skin rashes
- Sneezing and coughing
- Loss of breath or breathing problems
- Signs of faintness or unresponsive behavior

Report all incidences of allergic reactions to laboratory substances according to the policy of your school. In non-serious cases, the teacher may need to provide gloves, respirators, or other personal safety equipment for the student.

Cutting Instruments

For several activities, tools with sharp cutting edges are used. The teacher must provide specific instructions for the safe use of these cutting instruments. Students will need to know how to hold the tool, how much pressure to exert, and what surface to cut on to protect them and the equipment.

If an injury should result from a cutting instrument, the teacher must follow first aid practices according to school policy and report all accidents to the main office. It will be essential for the teacher to demonstrate the proper use of scalpels and monitor students closely for dangerous techniques.

A first aid kit must be available in every laboratory and school facility in case of minor medical injuries. A bodily fluids spill kit should be accessible, and follow precautions to clean up and dispose of bodily fluids. Most school districts have bloodborne pathogen training for district employees but not students. The teacher needs to inform students of the potential risk of contact with bodily fluids.

Electrical Hazards

Common electrical hazards, such as plugs and cords, are present in laboratory situations. However, the biggest concern for wet laboratory activities using electrical devices is an electrical shock due to moisture conduction. The teacher will need to plan activities accordingly to prevent potential electrical shock when using electronics near liquids. It is also essential to check all electrical equipment to ensure all cords and connections are adequately insulated and in good shape.

Fire Safety

Agricultural classrooms, labs, and shops commonly have combustible materials such as gasoline, ethanol, and cleaning solvents. A fuel source, heat, and oxygen are all needed to sustain a fire. Extinguish fire by eliminating one of the three components. Review these basic fire safety guidelines with students.

- Know the location of all fire extinguishers, fire blankets, and first aid kits.
- Work in properly ventilated areas to avoid the accumulation of flammable fumes.
- Review emergency plans and procedures.
- Store flammable materials in proper safety containers and cabinets.
- Do not complete electrical work near combustible or flammable material.
- Store flammable and combustible liquids in proper, labeled containers.
- Mark all traffic areas and paths to all exits.
- Keep traffic areas and exit paths free from debris.

Glass

Glass containers, slides, and equipment will be used in the laboratory. It is important to remind students of the fragile nature of these items, as some students may not identify them as consisting of glass. Equip each laboratory with tools to clean up broken glass and dispose of it to prevent injury. Do not throw broken glass into the wastebasket as it poses a risk of harm to janitorial staff. Proper storage is essential to protect glass objects from breakage.

If cuts result from broken glass, contact your front office personnel immediately and follow procedures set by your local school district for handling the injury. Be aware of the district policy for cleaning up blood resulting from cuts and inform students of the dangers.

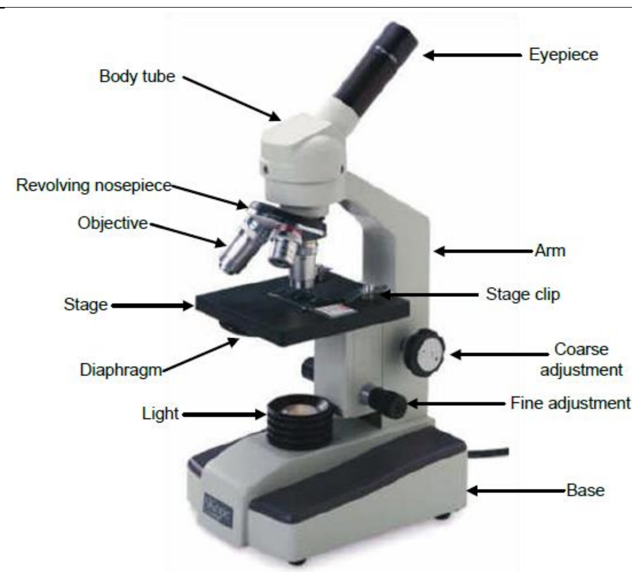
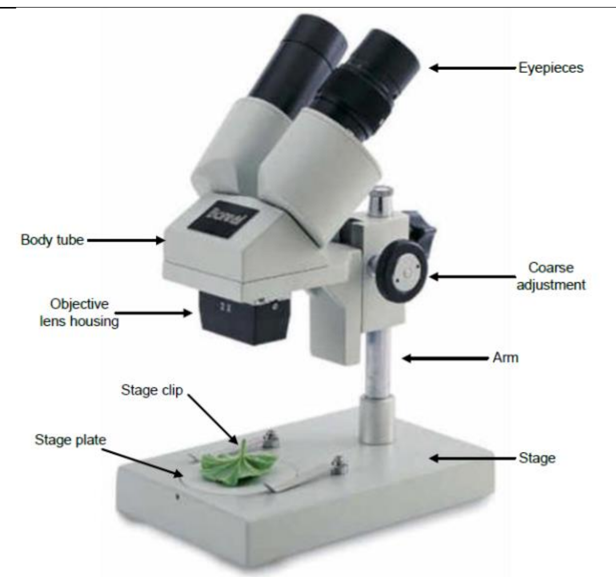
Lifting

Laboratory supplies and projects may present a risk to students in terms of injury from lifting heavy items. Be aware of district policies concerning lifting heavy objects. A good thumb rule is to make special accommodations with equipment moving anything over 50 pounds. It is a teacher's responsibility to prevent students from lifting heavy objects without providing the proper equipment to do it safely.

Microscope Care and Operation

Microscopes are commonly used in the laboratory setting. Throughout the year, there will be opportunities to observe organisms and tissues at the microscopic level. Proper care and use of microscopes are essential for accurate observations as well as laboratory safety.

A microscope is an instrument that produces an enlarged image of an object. Microscopes used most often are light microscopes, which use light to enlarge the image. The two types of microscopes used in this course include compound light microscopes and stereomicroscopes. Use a compound light microscope to view tiny objects that have been prepared on a slide. Use stereomicroscopes to study larger specimens and to observe the surfaces of structures.

<table>
<tr><th colspan="2">Parts of the Microscope</th></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>Compound Light Microscope</td><td>Stereomicroscope</td></tr>
</table>

General Procedures for Microscope Use

- When moving a microscope, always pick up the microscope by the arm with one hand and use the other hand under the base for support. Use both hands while carrying the microscope.
- Place the microscope securely on the workspace well away from the edge.
- If the microscope has a power cord, secure the cord on the desk or countertop. Do not allow the excess cord to hang down where a passerby could snag it.
- Grasp the plug firmly when plugging and unplugging the microscope, do not pull on the cord.
- Always begin observations with the revolving nosepiece set to the low-power objective.
- Do not touch the glass part of the lenses with your finger; use a piece of lens paper to clean the viewing area.
- To determine the magnification power of an objective setting, multiply the magnification of the eyepiece by the magnification of the objective.

Focusing the Compound Light Microscope

1. Turn the revolving nosepiece so the lowest power objective is in the viewing position.
1. Use the coarse adjustment to move the objectives and the stage as far apart as possible.
2. Place a slide on the stage using the stage clips.
3. With the objective set at the lowest magnification, use the coarse adjustment knob to bring the stage and objective as close together as possible without touching the slide to the objective.
4. Looking into the eyepiece, focus the objective by slowly raising the lens using the coarse adjustment.
5. Use the fine adjustment to complete focusing.
6. When the specimen is centered and focused at low power, rotate the revolving nosepiece to a higher power. Avoid contact between the slide and the objective lens.
7. Use only the fine adjustment to focus on higher powers.

Noise

Equipment, including engines and power tools, produce noise with sound intensity harmful to a student’s ears. Sound intensity is measured in decibels from 0-140. Prolonged exposure to noise at high decibel levels could lead to hearing loss over time. Ear protection, such as earplugs and earmuffs, have a noise reduction rating. The rating number is the number of decibels the protection reduces the noise exposure intensity. Determine the exposure of sound intensity and compare to OSHA standards for acceptable levels of sound intensity and duration to select hearing protection needed in your shop.

Respiratory Protection

Airborne chemicals can occur in many forms, including mists, dust, vapors, gasses, and fumes. Students must have proper respiratory protection, and facilities must be equipped with adequate ventilation to prevent student exposure to airborne chemicals. Review SDS sheets for all shop materials and chemicals to determine the type of respiratory protection needed. Also, review all OSHA standards for ventilation requirements needed for planned shop activities and ensure those standards are met before starting those activities.

Physical Burns

Burns can happen from alcohol and Bunsen burners used for some laboratory exercises. Treat burns according to school district policy.

Tools

An agricultural laboratory has various tools available for students to use when conducting activities or building projects. Each tool will have specific safety concerns associated with it. Complete proper instruction before using a new tool. Keep all tools in appropriate storage areas to prevent the handling of tools not necessary for the activity.

Hand Tools

Quality hand tools provide a safe and productive environment in the agricultural lab and shop settings. Students should follow these guidelines when working with hand tools.

- Wear proper PPE, such as safety glasses, ear protection, and protective clothing.
- Secure hair and loose clothing.
- Work in areas with quality lighting and visibility.
- Receive permission from the supervising teacher before operating any tool.
- Inspect tools for damage before using. Do not use a damaged tool.
- All personnel are a safe distance away from the tool operator.
- Use tools for the intended purpose.
- When using cutting tools, point away from the body.
- Keep sharp cutting instruments concealed and protected when not in use.
- Move tools with sharp edges or points with the pointed end in the downward position.
- Do not carry tools in pockets
- Keep all cutting tools properly conditioned and sharp.
- Keep tools free of debris, such as oil and grease.
- Report all injuries to supervising teachers.

Power Tools

Students should use power tools and equipment for their intended use. Students can reduce the risk of accidents by following these guidelines.

- Follow manufacturer operating instructions when operating power tools.
- Inspect power tools for damage before using. Do not use a damaged power tool.
- Wear proper PPE, including eye, ear, and head protection.
- Do not wear loose clothing, ties, or rings that could be caught in moving parts.
- Use UL® approved power tools installed in compliance with the NEC®.
- Do not use electrical tools in wet or damp areas.
- Keep the power switch in the off position before connecting a tool to a power source.
- Fasten all safety guards in place before starting.
- Keep power cords out of traffic areas to avoid tripping.
- Keep hands and arms away from moving parts.
- Tools needing repair or service should be shut off, locked out, tagged out, and disconnected.
- Consult OSHA for additional rules and regulations for tool operation at **https://www.osha.gov/SLTC/etools/machineguarding/intro.html**.

Teacher Resource Documents

Course General Documents

Copyright

Acknowledgments

Student Support

Common Templates		
Safety Standards Template	**PDF**	**Word**
Near Miss Report	**PDF**	**Word**
Tool Safety Checklist	**PDF**	**Word**
Tool Operation Template	**PDF**	**Word**

Student Documents		
APA Citations	**PDF**	**Word**
CASE Safety Glossary	**PDF**	**Word**
CASE Safety Manual	**PDF**	**Word**
Graph Paper	**PDF**	
Laboratory Safety Agreement	**PDF**	**Word**
Presentation Notes	**PDF**	**Word**
SAE for All Foundational Checksheet	**PDF**	**Word**
Sample Presentation Notes	**PDF**	**Word**

Teacher Support

Assessment Tools		
Using Single Point Rubrics	**PDF**	**Word**
Safety Standards Evaluation Rubric	**PDF**	**Word**

Lesson Planning		
CASE Safety Description	**PDF**	**Word**
CASE Safety Student Description	**PDF**	**Word**
Lesson Planning Documents	**PDF**	**Word**

Instructional Safety Resources	**PDF**	**Word**
Detailed Course Outline	**PDF**	**Word**
Topical Course Outline	**PDF**	**Word**
Teaching Timeline	**PDF**	**Word**

Materials		
CASE Safety Inventory by Vendor	**PDF**	**Word**
CASE Safety Materials	**PDF**	**Word**
CASE Safety Posters	**PDF**	
CASE Safety Data Sheet Binder	**PDF**	

Standards Alignment		
National AFNR Content Standards	**PDF**	**Word**

Course Teaching Timeline

IMPORTANT: This timeline is for advance planning and preparation purposes only. It is not intended to replace Day-to-Day Plans or Teacher Notes. Please refer to the plans, teacher notes, individual activities, projects, and problems for specific instructions as you prepare for each lesson. This timeline has been developed for a 45-50-minute class period. Adjust as needed for your school schedule.

Day	Lesson	APP & CU	Teacher Presentation/ Discussions	Completion/ Assessments	Advanced Preparation
1	Lesson 1.1	Activity 1.1.1	PPT – Safety is an Attitude		
2		Activity 1.1.2			
3		Activity 1.1.3			
4		Activity 1.1.4			Print 1.1.4 Incident Cards
5		CU 1.1		CU 1.1 Key	
6	Lesson 1.2	Activity 1.2.1			Print 1.2.1 ERG Cards
7				Activity 1.2.1	Print 1.2.1 ERG Flowchart
8		Activity 1.2.2	PPT – First Aid		
9				Activity 1.2.2	
10		Activity 1.2.3	PPT – Fire Extinguisher Safety		Gather hearing protection devices
11				Activity 1.2.3	
12		Activity 1.2.4			Secure lab and shop spaces for measuring and evaluation for Activity 1.2.5
13		Activity 1.2.5			
14		CU 1.2		CU 1.2 Key	
15	Lesson 2.1	Activity 2.1.1			
16		Project 2.1.2		Safety Standards Evaluation Rubric	
17		Project 2.1.3			
18					
19			Project 2.1.3 Presentations	Project 2.1.3 Evaluation Rubric	
20		CU 2.1		CU 2.1 Key	
21	Lesson 2.2	Activity 2.2.1			Print Tool Safety Checklist
22				Activity 2.2.1	
23		Activity 2.2.2	PPT – Operating Procedure		Print Tool Operation Template
24				Activity 2.2.2	Prepare lockout tagout supplies

Day	Lesson	APP & CU	Teacher Presentation/ Discussions	Completion/ Assessments	Advanced Preparation
25		Activity 2.2.3		Lockout tagout demonstration	Print 2.2.3 Tagout Blanks
26		CU 2.2		CU 2.2 Key	Gather 3.1.1 lab supplies
27	Lesson 3.1	Activity 3.1.1			
28		Activity 3.1.2	PPT – How to Measure		
29					
30				Activity 3.1.2	
31		Activity 3.1.3			
32				Activity 3.1.3	
33		CU 3.1		CU 3.1	
34	Lesson 3.2	Activity 3.2.1			Print Glo Germ Comparison Chart
35		Project 3.2.2		Project 3.2.2 Evaluation Rubric	Gather 3.2.3 fresh food materials
36		Activity 3.2.3	Video – How to Master Basic Knife Skills – Knife Cuts 101		
37		CU 3.2		Serve Activity 3.2.3 Salsa CU 3.2 Key	Print hardcopies or have digital LMS access of safety documents for 4.1
38	Lesson 4.1	Project 4.1.1 Or 4.1.2		Student completes either 4.1.1 or 4.1.2	
39					
40				Project 4.1.1 and 4.1.2 Rubrics	

Name____

Presentation Notes

Course Name: ____

Unit Name: ____

Lesson Topic: ____

Presentation on: ____

Notes from Presentation:

Reflection Page

List 5 key points that are important to remember from this presentation.

1.
2.
3.
4.
5.

List 3 ideas or concepts that this new information has in common with previous things learned.

1.
2.
3.

List questions or ideas that remain unclear about the information presented that should be asked for clarity at the appropriate time.

APA Citations

The following style of citation is based on the sixth edition of *Publication Manual of the American Psychological Association* (APA). It is recommended that this document be purchased and used as a reference in the classroom or laboratory.

Commonly Used Citation Examples

Periodical references

Author, A.A. (year). Title of article. *Title of Periodical*, Volume(Issue), pp-pp.

NOTE: If more than one author, separate names with commas. Use last name and initials only. For the AND use the ampersand "&."

Example: Magazine article, one author

Jansen, D.J. (2011). Professional development for change. *The Agricultural Education Magazine*, 84(2), 9-11.

Example: Newspaper article, one author

Mortenson, E. (2014, April 18). Starting small: Farming still attracts many despite challenges. *The Capital Press*, pp. 1, 12.

NOTE: You use p. or pp. before the page number.

Basic On-line References

Author, A.A. (date the web page was last updated if known; if not, use n.d.). Title of article. *Name of Periodical.* Retrieved from *Specify path*

OR:

Author, I., & Author, I., (date the web page was last updated). *Title of full work.* Retrieved from *Specify path*

NOTE: DO NOT put a period at the end of the path. Author may be the name of the site, as sometimes a specific author is not given.

Example: article from on-line periodical

Yancey, J. (2014). Six tips for creating a resume. *New Horizons*. Retrieved from **http://ffanewhorizons.org/six-tips-creating-resume/**

Example: on-line resource

Wight Hat Ltd. (2013). *Metric conversions*. Retrieved from **http://www.metric-conversions.org/**

Book references

Author, A. A. (year). *Title of work*. Location: Publisher.

NOTE: You list the publication information as the city with a colon and then spell out the name of the publisher. If it is the same as the author, simply place author.

Example: Entire book, multiple authors

Johnson, R.L., Stahmer-DeMoss, G., & Sorensen, R. (2007). *Earth Science with Vernier*. Beaverton, OR: Vernier Software & Technology.

Example: entire book, editor

Feldkamp, S. (Ed.). (2002). *Modern biology*. Austin, TX: Holt, Rinehart, and Winston.

Audiovisual References

Producer, A.A. (Producer), & Director, A.A. (Director). (year). Title of media [Style of media]. Country of Origin: Studio.

NOTE: Specify the medium in brackets right after the name. This would work for other non-print media, such as video tapes, audiotapes, slides, charts, and works of art.

Example: motion picture

Jackson, M. (Director). (2010). *Temple Grandin* [Motion picture]. United States: HBO Films.

Example: video

Pork Checkoff (Producer). (2008). *Pig farmers take action* [YouTube]. Retreived from **http://www.youtube.com/watch?v=VEsGjjdHEsk&list=PLFB0D57F0383ABAE0**

APA Citation Resources

Americal Psychological Association. (2010). *Publication manual of the American Psychological Association* (6th ed.). Washington, D.C.: Author.

Purdue Online Writing Lab. (2014). *APA style*. Retrieved from **https://owl.english.purdue.edu/owl/section/2/10/**

The Landmark Project. (2010). *Son of Citation Machine*. Retrieved from **http://www.citationmachine.net/**

Near Miss Report

Name of Witness:	
Date:	**Time:**
Who was involved in the incident?	
Where did the incident occur?	
What were the unsafe conditions?	
What happened during the incident?	
What were the unsafe acts?	
What were the immediate and underlying root causes of the incident?	
How can similar incidents be prevented?	
Name of teacher or safety professional notified:	
Teacher/ Safety Professional Signature	***Date***

Tool Operation Template

Record the information for each step of the tool/machine operation process.

Name of the Tool/Machine: ____________________

PPE Requirements
Record the PPE needed and a reason for each.
Clothing and Grooming Requirements
Explain how and where loose clothing and hair could be caught in the tool.
Environment
Explain the environmental requirements for safe use, such as lighting and ventilation.
Tool/Machine Attachments
List the attachments, such as bits and blades, used and purpose of each.
Material
What type of materials does this tool work on?
Fastening
Explain how material or machine should be fastened before using it.

Settings
Describe the settings on the machine and list the steps for setting them.
Power Supply
Explain how to inspect the power supply for risk of injury. Describe how and when you turn the machine on.
Personal Positioning
Where should you stand while turning on and operating the machine? Where should others be standing?
Use
How do you properly operate the machine?
Shutting Down
How and when do you shut down the machine?
Storage
How do you clean, inspect, and store the machine?

Equipment Safety Checklist

Equipment Name:

Non-Mechanical Hazards

Is there a potential noise hazard?	**Yes**	**No**	If yes, what PPE is needed?
Does the equipment produce harmful substances?	**Yes**	**No**	If yes, what PPE is needed?

Mechanical Inspection

Power Sources			**Power Transmission**			**Points of Operation**		
Place a check by all observed sources:			Place a check by all observed components:			Describe the work observed at the operation points.		
Electrical	☐		Belt and pully	☐				
Mechanical (Power take-off)	☐		Chain and sprocket	☐				
Combustion engine	☐		Gears	☐				
Hydraulic	☐		Hoses	☐				
Pneumatic	☐		Cylinders and rods	☐				
Are all power sources connected properly?	**Yes**	**NO**	Are any power transmission components exposed?	**Yes**	**NO**	Is there point of operation safeguards for the equipment?	**Yes**	**NO**
Are all power sources safeguarded?	**Yes**	**NO**	Do any power transmission components need maintenance?	**Yes**	**NO**	Have safeguards been tampered with or removed?	**Yes**	**NO**
What maintenance do you recommend?			What maintenance do you recommend?			What maintenance do you recommend?		

Mechanical Hazards

Place a check by any motions or actions that are potential hazards for each equipment area. Record the type of guard preventing injury from that action or motion.

Action or Motion	Power Source		Power Transmission		Point of Operation	
		Type of Guard in Place		Type of Guard in Place		Type of Guard in Place
Rotating	☐		☐		☐	
In-Running Nip Points	☐		☐		☐	
Reciprocating	☐		☐		☐	
Transversing	☐		☐		☐	
Cutting	☐		☐		☐	
Punching	☐		☐		☐	
Shearing	☐		☐		☐	
Bending	☐		☐		☐	

**** Types of guards: Fixed, Interlocked, Adjustable, Self-adjusting***

Hazard Prevention

Where are the operating controls located?
How is the equipment isolated (locked out) from its energy source before a technician performs maintenance?
What hazards should the operator be aware of before using the equipment?
What PPE should an operator wear to prevent injuries from mechanical hazards?

Name____

Sample Presentation Notes

Course Name: ____

Unit Name: ____

Lesson Topic: ____

Presentation on: The size of the matter

Notes from Presentation:

There are three main sizes of soil particles
- Sand
- Silt
- Clay

Sand - .05 - 2mm
- Round Shape
- feels gritty

Attributes to Soil
- Adds porosity
- Reduces water holding capacity

Silt - .002 - .05mm
- Round Shape but very small to detect
- Feel smooth but does not stick together very well

Attributes to soil
- moderately good for porosity
- helps water holding capacity

Clay - Less than .002mm
- flat or platy
- Sticky when wet - ribbon test
- Bad for porosity
- Ties up water so plants cant use it

Testing for Particles

Field tests can be done to determine the presence of each particle

1. moisten a sample of soil with water in your hand
2. Break up all ~~clouds~~ clods and add enough water to make a slurry
3. Rub a thin layer of slurry between your thumb and fingertips to isolate the Particles

Detection of Particles
- Sand is relatively easy to detect the gritty particles
- wet Silts may seem slick like clay but not sticky
- Conduct a ribbon test to determine how much clay content is Present

Loams
- Loam that has less than 27% clay is a mixture of sand, silt, and clay
- Loam soils are considered to be the optimal soils for growing plants

Reflection Page

List five key points that are important to remember from this presentation.

1. three main sizes of soil particles
2. Sand adds porosity
3. Reduces water holding capacity - sand
4. Silt good for porosity
5. Clay is bad for porosity

List three ideas or concepts that this new information has in common with previous things learned.

1. Mineral matter is particle size
2. Soil size allows you to know how much water / air soil can hold
3. organic matter plays a factor in soil texturing

List questions or ideas that remain unclear about the information presented that should be asked for clarity at the appropriate time.

- i would like to try soil texturing
- it would be nice to see real samples of sand, silt, clay, and loam for real life comparison

Vernier Resources

Web Resources	Downloads
Vernier Website LabQuest® Go Direct®	LabQuest Viewer® Software Graphical Analysis™ 4 Software

LabQuest and Sensor Options	Go Direct® Sensor Options
Temperature LabQuest® 2 User Manual LabQuest® 3 User Manual LabQuest® Charge Station LabQuest® Quick-Start Guide	Go Direct® Temperature Go Direct® Charge Station

Lesson 1.1 Safety Starts with You

Preface

The use of agriscience equipment exposes people to many hazards. Workplaces limit accidents by identifying hazards and developing safety protocols. Agriscience students should be educated and evaluated on the location of safety equipment, safety procedures, and use of personal protective equipment (PPE). Ag teachers can enforce safety using the *CASE Safety Manual*, *Laboratory Safety Agreement*, and *Near Miss Reports*.

During this lesson, students review safety practices and attitudes. First, they locate emergency equipment in the agriscience facility and identify their purposes. Then, students draft safety rules and review the *CASE Safety Manual*. Next, students explore types of PPE and evaluate near misses.

Concepts	**Performance Objectives**
Students will know and understand	*Students will learn concepts by doing*
1. Emergency equipment is essential in a laboratory and has specific uses.	• Locate and determine the purpose of emergency equipment items in the classroom, laboratory, and shop facilities. (Activity 1.1.1)
2. Understanding and following procedures and rules are essential to maintaining a safe work environment.	• Work with classmates to draft a list of ten safety rules. (Activity 1.1.2)
3. Personal protective equipment is the last line of defense against injury.	• Identify types of PPE and their uses in the shop. (Activity 1.1.3)
4. Working in a mechanical shop requires diligence when following safety procedures and expectations.	• Identify near misses and complete an example near-miss report. (Activity 1.1.4)

National AFNR Common Career Technical Core Standards Alignment

Career Ready Practices
1. Act as a responsible and contributing citizen and employee.
• CRP.01.01: Model personal responsibility in the workplace and community.

Essential Questions

1. What rules and procedures limit accidents in a laboratory setting?
2. Why are laboratory and shop areas color-coded?
3. How do you put out a fire?
4. What is personal protective equipment?
5. Why is it important to follow laboratory procedures?
6. What personal protective equipment (PPE) should you wear in an agricultural work area?
7. How do you select the PPE required for specific jobs?
8. What is a near miss?

Key Terms

Abrasion	**Accident**	**Attitude**
Caution	**Danger**	**Electrocute**
Emergency	**Extinguish**	**Fire extinguisher**
Fire triangle	**Fuel**	**Hazard**
Heat	**Oxygen**	**Personal Protective Equipment (PPE)**
Procedure	**Safety**	**Safety color**
Safety glasses	**Safety goggles**	**Near miss**
Root cause	**Warning**	

Day-to-Day Plans
Time: 5 days

Refer to the Teacher Resources section for specific information on teaching this lesson, in particular ***Lesson 1.1 Teacher Notes, Lesson 1.1 Glossary***, ***Lesson 1.1 Materials***, *and other support documents.*

Day 1:

- Present the **Concepts and Performance Objectives**, **Essential Questions**, and **Key Terms** to provide a lesson overview.
- Present PowerPoint® **Safety is an Attitude**.
- Students take notes using the **Presentation Notes** pages provided by the teacher.
- Provide students with a copy of **Activity 1.1.1 In Case of Accidents**.
- Students work individually to complete *Activity 1.1.1 In Case of Accidents*.

Day 2:

- Complete *Activity 1.1.1 In Case of Accidents* if necessary.
- Review emergency equipment and provide a tour of facilities, pointing out potential hazards.
- Provide students with a copy of the **CASE Safety Manual**, **Laboratory Safety Agreement**, and **Activity 1.1.2 You Make the Rules**.
- Students work in pairs and groups to complete *Activity 1.1.2 You Make the Rules*.
- Review the *CASE Safety Manual* and *Laboratory Safety Agreement* with the class.

Day 3:

- Provide students with a copy of **Activity 1.1.3 PPE With a Purpose**.
- Students work individually to complete *Activity 1.1.3 PPE With a Purpose*.
- Review the proper PPE to use at each station for *Activity 1.1.3 PPE With a Purpose*.
- Students revise and update *Activity 1.1.3 PPE With a Purpose* as the teacher discusses each station with the students.

Day 4:

- Provide students with a copy of **Activity 1.1.4 That Was Close** and the **Near Miss Report**.
- Provide each student group one **Activity 1.1.4 Incident Card**.
- Students complete *Activity 1.1.4 That Was Close*.

Day 5:

- Distribute **Lesson 1.1 Check for Understanding**.
- Students complete *Lesson 1.1 Check for Understanding* and submit for evaluation.

- Use **Lesson 1.1 Check for Understanding Answer Key** to evaluate student assessments.

Instructional Resources

PowerPoint® Presentations

Safety is an Attitude

Student Support Documents

Lesson 1.1 Glossary

Presentation Notes

Activity 1.1.1 In Case of Accidents

Activity 1.1.2 You Make the Rules

Activity 1.1.3 PPE with a Purpose

Activity 1.1.4 That Was Close

CASE Safety Manual

Laboratory Safety Agreement

Teacher Resources

Lesson 1.1 Safety Starts with You (PDF)

Lesson 1.1 Teacher Notes

Lesson 1.1 Materials

Lesson 1.1 Check for Understanding

Activity 1.1.1 Emergency Equipment Cards

Activity 1.1.4 Incident Cards

Answer Keys and Assessment Rubrics

Lesson 1.1 Check for Understanding Answer Key

Reference Sources

Herren, R. V., & Donahue, R. L. (2000). *Delmar's agriscience dictionary with searchable CD-ROM*. Albany, NY: Delmar.

National Safety Council. (2013). *Near miss reporting*. Retrieved from **https://www.nsc.org/work-safety/tools-resources/near-miss-reporting**

OSHA. (2016). *The importance of root cause analysis during incident investigation*. Retrieved from **https://www.osha.gov/Publications/OSHA3895.pdf**

Reardon, M., & Derner, S. (2004). *Strategies for great teaching*. Chicago, IL: Zephyr Press.

SAE for All

Supervised Agricultural Experience (SAE) activities are essential components of an effective agricultural education program. *CASE Safety* lessons have SAE connections for experiential learning beyond the classroom walls to add relevance to their coursework.

Foundational SAE

All students in an agricultural education program are expected to have a Foundational SAE. Students completing the APP and extensions listed below will meet the Foundational SAE qualification for the

Intermediate (Grades 9-10) level. Students should place all documented evidence in their *Agriscience Notebook* along with the **SAE for All Foundational Checksheet**.

- Activity 1.1.1 In Case of Accidents
  - CS.03.01.01.b. Execute health, safety, and environmental procedures to comply with regulatory and safety standards.
- Activity 1.1.2 You Make the Rules
  - CS.03.01.01.b. Execute health, safety, and environmental procedures to comply with regulatory and safety standards.
  - CS.03.04.01.b. Analyze and demonstrate adherence to protective equipment requirements when using various AFNR tools and equipment.
- Activity 1.1.3 PPE With a Purpose.
  - CS.03.01.01.b. Execute health, safety, and environmental procedures to comply with regulatory and safety standards.
  - CS.03.04.01.b. Analyze and demonstrate adherence to protective equipment requirements when using various AFNR tools and equipment.
  - CS.03.04.03.b. Assess and demonstrate appropriate operation, storage, and maintenance techniques for AFNR tools and equipment.
- Activity 1.1.4 That Was Close
  - CS.03.01.01.b. Execute health, safety, and environmental procedures to comply with regulatory and safety standards.
  - CS.03.04.01.b. Analyze and demonstrate adherence to protective equipment requirements when using various AFNR tools and equipment.
  - CS.03.04.03.b. Assess and demonstrate appropriate operation, storage, and maintenance techniques for AFNR tools and equipment.

Access the **SAE for All Educator Resources** site for additional teacher and student resources.

Lesson 1.1 Teacher Notes

Use the following notes to teach the course.

- Students keep an *Agriscience Notebook* to record notes, experiences, thoughts, and other important information they acquire during this class. Students place all activity sheets and records of their work in the notebook.
- Make multiple copies of the **Presentation Notes** pages, found in the **Teacher Resources**, for students to take notes and record observations. Students keep *Presentation Notes* in their *Agriscience Notebook* for future reference.
- A *Lesson Materials* list is provided for each lesson to plan for the upcoming lesson. Items listed on the materials list are from various vendors; therefore, ensure that you have placed equipment and supply orders well in advance of instruction. Use the **CASE Vendor Resources** for updated order information, including prices and recommended vendors.
- The **CASE Safety Glossary** and individual lesson glossaries list all *Key Terms* identified in each lesson. Make the glossary or single lesson glossaries available to students in the classroom or instruct students to add them to their *Agriscience Notebooks*.

Lesson 1.1 Safety Starts with You

In preparation for teaching this lesson, review Concepts, Performance Objectives, Essential Questions, and Key Terms, along with the PowerPoint® presentation. Also, review all activity directions, expectations, and work students complete.

Throughout this lesson, students learn how to work safely in an agriscience facility. They begin the lesson by identifying safety equipment and procedures used in agriscience lab and shop settings. Then, students review the *CASE Safety Manual* and *Laboratory Safety Agreement*. Students conclude the lesson by reviewing PPE applications and evaluating near misses.

PowerPoints®

Safety is an Attitude

Use this presentation before *Activity 1.1.2 In Case of Accidents* to develop an awareness of laboratory safety. This presentation does not provide every safety precaution but introduces the concept of maintaining an attitude of safety. The presentation also introduces safety color-coding used to relay messages, basic hazards, and fire safety.

Safety Documents

Laboratory Safety Agreement

The document serves as a safety contract for the student. After receiving instruction on safe practices and student behavioral expectations, the student, teacher, and parent or guardian should sign the document stating their agreement to the outlined practices. Copy each student's signed *Laboratory Safety Agreement* and save the signed document for local records. Students add the photocopy to their *Agriscience Notebook*.

CASE Safety Manual

This manual outlines specific guidelines for many laboratory practices. Provide each student a copy of the *CASE Safety Manual* and refer to the safety manual throughout the year when introducing new laboratory procedures.

Activities, Projects, and Problems

Activity 1.1.1 In Case of Accidents

Students learn the location and function of emergency equipment in your facility. While the format is similar to a scavenger hunt, remind students that this is not a timed activity, and that safety is the goal.

Teacher Preparation
Present *Safety is an Attitude* to begin the activity.

Print the **CASE SDS Binder**. The binder includes SDS sheets for all lab chemicals used throughout all CASE curriculum. Then, inventory additional local materials and print the appropriate SDS sheets. Place these in a three-ring SDS binder and place them in a clearly marked and easily assessable location.

Prior to the activity, print **Activity 1.1.1 Emergency Equipment Cards**. Cut and place cards in the appropriate locations. The cards may need to be edited, added to, or removed depending on the facilities of your program. Use equipment specific to your classroom. Example equipment from *Activity 1.1.1 Emergency Equipment Cards* includes*:*

- Emergency Response Card
- Emergency Stop Button
- Eyewash/Shower Station
- Fire Alarm
- Fire Blanket
- Fire Extinguisher
- First Aid Kit
- Flammable Waste Can
- Safety Data Sheet (SDS) Binder

Be sure to mark work areas with appropriate color indicators for students when sketching the facility. Color indicators are as follows.

- Red – Danger or emergency
- Orange – Warning
- Yellow – Caution
- Blue – Information
- Green – Safety equipment
- White – Traffic markings
- White and Black – Traffic stop
- Gray – Work area

To begin the activity, divide the class into an equal number of students for each station and direct them where to start.

Student Performance
Students work individually to rotate from station to station based on a clue on each card. They record information about each piece of safety equipment and its location. When they return to the station where they started, they have completed the activity. At this point, students sketch the facility and map the location of each piece of emergency equipment. Students add a key and the following colors to indicate hazard areas.

- Red – Danger or emergency
- Orange – Warning
- Yellow – Caution
- Blue – Information
- Green – Safety equipment
- White – Traffic markings
- White and Black – Traffic stop
- Gray – Work area

When students have completed their sketches, review the equipment and location of each item with the class. Take a few minutes to point out critical pieces of equipment and the hazards associated with each.

Results and Evaluation
Review student sketches for accuracy and understanding of safety colors.

Activity 1.1.2 You Make the Rules

Students work in pairs and groups to develop a list of ten safety rules using the *CASE Safety Manual*. Then they compare their rules to the *Laboratory Safety Agreement*.

Teacher Preparation

Review the *Laboratory Safety Agreement* and *CASE Safety Manual* before starting the activity. Students sign the *Laboratory Safety Agreement* after the activity. Each student needs a copy of the agreement returned to keep in their *Agriscience Notebook* as a reference.

Student Performance

Students start the activity by working with a partner to create a list of ten safety rules on a piece of paper. Next, students collaborate with another pair to form a group of four. Each group develops a revised list of ten safety rules using the *CASE Safety Manual* and records them on their worksheet. Then, students answer the analysis questions in their groups.

After each group has completed their list, they compare them to the *Laboratory Safety Agreement*. Then, the teacher leads a discussion of the rules students must follow when working in the shop or lab. Students sign the *Laboratory Safety Agreement* and submit them to their teacher.

Results and Evaluation

Evaluate student answers to analysis and conclusions to assess student learning.

Table 2. ***Analysis Questions and Potential Responses***

Q1	How did your personal experiences affect the rules you developed?	*Personal experience makes specific rules more meaningful or memorable.*
Q2	What rules did you and your partner initially overlook that you learned from others?	*Student answers will vary but might include specific rules on equipment use.*
Q3	Why should the rules you overlooked be included in the final list?	*Answers will vary, but any rule or procedure on the Laboratory Safety Agreement that was not included in the student list could be listed.*

Activity 1.1.3 PPE with a Purpose

Use this activity to reinforce the types of PPE students need and when they should use PPE.

Teacher Preparation

Set out the example PPE for students to research. Set up 15 stations for the students to observe, as described in Table 4. The stations listed are recommendations; you may need to adjust them based on your department. Arrange the stations, so students recommend all PPE at least once. Each station should have all the materials except the needed PPE.

Table 4. ***Example Materials***

Task	Example Materials	Example PPE Needed
Painting a project	Paint, brush, metal	Safety glasses, hair tie, respirator, closed-toed shoes, nitrile gloves
Grinding metal	Grinder, metal	Safety glasses, hair tie, leather closed-toed shoes, face shield, earplugs
Wiring an electrical circuit	Switch, diagonal cutting pliers, screwdriver, wire stripper	Safety glasses, hair tie
Making food for an FFA meeting	Food, plate	Foodservice gloves, hairnet

Swabbing biological specimens	Agar dish, incubator	Disposable lab gloves, laboratory apron
Welding metal	Arc welder, electrode, metal, chipper	Fire-resistant shop coat, welding helmet, leather gloves, safety glasses, hair ties, leather closed-toed shoes, leather apron
Cleaning parts with a solvent	Carburetor and carburetor cleaner	Safety goggles, respirator, rubber gloves, hair tie, closed-toed shoes
Sanding a board	Wood board and electric sander	Safety glasses, hair tie, shop coat, earplugs, closed-toed shoes
Cutting metal	Metal, metal chop saw	Safety glasses, hair tie, shop coat, face shield, closed-toed shoes
Mixing chemicals	Fertilizer or pesticide from the greenhouse, chemical measuring cups, sprayer	Safety goggles, hair tie, disposable lab gloves, rubber gloves
Tightening a bolt	Socket wrench, small engine	Safety glasses, hair tie, leather closed-toed shoes.
Hammering a nail overhead	Nail, board, hammer	Safety glasses, hair tie, leather closed-toed shoes, hard hat
Removing the oil from a small engine	Small engine, wrench, funnel, oil container	Safety glasses, hair tie, leather closed-toed shoes, shop coat, nitrile gloves
Drilling a hole in a piece of metal or wood.	Drill, clamp, metal, or wood	Safety glasses, hair tie, leather closed-toed shoes, face shield

Student Performance

In Part One, students research the example PPE using Chapter 2 of the *Agricultural Technical Systems and Mechanics* textbook and internet resources to help them with their research. Then, they rotate through the ten job stations, identifying the types of PPE each job will need. Students will record potential hazards and required PPE on *Activity 1.1.3 Student Worksheet*. Once students have rotated through each station, review the required PPE at each.

Results and Evaluation

Students identify the types and uses of PPE. The purpose of each type of PPE is listed in Table 5. They record their findings in Table 1 and Table 2 on *Activity 1.1.3 Student Worksheet.* Use Table 4 above to assess Table 2 of the student worksheet.

Table 5. *PPE Purpose*

PPE	Purpose
Earplugs	**Protection from high decibel noise**
Face shield	**Protects face from flying objects**
Fire-resistant shop coat	**Protects the body from fires**
Gloves, disposable, lab	**Protects hands from mild chemicals, biological specimens**
Gloves, foodservice	**Protects food from food handler**
Gloves, leather	**Protects hands from sharp objects**
Gloves, nitrile	**Protects hands from chemicals and small abrasives. Thicker than lab gloves**
Gloves, rubber	**Protects hands from liquids, chemicals, or harsh abrasives (sandblasting)**
Hairnet	**Protects food from food handler hairs**
Hair ties	**Holds back hair to prevent entanglement in equipment**
Hard hat	**Protection from falling objects**
Laboratory coat	**Protects the body from chemicals or biological specimens**

Leather chaps or apron	**Protects legs from sharp or hot objects**
Respiration mask	**Filters chemicals and debris in the air that can damage the lungs**
Safety glasses	**Protects eyes from flying objects, impact, minor dust**
Safety goggles	**Protects the eyes from chemical splash**
Welding helmet	**Protection from high-intensity light and sparks while welding.**
Work boots or closed-toed shoes	**Protects feet from heavy objects that could fall on them**

Activity 1.1.4 That Was Close!

Students identify near misses and explain root causes and potential accidents.

Teacher Preparation

Print and cut out five sets of **Activity 1.1.4 Incident Cards** on card stock, one set per group of four students. Print and keep blank copies of the **Near Miss Report** for future use. Blank copies of the *Near Miss Report* should be available in a permanent location in the classroom or laboratory facility.

Student Performance

Provide a set of *Activity 1.1.4 Incident Cards* to each group of students. Assign each student in the group one card. Students read and analyze their assigned incident card for possible accidents, root causes, and future prevention. Then, they share their information with group members. After students have shared their incidents, they each complete a *Near Miss Report* for their assigned incident.

Results and Evaluation

During this activity, students should learn how the industry tracks near misses and acts upon near misses before accidents occur. Students may be unfamiliar with equipment and processes at this point. Mastery of identifying a near miss may not occur at this stage. Use Socratic questioning to help students find potential near misses. Students keep the example *Near Miss Report* in the *Safety* section of their *Agriscience Notebook*. Encourage students to complete a *Near Miss Report* when witnessing an incident in the shop or laboratory. Table 6 outlines examples of hazards students may identify during the activity.

Table 6. ***Near Misses***

Incident		Near Misses
1	Your teacher demonstrates how to use a small engine. They clean up a fuel spill with shop disposable shop towels and throw them into the trash can.	**This is an example of improper disposable, creating a fire hazard.**
2	A student uses an electric hot plate to boil water for an experiment. They use an extension cord that is loosely dangling in a walkway.	**The extension cord presents a potential tripping hazard, thus, a splash and burn hazard.**
3	A student is mixing acids and bases for an experiment. They are cautious and tie back long hair. Then they put on disposable lab gloves, safety glasses, and a lab coat.	**Improper PPE use. Safety glasses do not protect eyes from chemical splashes. The student should wear safety goggles.**
4	A student is using a circular saw to cut a board. Today is a gameday and they are wearing business casual attire. Before class, they put on a laboratory coat from the lab to protect their clothing from sawdust. They also wear safety glasses and tie back long hair.	**Improper PPE use. Loose clothing with long sleeves, such as a laboratory coat, can get caught in a blade.**

Assessment

Lesson 1.1 Check for Understanding

Lesson 1.1 Check for Understanding is included for you to use as an assessment tool for this lesson. Use **Lesson 1.1 Check for Understanding Answer Key** for evaluation purposes.

Name____

Activity 1.1.1 In Case of Accidents

Purpose

Safety is everyone's responsibility. You can prevent most accidents if you know your surroundings and follow basic safety practices. Even when you are careful and follow procedures, accidents can happen, and knowing what to do in an emergency is critical for protecting yourself and others. The first step in any emergency is to remain calm. Then, assess the situation and determine what action you need to take.

Safety equipment is specific to the lab or shop situation and should be readily available. When working with any type of equipment, it is crucial to understand and follow safety procedures and the location of the safety equipment. Know where to find emergency equipment and supplies quickly to protect yourself and others.

Where are emergency items stored in your classroom, laboratory, and shop?

Materials

Per class:

- *Activity 1.1.1 Emergency Equipment Cards*
- Safety equipment

Per student:

- *Agriscience Notebook*
- Colored pencils
- Pencil

Procedure

Locate various pieces of emergency equipment stations in the classroom, laboratory, and shop using clues.

Part One – Finding Emergency Equipment

1. Move to the first station assigned by your teacher.
2. Read the equipment card.
3. Record the item name and the purpose and use in Table 1 on *Activity 1.1.1 Student Worksheet.*
4. Record a description of what the item looks like and its location in Table 1.
5. Read the next clue on the bottom of the equipment card to locate the next piece of safety equipment.
6. Continue to the next station and repeat Steps 2–5.
7. Move from station to station as directed by the clues until finished.

Part Two – Drawing Equipment Locations

1. Observe the laboratory area from Part One.
2. Draw a map of the area in Figure 1 on *Activity 1.1.1 Student Worksheet*.
3. Record the location of each safety item on your map.
4. Use colored pencils to indicate safety hazards and work zones using the proper safety colors.
   - Red – Danger or emergency
   - Orange – Warning
   - Yellow – Caution
   - Blue – Information
   - Green – Safety equipment
   - White – Traffic markings
   - White and Black – Traffic stop
   - Gray – Work area
5. If you use symbols to represent the items on the map, create a key for each symbol.

Conclusion

1. Why is knowing emergency equipment location helpful in an emergency?

2. Which pieces of emergency equipment would you use if there were a fire?

3. In addition to using the proper equipment, what else should you do when an accident happens?

Name____

Activity 1.1.1 Student Worksheet

Table 1. ***Safety Equipment***

Safety Item	Purpose and Use	Description	Location

Figure 1. Safety Equipment Map

Activity 1.1.1 Emergency Equipment Cards

Flammable Waste Can

A metal container stores rags and clothes to clean up flammable liquids.

The waste should be appropriately disposed of regularly.

Next Clue
“What is this liquid?”

Safety Data Sheet (SDS) Binder

This binder contains the SDS for all the chemicals and solutions used in the classroom.

The section for each chemical has how to handle the chemical safely, how to clean up any spills and what to do if you come into direct contact with the chemical.

Next Clue
“The building is on fire!”

Fire Alarm

If the event of a fire, follow the directions on the panel.

Only activate the alarm if there is an actual fire emergency.

Next Clue
“Kill the power!”

Emergency Stop Button

In an emergency where a piece of equipment is hurting someone, you can press this button, and it will stop all power to the shop.

The button is red to represent danger. Notify the teacher immediately if you have to use this button.

Next Clue
“There’s something in your eye!”

Eyewash/Shower Station

An eyewash station is used to remove foreign material from the eyes. In emergencies, serious injury can be avoided by prompt action.

The shower can assist with washing off chemicals to prevent further injury.

Next Clue
“I’m bleeding!”

First Aid Kit

In this kit, you will find:

- Band-aids
- Gauze
- Burn gel
- Medical tape

It is used to provide emergency medical care and to bandage minor injuries.

Next clue
“Help me put out this burning rag!”

Fire Extinguisher

When putting out fires, remember three steps:

1. Hold upright and pull the ring pin.
2. Start back 10 feet. Aim at the base of the fire.
3. Squeeze lever. Sweep side to side.

Extinguishers are marked according to the class of fires on which they will safely work.

Next Clue
"Someone is on fire. Cover them up!"

Fire Blanket

A Fire Blanket can be used on most fires. They work by smothering the fire and depriving it of oxygen.

When using the blanket

- Unfold the blanket completely.
- Keep the blanket between you and the fire, and throw the blanket on the fire.
- If the fire is on a person, wrap the blanket around the flames on the victim.
- Let the blanket cool for more than 1 hour; they are designed to be reused.

Next Clue
"Who you gonna call?"

Emergency Response Card

This card contains important steps on how to respond to an emergency.

Remember, in severe emergencies, dial 911. This card also guides you through the information the 911 respondent will need to know.

Next Clue
"Clean up in aisle three, gasoline."

Name____

Activity 1.1.2 You Make the Rules

Purpose

Safety first! You may have seen or heard this phrase in many settings, from home to school to a factory, but wonder how safety can always be first. What does being safe truly mean? Safety procedures and rules are two means of creating a safe environment. Safety procedures are routine steps for carrying out activities. Safety rules are specific statements that inform what is to be done. There are many ways to complete a job when working with tools and equipment in a laboratory, shop, or outdoors; however, safely approaching that job can make a huge difference.

Materials

Per pair of students:

- Highlighter
- Markers
- Paper, copier

Per student:

- *Agriscience Notebook*
- *CASE Safety Manual*
- *Laboratory Safety Agreement*
- Pencil

Procedure

Work with a partner to develop a list of the top rules or procedures for working with equipment and materials in class activities and projects. Then work with another pair to compare your ten rules. Finally, compare your list of rules with the *Laboratory Safety Agreement*.

Part One – Pair it Up

Work with your partner to develop a list of the ten safety rules or procedures. Record your list on the copier paper with the markers provided. Keep in mind that these are guidelines you think everyone should follow. You have 10 minutes to develop the list with your partner.

Part Two – Expand the Team

Join another pair of students to form a group of four. Share your rule list with your group. After both pairs have shared their lists, use the highlighters to highlight similar rules or procedures. Use the *CASE Safety Manual* and both lists of safety rules to create a master list of the top ten safety rules and procedures. Record your rules in Table 1 on *Activity 1.1.2 Student Notes*. Answer the *Analysis Questions*. You have fifteen minutes to complete Part Two.

Part Three – Group Sharing and Class Collaboration

Your teacher will present the *Laboratory Safety Agreement* to the class. Compare it to the list of the top ten safety rules and procedures from Table 1. Sign the *Laboratory Safety Agreement* and have your parent/guardian sign it before submitting it to your teacher. Place a copy of the document in your *Agriscience Notebook* to refer to as you complete the exercises throughout this course.

Conclusion

1. How are rules essential to maintaining a safe work environment?

Name____

Activity 1.1.2 Student Notes

Table 1. ***Top Ten Safety Rules and Procedures***

1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Analysis Questions

Q1 How did your personal experiences affect the rules you developed?

Q2 What rules did you and your partner initially overlook that you learned from others?

Q3 Why should the rules you overlooked be included in the final list?

Name____

Activity 1.1.3 PPE with a Purpose

Purpose

You are required to wear personal protective equipment (PPE) in an agricultural laboratory or mechanics facility. Engineers design PPE to protect you from hazards in a work area. The PPE you will need varies based on the work you are doing. PPE can protect you from laboratory chemicals or potential flying objects in a shop.

PPE protects you from more than external injuries. High-pitch noises and inhaled fumes may have a long-term impact on your body that you may not realize in the short term. All types of PPE must be available and correctly worn when working in agriscience classes. Some PPE will always be required in the laboratory or shop, while certain tools and machines may require additional PPE, such as respiration equipment and helmets.

How can you assess a tool to determine what PPE you must wear? What proactive approaches should you take to be safe?

Materials

Per class:

- (15) Example workstations
- Earplugs
- Face shield
- Fire-resistant shop coat
- Gloves, disposable, lab
- Gloves, foodservice
- Gloves, leather
- Gloves, nitrile
- Gloves, rubber
- Hair ties
- Hairnet
- Hard hat
- Laboratory coat
- Leather chaps or apron
- Respiration mask
- Safety goggles
- Welding helmet
- Work boots or leather closed-toed shoes

Per student:

- *Agricultural and Technical Systems and Mechanics* textbook
- *Agriscience Notebook*
- Device with internet access
- Pencil
- Safety glasses

Procedure

Observe the PPE available for you to use in the laboratory and shop and identify the purpose of each. You will then rotate through multiple workstations in the shop. Use your observations and current knowledge of tools to determine the PPE required.

Part One – Identify the Purpose

Your teacher has provided you with multiple examples of PPE. Use Chapter 2 of *Agricultural Technical Systems and Mechanics* and internet resources to identify the items and explain the purpose of each. Record your findings in Table 1 of *Activity 1.1.3 Student Worksheet*.

Part Two – Identify the Dangers

Your teacher has set up 15 example workstations where common tasks in the laboratory and shop occur. Work with your partner to identify the potential hazards at each station and the PPE that can protect you from those hazards.

1. Put on your safety glasses and tie back long hair.
2. Rotate through the workstations as instructed by your teacher. You will have two minutes per station.
3. Record the hazards and the proper PPE needed in Table 2.

Part Three – Share and Compare

1. Your teacher will assign you and your partner one of the stations to report on.
2. Rotate through the stations as instructed by your teacher.
3. Share the hazards you identified, and the PPE students should wear during each task.
4. Your classmates and teacher will identify any hazard or PPE you may have missed.
5. Record any PPE or hazards you missed in Table 2.

Conclusion

1. What was the most common hazard identified?

2. What PPE is most common?

3. Why do some tasks in the laboratory or shop require specialized PPE?

Name____

Activity 1.1.3 Student Worksheet

Table 1. *PPE Purpose*

PPE	Purpose
Earplugs	
Face shield	
Fire-resistant shop coat	
Gloves, disposable, lab	
Gloves, foodservice	
Gloves, leather	
Gloves, nitrile	
Gloves, rubber	
Hairnet	
Hair ties	
Hard hat	
Laboratory coat	
Leather chaps or apron	
Respiration mask	
Safety glasses	
Safety goggles	
Welding helmet	
Work boots or leather closed-toed shoes	

Table 2. ***Hazards and PPE***

Task	Hazards	PPE
Painting a project		
Grinding metal		
Wiring an electrical circuit		
Making food for an FFA meeting		
Swabbing biological specimens		
Welding metal		
Cleaning parts with a solvent		
Sanding a board		
Measuring chemicals		
Cutting metal		
Mixing chemicals		
Tightening a bolt		
Hammering a nail overhead		
Removing the oil from a small engine		
Drilling a hole in metal or wood		

Name____

Activity 1.1.4 That Was Close!

Purpose

Have you ever seen a car go through a red light without causing an accident? Slipped on a sidewalk without falling? Most of us have been in situations where we were "lucky" enough not to get hurt. These incidents, called near misses, often occur in industry and manufacturing. Addressing near misses is a vital step in future injury prevention.

Throughout this course, you will work in a shop and/or laboratory, potentially exposing you to near misses. You and your classmates must monitor and report near misses before they become serious accidents. Reporting a near miss is not "ratting" or "tattling" about another person's actions. It is a responsible action to prevent others from injury.

All accidents have a root cause. All near misses have a root cause as well. Identifying the root cause of a near miss can prevent an accident from happening in the future. An example near miss would be a coworker operating a power drill without PPE and injury. Avoiding injury does not mean it is OK not to wear PPE. The risk of an eye injury is much higher when not wearing eye protection. An immediate root cause may be the PPE was not available. Underlying root causes could be improper training or the coworker rushing to complete a job. Addressing these near misses prevents future accidents.

What near misses are common? How do you report and prevent a near miss?

Materials

Per group of four students:

- *Activity 1.1.4 Incident Cards*

Per student:

- *Agriscience Notebook*
- *Near Miss Report*
- Pencil

Procedure

Analyze a near miss. Then, share example near misses in a group of four. Then, complete an example incident report.

Part One – Incident Card

1. Obtain an *Activity 1.1.4 Incident Card* from your teacher.
2. Describe the incident in Table 1 of *Activity 1.1.4 Student Worksheet*. Include the following in your description:
   - A description of the incident
   - Potential accidents that could have occurred during the incident
   - Root causes of the incident
   - Means of prevention

Part Two – Share Incidents

Share your incident by reading the card out loud to the group. Detail potential accidents, root causes, and means of prevention. Record incidents from other group members in Table 2.

Part Three – Near Miss Report

Using the *Near Miss Report*, complete an incident report for your assigned incident card. Submit the report as directed by your teacher.

Conclusion

1. How does reporting a near miss to improve the safety of a work environment?

2. What is an example of a near miss you have witnessed?

3. How will near miss reporting keep your fellow students safe?

Name____

Activity 1.1.4 That Was Close!

Table 1. ***Your Incident***

Incident Card	
Description of Incident	
Potential accidents that could have occurred during the incident	
Root causes of the incident	
Means of prevention	

Table 2. ***Group's Incidents***

Incident Card	
Description of Incident	
Potential accidents that could have occurred during the incident	
Root causes of the incident	
Means of prevention	
Incident Card	
Description of Incident	
Potential accidents that could have occurred during the incident	
Root causes of the incident	
Means of prevention	
Incident Card	
Description of Incident	
Potential accidents that could have occurred during the incident	
Root causes of the incident	
Means of prevention	

case learning

CURRICULUM FOR AGRICULTURAL SCIENCE EDUCATION

CASE Safety

Safety is an Attitude

Unit 1 – Lesson 1.1 Safety Starts with You

What is Safety?

The freedom from accidents

A personal responsibility

Respect for yourself, your classmates, and property

The Attitude of Safety

- ✓Positive attitude
- ✓Willingness to try new things
- ✓Read and follow all procedures
- ✓Clean up according to instructions
- ✓Care for self, others, and property

Personal Protective Equipment

Equipment designed to protect you from injury or illness

- Safety glasses or safety goggles
- Hair tie for long hair
- Lab apron of lab coat
- Disposable gloves
- Close-toed shoes

Wear when working with chemicals, heat, and moving mechanisms

Safety Glasses vs Safety Goggles

Safety Glasses

- Impact hazards
- Front and some side coverage
- Protection from objects that could bruise, pierce or damage the eyes

Safety Goggles

- Splash hazards
- 360º coverage
- Protection from chemical and airborne hazards

Working with Hazardous Materials

Glass
- Handle with care, do not touch broken glass

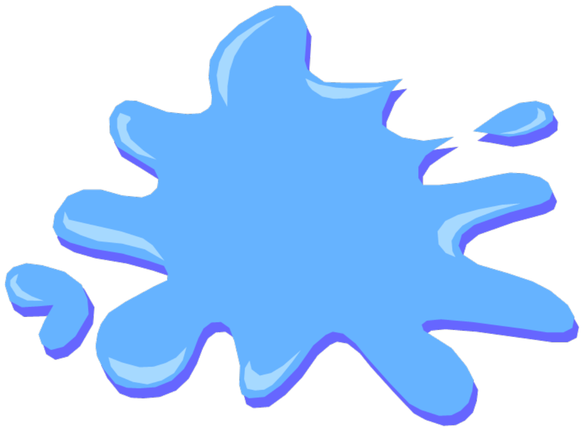
Chemicals
- Mix only as directed

Fire
- Keep hair and loose clothing pulled back

Tools
- Use for designated purpose

Accidents Happen

- Report all spills and breakages to instructor
- Clean up equipment and workspace properly
- Do not attempt to dispose of materials without instruction – there may be harmful reactions



Safety Colors

Used as indicators, reduces need for words

Each color or combination of colors conveys a specific message

Messages these colors can convey:

- Alert people to danger or hazards
- Help locate certain objects
- Help people react quickly to emergencies

Safety Colors

Red	-**Danger** or emergency such as safety switches and fire equipment
Orange	-**Warning** to hazards like sharp edges or openings
Yellow	-**Caution** around moving parts of machinery
Blue	-Used to convey **Information**

Safety Colors

Green	- Indicates the presence of **Safety equipment**
White	-**Traffic Markings**
White &Black Stripes	-Used for traffic to **Stop** before entering white zone
Gray	- Indicates work area

Major Safety Concerns

Fire

- Presence of flammable and combustible materials
- Heat sources

Electrocution

- High voltage equipment

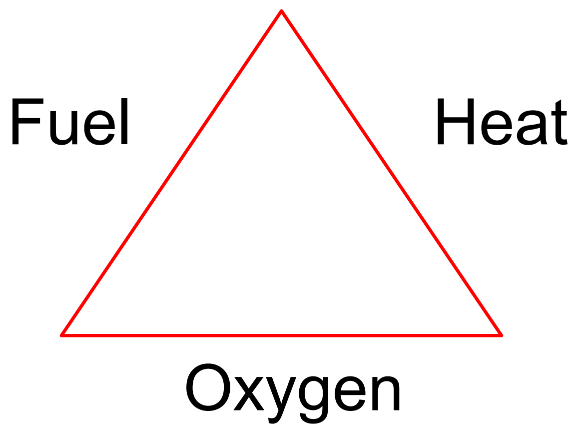
Bodily injury

- Crushing, smashing, pinching, abrasions

Components Needed for Fire

The three components needed for fire:

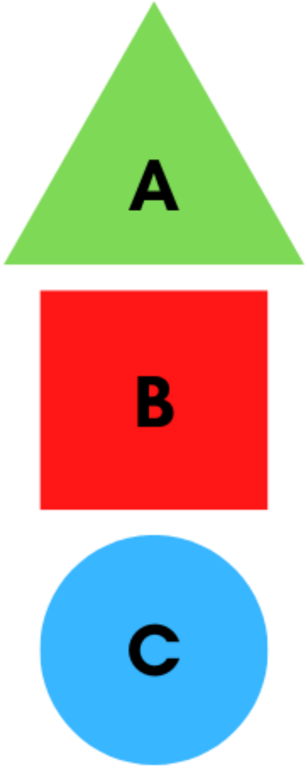
- Fuel
- Heat
- Oxygen



Together, they are known as the fire triangle.

To produce a fire all three elements must be present.

Fire Classes



A – Ordinary Combustibles
- Wood, paper, cloth

B – Flammable Liquids
- Grease, oil, paint, solvents

C – Live Electrical Equipment
- Electrical panel, motor, wiring

D – Combustible Metal
- Magnesium, aluminum

K – Flammable Liquids
- Cooking oils, animal fats, vegetable oils

Preventing Fires

Removing one of the sides of the fire triangle will eliminate the fire.

Fire prevention is important in the shop and laboratory.

- Use fire only in safe surroundings
- Store combustible materials and fuels properly

Presentation Review

- Mark or highlight three key points.
- List two ideas or concepts related to previous knowledge.
- List questions you have about this topic.
- Keep notes organized and available for use throughout the course.

References

- Feldkamp, S. (Ed.). (2002). *Modern biology*. Austin, TX: Holt, Rinehart, and Winston.
- Herren, R. V., & Donahue, R. L. (2000). *Delmar's agriscience dictionary with searchable CD-ROM*. Albany, NY: Delmar.
- Herren, R. V., & Cooper, E. L. (2010). *Agricultural mechanics: Fundamentals & applications (6th ed.)*. Albany, NY: Delmar.

Lesson 1.1 Glossary

A

Abrasion – A scraped spot or area; the result of rubbing or scuffing.

Accident – An undesirable or unfortunate happening that occurs unintentionally and usually results in harm, injury, damage, or loss; casualty; mishap.

Attitude – A manner, disposition, feeling, or position with regard to a person or thing; tendency or orientation.

C

Caution – Alertness and prudence in a hazardous situation; care; wariness.

D

Danger – Liability or exposure to harm or injury; risk; peril.

E

Electrocute – To kill by electricity.

Emergency – A sudden, urgent, usually unexpected occurrence or occasion requiring immediate action.

Extinguish – To put out (fire or light); put out the flame of something burning or lighted.

F

Fire extinguisher – A portable container, usually filled with special chemicals for putting out a fire.

Fire triangle – The three conditions, fuel, heat, and oxygen, that must be present to produce a fire.

Fuel – Any material that will burn.

H

Hazard – An unavoidable danger or risk, even though often foreseeable.

Heat – The type of energy that causes the temperature of an object or environment to rise.

O

Oxygen – A colorless, odorless reactive gas that is one of the three ingredients necessary for a fire.

P

Personal Protective Equipment (PPE) –Safety equipment worn for protection against safety hazards in the work area

Procedure – One of a series of steps taken to accomplish an end.

S

Safety – The freedom from accidents.

Safety color – Color used as part of a standardized coding system according to which each color conveys a specific safety message.

Safety glasses – Glasses with impact-resistant lenses, reinforced frames, and side shields.

Safety goggles – Goggles that shield the eye against liquid or chemical splash, vapors, and fumes.

N

Near miss – – An unplanned event that did not result in injury, illness, or damage – but had the potential to do so.

R

Root cause – The most basic cause that can be reasonably identified.

W

Warning – Something that serves to warn, give notice, or caution.

Name____

Lesson 1.1 Check for Understanding

1. Describe three pieces of personal protective equipment you should wear when working with chemicals and why each piece is necessary.

Item	Reason of importance
1.	
2.	
3.	

2. List two safety rules or procedures from the *Laboratory Safety Agreement* you think are the most important and describe why you believe this is so.

3. Why is it important to follow laboratory and shop procedures?

4. Match the following emergency equipment items with their description:

____	Emergency Stop Button	A.	Device to remove one of the three elements of a fire
____	Fire Blanket	B.	Contains items like gauze, burn gel, etc.
____	First Aid Kit	C.	Shuts down all power to the shop
____	Fire Extinguisher	D.	Used to remove foreign material
____	Eye Wash/Shower	E.	Special fabric used to smother a fire and deprive it of oxygen
____	Emergency Response Card	F.	Details the information needed by the 911 responder

5. List five types of PPE. For each item, provide a brief purpose and how it should be worn.

6. What is a near miss? List two examples.

Lesson 1.1 Check for Understanding Answer Key

1. Describe three pieces of personal protective equipment you should wear when working with chemicals and why each piece is necessary.

Answers will vary but might include the following.

Item	Reason of importance
Safety goggles	**eye protection**
Disposable gloves	**hand and skin protection**
Lab apron	**skin and clothing protection**

2. List two safety rules or procedures from the *Laboratory Safety Agreement* you think are the most important and describe why you believe this is so.

Answers will vary.

3. Why is it important to follow laboratory and shop procedures?

Answers will vary but might include getting accurate results or avoiding injury.

4. Match the following emergency equipment items with their description:

C	Emergency Stop Button	A.	Device to remove one of the three elements of a fire
E	Fire Blanket	B.	Contains items like gauze, burn gel, etc.
B	First Aid Kit	C.	Shuts down all power to the shop
A	Fire Extinguisher	D.	Used to remove foreign material
D	Eye Wash/Shower	E.	Special fabric used to smother a fire and deprive it of oxygen
F	Emergency Response Card	F.	Details the information needed by the 911 responder

5. List five types of PPE. For each item, provide a brief purpose and how it should be worn.

Answers may vary but may include any five of the following.
Safety glasses, safety goggles, laboratory coat fire-resistant shop coat, hair ties, leather gloves, rubber gloves, earplugs, welding helmet, respiration mask, leather chaps, and work boots or leather closed-toed shoes.

The purpose of the item should explain how it protects the operator.
The use should explain an action or procedure requiring PPE.

6. What is a near miss? List two examples.

A near miss is a safety violation that didn't result in injury or accident. Examples will vary but may include PPE violations, not following operating procedures, fire hazards, tripping hazards, etc.

Lesson 1.1 Materials

Unit 1 – Lesson 1.1 Safety Starts with You

APP	Qty/ 20	Qty/ 30	Unit	Item Specifications	Vendor
1.1.1	1	1	Each	*Activity 1.1.1 Emergency Equipment Card*	*CASE Teacher Notes*
	20	30	Set	Colored pencils, assorted	Local
	1	1	Each	Emergency stop button	Local
	1	1	Each	Eye wash/shower station	Local
	1	1	Each	Fire alarm	Local
	1	1	Each	Fire blanket	Local
	1	1	Each	Fire extinguisher	Local
	1	1	Each	First aid kit	Local
	1	1	Each	Flammable waste can	Local
	1	1	Each	Scissors	Local
	1	1	Each	SDS Binder	Printed
1.1.2	10	15	Each	Highlighter	Local
	10	15	Set	Markers	Local
	10	15	Each	Paper, copier	Local
1.1.3	1	1	Each	Earplugs	Local
	10	10	Each	Example workstations – See Teacher Notes	Local
	1	1	Each	Face shield	Local
	1	1	Each	Fire-resistant shop coat	Local
	1	1	Pair	Gloves, disposable, lab	Ward’s
	1	1	Pair	Gloves, foodservice	Local
	1	1	Pair	Gloves, leather	Local
	1	1	Pair	Gloves, nitrile	Local
	1	1	Pair	Gloves, rubber	Local
	1	1	Pair	Hairnet	Local
	1	1	Each	Hair ties	Local
	1	1	Each	Hard hat	Local
	1	1	Each	Laboratory coat	Ward’s
	1	1	Each	Leather chaps or apron	Local
	1	1	Each	Respiration mask	Local
	1	1	Each	Safety goggles	Ward’s
	1	1	Each	Welding helmet	Local
	1	1	Each	Work boots or leather closed-toed shoes	Local
	20	30	Each	*Agricultural and Technical Systems and Mechanics* textbook	American Technical Publishers
	20	30	Each	Device with internet access	Local
	20	30	Each	Safety glasses	Ward’s
1.1.4	1	1	Each	*Activity 1.1.4 Incident Cards*	CASE Teacher Notes
	1	1	Each	Scissors	Local
	20	30	Each	*Near Miss Report*	CASE Teacher Notes

Lesson 1.2 The Hazards Around You

Preface

Daily, we are in the presence of hazards. Would your students be ready if there was an accident or a fire? Safety Data Sheets (SDS), first aid, fire extinguishers, and sound and spacing regulations help respond to emergencies. These tools and regulations allow someone to act, report conditions, or ensure that equipment is in working order.

Knowing how to use emergency equipment properly will ensure a proper response. The laboratory and shop are environments in which to learn if general guidelines are followed by students, teachers, and school districts. Setting limits on the number of students in a class or space in Career and Technical Education courses allows students to work with their hands without crowding or compromising safety.

Students start the lesson using Safety Data Sheets (SDS) and an Emergency Response Guide (ERG) to respond to chemical accidents. Then, they explore the most common workplace injuries and create a first-aid booklet. Next, students study the types of fire extinguishers and compare types of hearing protection. To complete the lesson, students look in-depth at facilities by measuring facilities and looking for recommended square footage in workspaces.

Concepts	Performance Objectives
Students will know and understand	*Students will learn concepts by doing*
1. Safety Data Sheets (SDS) and the Emergency Response Guide (ERG) contain important information on using chemicals and responding to chemical spills and emergencies.	• Use SDS forms and an ERG to determine the proper use and cleanup of chemicals. (Activity 1.2.1)
2. The purpose of first aid is to treat injuries or accidents to sustain life until professional medical attention can be received.	• Prepare an emergency first aid booklet. (Activity 1.2.2)
3. The three components of the fire triangle are heat, fuel, and oxygen.	• Identify the components of a fire triangle. (Activity 1.2.3) • Demonstrate proper understanding of fire extinguishers usage and properties in various settings. (Activity 1.2.3)
4. The Occupational Safety and Health Administration (OSHA) sets noise protection, intensity, and duration standards.	• Examine hearing protection devices and the duration and intensity each covers. (Activity 1.2.4) • Take sound level meter readings of activities in laboratory settings. (Activity 1.2.4)
5. The Occupational Safety and Health Administration (OSHA) sets space requirements for the workplace.	• Use a checklist to examine and calculate room occupancy load ratings. (Activity 1.2.5) • Compare gross square footage and net square footage calculations. (Activity 1.2.5)

National AFNR Common Career Technical Core Standards Alignment

Career Ready Practices
4. Communicate clearly, effectively and with reason.
• CRP.04.01: Speak using strategies that ensure clarity, logic, purpose, and professionalism in formal and informal settings.

• CRP.04.02: Produce clear, reasoned, and coherent written and visual communication in formal and informal settings.
• CRP.04.03: Model active listening strategies when interacting with others in formal and informal settings.
6. Demonstrate creativity and innovation.
• CRP.06.01: Synthesize information, knowledge, and experience to generate original ideas and challenge assumptions in the workplace and community.
3. Examine and summarize importance of health, safety, and environmental management systems in AFNR organizations.
• AG 3.1: Examine health risks associated with a particular skill to better form personnel safety guidelines.
• AG 3.2: Develop response plans to handle emergencies.
• AG 3.3: Identify hazards and acquire first aid skills to promote environmental safety.
• AG 3.4: Examine required regulations to maintain/improve safety, health and environmental management systems and sustainable business practices.
• AG 3.5: Enact procedures that demonstrate the importance of safety, health, and environmental responsibilities in the workplace.
• AG 3.6: Demonstrate methods to correct common hazards.
• AG.3.7: Demonstrate application of personal and group health and safety practices.
Power, Structural and Technical (AG-PST)
1. Apply physical science principles and engineering applications related to mechanical equipment, structures, and biological systems to solve problems and improve performance in AFNR power, structural, and technical systems.
AG-PST 1.2: Use hand and power tools commonly required in power, structural, and technical systems

Essential Questions

1. What are Safety Data Sheets?
2. How are Safety Data Sheets used in a shop setting?
3. What materials or items should be available in a work environment if an accident occurs?
4. What is first aid?
5. What factors determine how you provide first aid to a victim?
6. What are the classes of fire extinguishers?
7. How are fire extinguishers used?
8. What are the requirements for a fire extinguisher to pass inspection?
9. How can hearing loss be prevented?
10. What are the different types of hearing protection devices?
11. What are hearing protection standards?
12. Who sets standards for workspace requirements?
13. What factors determine the occupancy rating of a workspace?
14. What is the difference between net and gross square footage?

Key Terms

Building code	**Decibel**	**Ear canal cap**
Ear plugs	**Ear muffs**	**Emergency response guide (ERG)**
First aid	**Hazardous material**	**Health hazard**
International building code (IBC)	**Occupational Safety and Health Administration (OSHA)**	**Safety data sheet (SDS)**
Sound level meter (SLM)	**National Institute for Occupational Safety & Health (NIOSH)**	**Noise duration**

Noise intensity	Noise reduction rating	Ventilate

Day-to-Day Plans
Time: 9 days

Refer to the Teacher Resources section for specific information on teaching this lesson, in particular ***Lesson 1.2 Teacher Notes****,* ***Lesson 1.2 Glossary****,* ***Lesson 1.2 Materials****, and other support documents.*

Day 1:

- Present the **Concepts and Performance Objectives**, **Essential Questions**, and **Key Terms** to provide a lesson overview.
- Prepare **Activity 1.2.1 ERG Cards** for students to use in Part Two.
- Provide students with a copy of **Activity 1.2.1 SDS Protocols**.
- Students complete Part One of *Activity 1.2.1 SDS Protocols* individually.

Day 2:

- Provide students with a copy of **1.2.1 Activity ERG Flowchart Handout** for Part Two.
- Students complete Part Two *Activity 1.2.1 SDS Protocols* in pairs to complete the activity.

Day 3:

- Provide students with a copy of **Activity 1.2.2 Plan of Action**.
- Present PowerPoint® **First Aid**.
- Students take notes using the **Presentation Notes** pages provided by the teacher.
- Students complete Part One of *Activity 1.2.2 Plan of Action* as a class.

Day 4:

- Students complete Part Two and Three of *Activity 1.2.2 Plan of Action* individually.
- Students complete Part Four of *Activity 1.2.2 Plan of Action* as a class to complete the activity.

Day 5:

- Provide students with a copy of **Activity 1.2.3 Fight or Flee**.
- Prepare **Activity 1.2.3 Fire Extinguisher Cards** for students to use in Part Two.
- Present PowerPoint® **Fire Extinguisher Safety**.
- Students take notes in the *Activity 1.2.3 Fight or Flee Student Worksheet Table 1* provided by the teacher.
- Students complete Part One *Activity 1.2.3 Fight or Flee* individually.

Day 6:

- Students complete Part Two *Activity 1.2.3 Fight or Flee* in pairs.
- Students work in groups to complete Part Three of *Activity 1.2.3 Fight or Flee* to complete the activity.

Day 7:

- Provide students with a copy of **Activity 1.2.4 Hearing Protection**.
- Students complete *Activity 1.2.4 Hearing Protection* in groups.

Day 8:

- Provide students with a copy of **Activity 1.2.5 CTE Spacing**.
- Students complete *Activity 1.2.5 CTE Spacing* in groups.

Day 9:

- Distribute **Lesson 1.2 Check for Understanding**.
- Students complete *Lesson 1.2 Check for Understanding* and submit for evaluation.
- Use **Lesson 1.2 Check for Understanding Answer Key** to evaluate student assessments.

Instructional Resources

PowerPoint® Presentations

First Aid

Fire Extinguisher Safety

Student Support Documents

Lesson 1.2 Glossary

Presentation Notes

Activity 1.2.1 SDS Protocols

Activity 1.2.2 Plan of Action

Activity 1.2.3 Fight or Flee

Activity 1.2.4 Hearing Protection

Activity 1.2.5 CTE Spacing

Teacher Resources

Lesson 1.2 Lesson The Hazards Around You (PDF)

Lesson 1.2 Teacher Notes

Lesson 1.2 Materials

Activity 1.2.1 ERG Cards

Activity 1.2.1 ERG Flowchart (PDF)

Activity 1.2.3 Fire Extinguisher Cards

Lesson 1.2 Check for Understanding

Answer Keys and Assessment Rubrics

Lesson 1.2 Check for Understanding Answer Key

Reference Sources

AFP. (2023, November 27). *The ultimate guide to fire extinguishers for business*. Allegiant Fire Protection. **https://allegiantfire.net/news/fire-extinguishers-for-business/**

Dictionary.com. (n.d.-a). Dictionary.com. **http://www.dictionary.com/**

DOT, U. S. (n.d.). *Emergency response guidebook (ERG)*. PHMSA. **https://www.phmsa.dot.gov/training/hazmat/erg/emergency-response-guidebook-erg**

Extension, I. S. U. (n.d.). *Safe Farm Promoting Agricultural Health and Safety: Lend an ear to hearing Protection*. Index of /static_content. **https://nasdonline.org/static_content/**

Great Plains Center, U. of I. (2017, May). *How to Choose an HPD Handout*. University of Iowa College of Public Health. **https://www.public-health.uiowa.edu/wp-content/uploads/2017/05/How-to-choose-HPD-handout.pdf**

Grinnell Mutual. (n.d.). *Loss control bulletins: Preventing losses: Grinnell Mutual*. Grinnell Mutual Insurance. **https://www.grinnellmutual.com/insurance/business/preventing-losses/loss-control-bulletins**

Herren, R. V. (2010). Unit 4 Personal Safety in Agricultural Mechanics. In *Agricultural Mechanics Fundamentals and Applications* (6th ed., pp. 41–52). essay, Delmar.

Herren, R. V., & Donahue, R. L. (2000). *Delmar's agriscience dictionary with searchable CD-ROM*. Albany, NY: Delmar.

MN Dept. of Education. (2022b). *MN CTE School Laboratory/Shop Safety Manual*. Safety guidance for CTE. **https://education.mn.gov/MDE/dse/cte/safety/**

NIOSH, C. D. C. (n.d.). *Agricultural Safety*. Centers for Disease Control and Prevention. **https://www.cdc.gov/niosh/topics/aginjury/**

SAE for All

Foundational SAE

All students in an agricultural education program are expected to have a Foundational SAE. Students completing the APP and extensions listed below will meet the Foundational SAE qualification for the *Awareness or Intermediate (Grades 9-10) level*. Students should place all documented evidence in their Agriscience Notebook along with the **SAE for All Foundational Checksheet**.

SAE Workplace Safety Standards

- Activity 1.2.1 SDS Protocol
  - CS.03.01.01.b. Execute health, safety, and environmental procedures to comply with regulatory and safety standards.
- Activity 1.2.2 Plan of Action
  - CS.03.01.01.b. Execute health, safety, and environmental procedures to comply with regulatory and safety standards.
- Activity 1.2.3 Fight or Fleet
  - CS.03.01.01.b. Execute health, safety, and environmental procedures to comply with regulatory and safety standards.
  - CS.03.04.01.b. Analyze and demonstrate adherence to protective equipment requirements when using various AFNR tools and equipment.
  - CS.03.04.03.b. Assess and demonstrate appropriate operation, storage, and maintenance techniques for AFNR tools and equipment.
- Activity 1.2.4 Hearing Protection
  - CS.03.01.01.b. Execute health, safety, and environmental procedures to comply with regulatory and safety standards.
  - CS.03.04.01.b. Analyze and demonstrate adherence to protective equipment requirements when using various AFNR tools and equipment.
  - CS.03.04.03.b. Assess and demonstrate appropriate operation, storage, and maintenance techniques for AFNR tools and equipment.
- Activity 1.2.5 CTE Spacing
  - CS.03.01.01.b. Execute health, safety, and environmental procedures to comply with regulatory and safety standards.
  - CS.03.04.03.b. Assess and demonstrate appropriate operation, storage, and maintenance techniques for AFNR tools and equipment.

Access the **SAE for All Educator Resources** site for additional teacher and student resources.

Lesson 1.2 Teacher Notes

Lesson 1.2 The Hazards Around You

In preparation for teaching this lesson, review Concepts, Performance Objectives, Essential Questions, and Key Terms, along with the PowerPoint® presentation. Also, review all activity directions, expectations, and work students complete.

Throughout this lesson, students continue exploring safety in their school's agriscience facilities. They begin by looking at safety data sheets (SDS) and then view oil and gasoline SDSs. Students then discuss the six most common injuries and create a first-aid booklet. Fire extinguishment devices are reviewed, and the different classes of extinguishers are examined. Hearing protection devices and what protection they provide for everyday noises are surveyed. Students then conclude the lesson by looking at the recommended square footage for various tasks and determining how many people can work in that space safely.

PowerPoints®

First Aid

Use this presentation before *Activity 1.2.2 Plan of Action* to teach students what first aid is and when a person should use it. Focus on assessing the situation and the victim. Students use the presentation to identify the most common injuries that could occur in school labs or shop spaces.

Fire Extinguisher Safety

Use this presentation in conjunction with *Activity 1.2.3, Fight or Flee,* to teach students the types of fire extinguishers and how to use them. Students focus on the different classes and their usage. Students use the presentation to select the proper fire extinguishment device in a given scenario.

Activities, Projects, and Problems

Activity 1.2.1 SDS Protocols

Students review the SDS sheets for **gasoline** and **oil**. Then students work to find Emergency Response Guide recommendations for unknown materials.

Teacher Preparation

1. If you are unfamiliar with SDS forms, review the differences between the newer SDS format and the previously used **Material Safety Data Sheet (MSDS)** format found at (https://www.msdsonline.com/blog/complianceeducation/2012/08/20/from-msds-to-sds).

2. Print 20 copies of the gasoline and oil SDS to distribute to students before starting the activity.

3. Be prepared to instruct students on the location of SDS forms for the laboratory, according to local school district policy and OSHA requirements. If you have not yet compiled all SDS forms for items in the laboratory/shop, you can do so as an example for students to use throughout the course. When you receive items shipped, file the corresponding SDS forms. Print the **CASE SDS Binder** for local use. The CASE SDS Binder includes SDS sheets for all chemicals used in CASE courses.

4. ERGs are available in PDF, hardcopy, and through the ERG 2020 Application. You may also consider contacting your local fire department and inviting them in for a discussion and further explanation. This activity is intended for students to learn how to alert proper authorities and describe the scene from a

safe location. If needed, this video explains how to use the ERG App. A digital version of the ERG, called ERG 2020, is also available on the app store. The **Emergency Response Guidebook Application 2024** is available in Spring 2024. In class, show the video **How to use the ERG 2020 App < https://www.youtube.com/watch?v=QclcL01EVYY**>

5. Print the *Activity 1.2.1. ERG Cards* on cardstock and cut out. Each pair receives one scenario card. Each card leads the pair using different ERG application sections and to the Public Safety, Health, and Fire and Explosion Sections.

6. Print **Activity 1.2.1 ERG Flowchart** for students to reference while completing Part Two Table 2.

Student Performance

Part One

Students review the 16-section SDS forms and respond to questions on the student worksheet. Students examine SDS forms to locate information necessary for a laboratory. Be aware that answers may be found in different locations, depending on the SDS format and the item targeted by the SDS form.

Part Two

After watching a short video on using the Emergency Response Guide (ERG), students provide direction for public safety utilizing three scenarios and complete Table 2 with information from the ERG 2020 Application. Students use *Activity 1.2.1 ERG Flowchart* to assist in completing Table 2.

Results and Evaluation

During this activity, students should be able to read and identify common information in SDS sheets. An explanation of each section used in the SDS format is available at **https://www.osha.gov/Publications/HazComm_QuickCard_SafetyData.html**. However, Table 1 also provides a quick overview and information to help you guide students to the correct section(s) for each item on the SDS form.

Table 2 has potential answers to analysis questions for oil and gasoline SDS. Table 3 contains the ERG information for the three scenarios.

Table 1. ***SDS Review Form***

SDS Form Section Header	Information Contained
1. Product and company information	*Item name* *Uses*
2. Hazards identification	*Labels and pictograms* *Specific hazards*
3. Composition/information on ingredients	*Formula* *Ingredients in the mixture (if applicable)*
4. First-aid measures	*Measures for eye and skin contact* *Measures for inhalation and ingestion*
5. Firefighting measures	*Flammability* *Media to extinguish a fire*
6. Accidental release measures	*Containment, clean-up, and absorption* *Personal and environmental precautions*
7. Handling and storage	*PPE use for handling* *Specific end uses*
8. Exposure controls/personal protection	*Specific PPE materials and use* *Limits*
9. Physical and chemical properties	*Classifying properties: pH, appearance, and odor* *Boiling and melting points*
10. Stability and reactivity	*Corrosiveness* *Shelf life*
11. Toxicological information	*Organ damage and acute toxicity information* *Lethal dosage rates*

12. Ecological information	*Biodegradation* *Bioaccumulation and toxicity*
13. Disposal considerations	*Local, state, and federal regulations notice* *Container disposal*
14. Transport information	*Hazardous materials classification* *Labels for transport*
15. Regulatory information	*International, national, and state regulations*
16. Other information	*Disclaimers* *Date(s) of SDS preparation or revision*

Table 2. ***Analysis Questions and Potential Responses***

Oil SDS Analysis Questions		
Q1	What is the name of this product?	*SAE 30 Oil*
Q2	What should one do if this chemical comes in contact with the skin?	*Flush with water.*
Q3	What organs are most likely to be damaged if someone swallows this chemical?	*None known*
Q4	What is a hazard associated with this chemical?	*Product is stable*
Q5	Is this substance flammable?	*Yes*
Q6	Where and how should this product be stored?	*Store in the original container.*
Q7	What type of personal protective equipment is needed when handling this product?	*Safety glasses with shields, chemical-resistant gloves if in constant contact, closed-toed footwear*
Q8	How do you properly dispose of this chemical?	*Dispose of via a licensed waste disposal contractor.*
Q9	How do you treat spills?	*Inert materials*

Table 3. ***Emergency Response Guide Usage***

<table>
<tr><th colspan="3">Part Two Scenarios</th></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Intended Material: Unknown Materials
Mixed Load/Unidentified Cargo
ERG Orange #111</td><td>Health Hazards:
Inhalation, ingestion, or contact may cause severe injury, infection, disease, or death.
High Concentrations of gas may cause asphyxiation without warning.
Contact may cause burns to skin and eyes
Fire or contact with water may produce irritation, toxic and/or corrosive gases
Runoff from fire control may cause pollution</td></tr>
<tr><td>Fire or Explosion:
May explode from heat, shock, friction, or contamination
May react violently or explosively in contact with air, water, or foam.
May be ignited by heat, sparks, or flames.
Vapors may travel to source of ignition and flash back.
Ruptured cylinders may rocket.</td></tr>
<tr><td>Public Safety:
Call 911.
As an immediate precautionary measure, isolate spill, or leak area, for at least 100 meters, (330 feet) in all directions.
Keep unauthorized personnel away.
Stay upwind, uphill, and/or upstream.</td></tr>
</table>

2	**Intended Material: Propane (C_3H_8)** Gases-Flammable ERG Orange #115, ID#1075	*Health Hazards:* • Vapors may cause dizziness or asphyxiation without warning. • Some may be irritating if inhaled at high concentrations. • Contact with gas or liquified gas may cause burns, severe injury, and/or frostbite. *Fire or Explosion:* • Extremely Flammable. • Easily ignited by heat, sparks, and flames. • Forms explosive mixtures with air • Vapors from liquefied gas are initially heavier than air and spread along the ground. • Vapors may travel to source of ignition and flash back. • Cylinders exposed to fire may vent and release flammable gas through pressure relief devices. • Containers may explode when heated. • Ruptured cylinders may rocket. *Public Safety:* • Call 911. • As an immediate precaution, isolate the spill or leak area for at least 100 meters (330 feet) in all directions. • Keep unauthorized personnel away • Stay upwind, uphill, and/or upstream. • Many gases are heavier than air, spread along the ground, and collect in low or confined areas (sewers, basements, tanks).
3	**Intended Material: Anhydrous Ammonia (NH_3)** Gases - Toxic and or Corrosive ERG #125, ID #1005	*Health Hazards:* • Toxic may be fatal if inhaled, ingested, or absorbed through the skin. • Vapors are extremely irritating and corrosive. • Contact with gas or liquefied gas may cause burns, severe injury, and/or frostbite. • Fire produces irritating, corrosive, and/or toxic gases. • Runoff from fire control or dilution water may cause environmental contamination. *Fire or Explosion:* • Some may burn, but none ignite readily. • Vapors from liquefied gas are initially heavier than air and spread along ground. • Some of these materials may react violently with water. • Cylinders exposed to fire may vent and release toxic and/or corrosive gas through pressure relief devices. • Containers may explode when heated. • Ruptured cylinders may rocket. • High concentrations in confined spaces present a flammability risk if an ignition source is introduced. *Public Safety:*

		• Call 911. • Keep unauthorized personnel away. • Stay upwind, uphill, and/or upstream. • Many gases are heavier than air, spread along the ground, and collect in low or confined areas (sewers, basements, tanks, etc.) • Ventilate closed spaces before entering, but only if properly trained and equipped.

Activity 1.2.2 Plan of Action

Students identify the potential injuries that could occur in the school shop. Then, students learn the types of first aid used to treat those injuries.

Teacher Preparation
Review standard first aid procedures with students using the PowerPoint® *First Aid*. Be prepared to guide students in identifying the most common accidents that could occur in the school shop and lab setting.

Student Performance
Students identify the most common injuries that could occur in your shop. Help students identify those injuries in a brainstorming session using the final presentation slide from PowerPoint® *First Aid*. Once students have decided on the top six injuries, they make a first aid booklet that provides basic first aid instruction assessing any situation and detailed instruction for the top six injuries. View the **How to Make a Mini Booklet** (http://www.teachertube.com/video/how-to-make-a-mini-book-83106) video instructions as necessary before starting the APP. Review the first aid requirements after the activity.

Results and Evaluation
Students create a first aid handbook to reference in case of an injury in the shop. Students should never practice first aid unless they have been appropriately trained.

Activity 1.2.3 Fight or Flee

Students review various fire extinguishment devices and how to use them best.

Teacher Preparation

1. Review common fire extinguishment devices using the PowerPoint® *Fire Extinguisher Safety* with students.
2. Prior to the activity, print **Activity 1.2.3 Fire Extinguisher Cards**. Have open lab spaces for students, such as greenhouses, shops, and lab settings, to gather information to inspect fire extinguishers for Part Three.

Student Performance
Part One
Students take notes in Table 1. Extinguishment Devices on *Activity 1.2.3 Student Worksheet* while the teacher presents the PowerPoint® Fire Extinguisher Safety. Students record the classes of fires, what materials those classes of extinguishers can use, the disadvantages of use, and which of the three components of the fire triangle the extinguishment device removes.

Part Two
Students select the best method of extinguishment for different types of fires using *Activity 1.2.3 Fire Extinguisher Cards*. Students decide from scenarios which extinguishment device(s) they should use during an emergency.

Part Three

Students are assigned a lab space or shop location to inspect fire extinguisher locations and readiness.

Results and Evaluation

Students should be able to select the correct fire extinguisher for eliminating a fire, determine if a fire extinguisher needs to be replaced, and review fire blankets, kitchen fire suppression systems, and smothering a fire.

Table 4. ***Fire Extinguisher Cards Key***

Part Two Scenarios	
1. Cooking	Cooking Fire Suppression System, then Class K Extinguisher
2. Magnesium	Class D Extinguisher
3. Electricity	Class A/B Extinguisher
4. Sawdust	Class A Extinguisher
5. Alcohol	Smother in the fume hood, close the door, and turn off the vent.
6. Jeans	Fire Blanket
7. Fabrics	ABC Extinguisher

Activity 1.2.4 Hearing Protection

Students examine hearing protection devices by reviewing their potential advantages and disadvantages. Then, students measure the sound levels of operating equipment using the NIOSH sound level meter application.

Teacher Preparation

Gather hearing protection devices and examine the available Noise Reduction Rate (NRR) number. If the NRR is unavailable, have students search online for information from the manufacturer. Review the NIOSH application. Prepare work areas for hammering a nail, indoor sander operation, and outdoor sander operation by preparing the items for Part Three using Table 3, which is found below.

Table 3. ***Teacher Advanced Preparation***

Part Three Hammering a Nail	
Materials	**Instructions**
Each Group • (4) Board, 2x4 cut into 3’ sections • (2) Hammer, claw • (40) Nail, 4d • (4) Safety glasses • (4) Hearing protection device	• Double the thickness of each board by nailing two sections together before students begin.
Part Three Sander Operation	
Materials	**Instructions**
Each Group • (1) Sander, powered • (4) Safety glasses • (4) Hearing protection device	• Start the piece of power equipment up. Do not operate or use the equipment.

Student Performance

Part One

- Students examine hearing protection devices provided by the teacher. Students estimate the protection level, as well as the advantages and disadvantages, and record their data in a table.

Part Two

- While using the NIOSH SLM application, students take noise-level recordings; note that students should be talking, moving around, etc., while taking measurements, but no equipment should be operated during this time.

Part Three

- Indoor sander operation sound level meter data should be taken inside or in a semi-enclosed area, with students wearing appropriate PPE.
- Outdoor sander operation sound level meter data should be taken outside or in an open area, with students wearing appropriate PPE.
- Students finish the activity by recording their findings in a table and finding the averages of noise level decibels and projected dose.

Results and Evaluation

Students complete Tables 1, 2, and 3 and answer analysis questions. With the sound level meter data from the hammering and sander locations, the students can evaluate sound levels and thus determine the proper hearing protection device required. Table 6 has potential answers to analysis questions.

Table 6. ***Analysis Questions and Potential Responses***

Q1	What are the advantages of using earmuffs?	*Answers will vary.* *Reusable, easy to use, will fit most people, etc.*
Q2	What are the disadvantages using formable ear plugs?	*Answers will vary.* *Non-reusable, you have to know how to use it correctly, may fall out of ear, may not fit ear, etc.*
Q3	Which hearing protection device provides the highest level of protection?	*Answers will vary. It depends on what HPD the teacher can provide. Students should mention the device that can lower the highest dB rating at or below 85-90 dB.*
Q4	Does the location of equipment operation affect noise level?	*When using a SLM, the testing should be done at ear level, providing the most accurate sound level readings. The noise level may vary with equipment type, but anything at or near ear level or directly under or over equipment will affect noise levels.*
Q5	Which of your trials had the highest max level?	*Answers will vary.*
Q6	What hearing protection device is required for these noise levels?	*Answers will vary.*

Activity 1.2.5 CTE Spacing

The students measure their local agriculture education facilities to calculate the occupancy load by square footage. Then, students review for recommended occupancy loads.

Teacher Preparation

Review the ***Minnesota CTE School Safety Manual***, <**https://education.mn.gov/MDE/dse/cte/safety/**>, pages 19-22, if needed, and *Figure 2. Minimum Facility Square Footage* to assist students with locating information. Plan to have available lab spaces for students to examine, such as a classroom, greenhouse, headhouse, agriscience laboratories, ag mechanics lab, livestock facilities, and storage areas for students to complete for Part Two. Be prepared to assist students in providing an oral overview of their findings as a classroom discussion.

Student Performance

Part One

Using the *1.2.5 Student Worksheet*, students in groups examine school laboratories and shop spaces for size and function. If students have checked any no checkboxes, students should provide additional information or details in the box at the bottom of the student worksheet pertaining to why the boxes were checked.

Part Two

Students compare their data to standards and highlight areas in different colors to identify if a facility meets or does not meet specific requirements. Students finish Part Two by preparing a brief summary of their findings by comparing their student worksheet to CTE space recommendations provided.

Results and Evaluation

Students can examine and calculate room occupancy load ratings with a given square footage requirement and compare gross and net square footage calculations. Table 7 has potential answers to analysis questions.

Table 7. ***Analysis Questions and Potential Responses***

Q1	Did your assigned facility pass or fail? Why or why not?	*Answers will vary.* *Students provide information on the answer as to why the facility passed or failed.*
Q2	How many no-check marks?	*Answers will vary.*
Q3	Can changes be adopted for the facility to pass? If so, what changes? If not, why?	*Answers will vary.* *Students discuss what changes can be adopted for the facility to pass.*
Q4	Can lowering class size allow the facility to pass? If so, what class size do you recommend?	*Answers will vary.* *Students should provide information regarding the occupancy rating based on their calculations and should suggest the number of people that fit the net gross feet available.*

Assessment

Lesson 1.2 Check for Understanding

Lesson 1.2 Check for Understanding is included for you to use as an assessment tool for this lesson. Use **Lesson 1.2 Check for Understanding Answer Key** for evaluation purposes.

Name____

Activity 1.2.1 SDS Protocols

Purpose

Many pieces of equipment require oil for lubricant and gasoline as fuel. Where can you access safety information about those chemicals?

Manufacturers of nearly all chemical materials provide Safety Data Sheets (SDS). Equipment operators and emergency personnel use SDS to clean up a chemical spill or respond to an accident. SDS should be easily accessible in the laboratory or workshop in an SDS binder. The binder provides workers and emergency personnel with the proper procedures for handling or working with a chemical. The safety data sheets include physical data, health effects, first aid, storage, disposal, protective equipment, and cleanup procedures.

An Emergency Response Guide (ERG) is used by emergency personnel to provide fast and efficient safety information to the public. If not putting anyone in harm's way and not attempting to clean up or stop a spill, individuals can provide pertinent details to emergency responders before they arrive on the scene. The ERG is released every four years and is available in hardcopy, PDF online, and via mobile application, the most updated version.

How do you use a Safety Data Sheet and an Emergency Response Guide when chemical accidents occur?

Materials

Per student:

- (2) SDS forms
- *Agriscience Notebook*
- Pencil

Per pair of students:

- *Activity 1.2.1 ERG Cards*
- Digital device with internet access
- *ERG 2020 digital application*
- Printed ERG flowchart

Procedure

Read SDS forms to determine important safety and clean-up information about two chemicals. Then, with a partner, practice using the ERG to respond to emergency scenarios.

Part One – SDS Review

1. Obtain two SDS forms from your teacher.
2. Review the SDS for gasoline and find the information needed to complete Table 1 on *Activity 1.2.1 Student Worksheet*.
3. Review the SDS for engine oil and answer the *Oil SDS Analysis Questions*.

Part Two – Emergency Response Guide

1. Watch the video **How to Use the 2020 Emergency Response Guidebook** (**https://www.youtube.com/watch?v=QclcL01EVYY**) presented by your teacher.
2. Obtain the *Practice Scenario Card* from your teacher.
3. Decide between you and your partner who will read the scenario and who will be the responder.

4. Have the chosen partner read the scenario and steps while the responder follows the steps on the flowchart in Figure 1. and finds the correct guide while using the ERG application.
5. Review the ERG information on the correct guide and the example responses in Table 2.
6. Obtain a scenario card from your teacher.
7. Switch roles as the reader and responder.
8. Have the chosen partner read the scenario and steps while the responder follows the steps on the flowchart and finds the correct guide in the ERG.
9. Record the chemical hazards for your scenario in Table 2.
10. Group together with two other pairs, completing the other two scenarios as instructed by your teacher.
11. Take turns sharing scenarios with your group.

Conclusion

1. When should you consult an SDS when working in the laboratory or workshop?
2. Why are SDS forms organized in a specific way?
3. In what ways can an ERG be utilized?
4. How are Safety Data Sheets and an Emergency Response Guide similar?

Name____

Activity 1.2.1 Student Worksheet

Table 1. ***SDS Review Form***

SDS Basic Information	
Name of Material	
Use(s) of Material	
First Aid Measures	
Eye Contact	
Skin Contact	
Inhalation	
Ingestion	
Fire and Explosion Hazards	
Flammability of Product	
Fire Fighting Media	
Precautions for Safe Handling and Use	
Handling a Spill	
Precautions for Handling and Storage	
Personal Protective Equipment Needed	
Physical and Chemical Properties	
Physical State and Appearance	
Odor	
Color	
pH	
Boiling Point	
Melting Point	

Oil SDS Analysis Questions

Q1 What is the name of this product?

Q2 What should one do if this chemical comes in contact with the skin?

Q3 What organs will most likely be damaged if a person swallows this chemical?

Q4 What is a hazard associated with this chemical?

Q5 Is this substance flammable?

Q6 Where and how should this product be stored?

Q7 What type of personal protective equipment is needed when handling this product?

Q8 How do you properly dispose of this chemical?

Q9 How do you treat spills?

Table 2. ***ERG Information***

Chemical Hazard Concerns			
Scenario Number	**Health Hazards**	**Fire or Explosion**	**Public Safety**
Practice Scenario	Inhalation or contact may irritate or burn skin and eyes. Fire may produce irritation and corrosive and/or toxic gases. Vapors may cause dizziness or asphyxiation. Water runoff may cause environmental contamination.	Highly Flammable – Easily ignited by heat, sparks, or flames. Can burn with an invisible flame; use an alternative method of detection. Most vapors are heavier than air, will spread along the ground, and collect in low or confined areas such as sewers, basements, tanks, etc.	Call 911. Keep personnel away. Stay upwind, uphill, and/or upstream.
Scenario 1			
Scenario 2			
Scenario 3			

Activity 1.2.1 ERG Cards

Emergency Response Guide - Practice Scenario

In the ag science laboratory, you are testing various fuel sources. The container of Ethanol is inadvertently knocked over, spilling the entire five-gallon fuel container on the tabletop, down the side of the wooden cabinets, and onto the tile flooring. As this is indoors, there is no wind, but the laboratory door connected to the building is open. Exterior windows cannot be opened for ventilation.

ERG Steps

1. Find Figure 1 on the *Activity 1.2.1 SDS Protocols.*
2. Read box 1.
3. There is no explosive placard or label available. Go to box 3.
4. There is no UN/NA ID Number available. Go to box 4.
5. The name of the material, box 4, is known. Go to box 9.
6. In the ERG application, select search by name or UN.
7. In the search bar, type Ethanol.
8. Select Ethanol, 110, Guide 127.
9. Guide 127 is for Flammable Liquids, Ethanol.

Emergency Response Guide - Scenario 1

Your group walks into the science lab one morning before school to borrow some equipment. The teacher is not in the room. You notice an odor and smoke/steam coming from the wooden chemical storage in the back of the classroom. You take your phone from a distance and zoom in for a better look. You see one metal container the size of a small paint can that has no label. On the outside of the can, it appears to have a rust ring around the bottom. You have no further information.

ERG Steps

1. Find Figure 1 on the *Activity 1.2.1 SDS Protocols.*
2. Read box 1.
3. There is no explosive placard or label available. Go to box 3.
4. There is no UN/NA ID number available. Go to box 4.
5. There is no known name of the material. Go to box 5.
6. There is no placard or label. Go to box 6.
7. There is not a railcar or road trailer. Go to box 7.
8. Box 7 states to Use Guide Orange Section 111.
9. In the ERG application, select browse guide pages.
10. Select Guide 111, mixed load/unidentified cargo.

Emergency Response Guide - Scenario 2

Working in the shop with an open overhead door as the welding fuel delivery truck backs up to the south side overhead shop door to drop off an order. While unloading, a tank you don't use in class is hit by another tank. The tank falls off the truck and hits the ground, valve first. It does have a cap, but the tank is leaking gas. The delivery driver attempted to hold and catch several tanks and is still in the back of the truck but is trapped. The wind is from the south at 15 mph, and the cloud of vapor and smell is being pushed directly into the occupied shop. The tank resembles a tank you have seen near a grill. From a safe distance, you see a red placard with the number 1075 and the words "Flammable Gas."

ERG Steps

1. Find Figure 1 on the *Activity 1.2.1 SDS Protocols*.
2. Read box 1.
3. There is no explosive placard or label available. Go to box 3.
4. There is a UN/NA ID number available. Go to box 8.
5. Box 8 states search by ID in the yellow pages. Go to box 12.
6. Box 12 states determine the guide number.
7. In the ERG application, select search by name or UN.
8. In the search bar, type ID 1075.
9. ID 1075 is for Guide 115. Select Propane, guide 115.
10. Guide 115 states gases flammable (including refrigerated liquids).

Emergency Response Guide - Scenario 3

You are going to school with your friends in the morning. On your way, you see an overturned large white tank in the west ditch. You can see a green placard with white writing with the single number 2 but not the four-digit ID number above. The overturned tank is releasing a white cloud of gas that is staying low, has filled the ditch, and has entered the roadway. You are northbound and see the wind pushing the gas from the west to the east, blocking the road. The current temperature is 40 degrees F. You stop a long distance away as your friend takes out their phone and goes to the ERG application. You have no ID# but can see a white placard and the number.

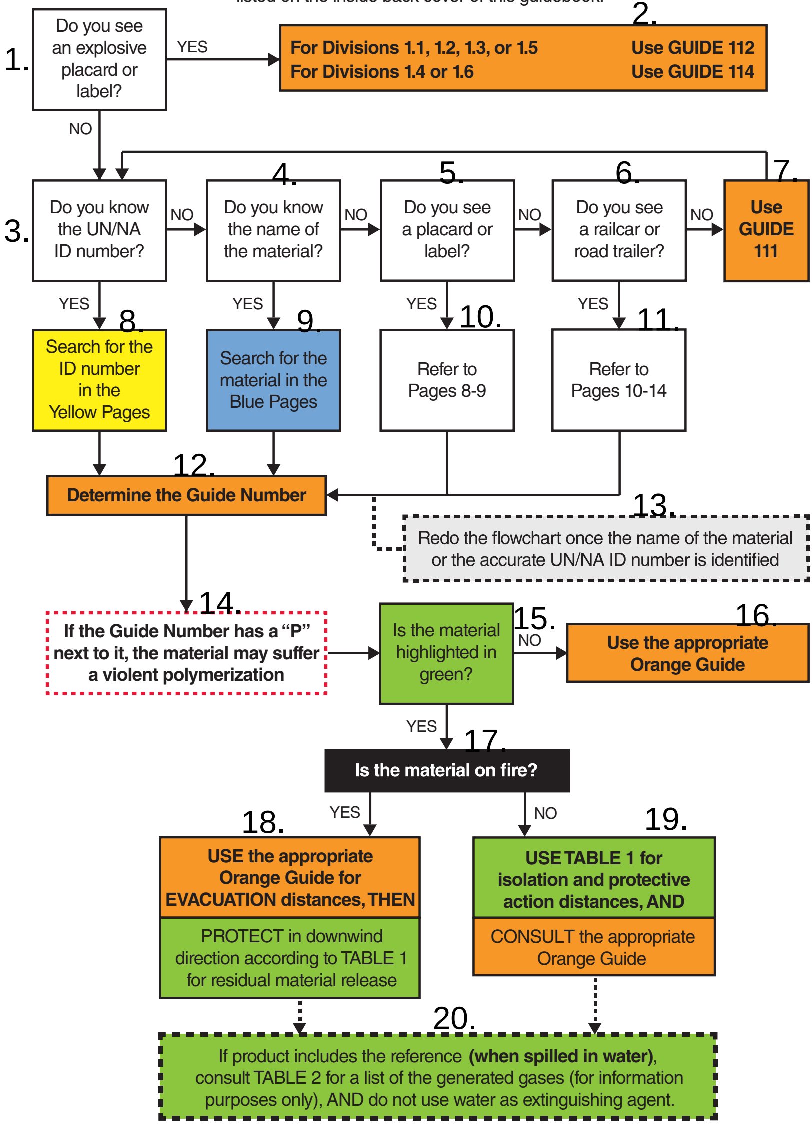
ERG Steps

1. Find Figure 1 on the *Activity 1.2.1 SDS Protocols*.
2. Read box 1.
3. There is no explosive placard or label available. Go to box 3.
4. There is no UN/NA ID number available. Go to box 4.
5. There is no known name of the material. Go to box 5.
6. There is a placard or label. Go to box 10.
7. In the ERG application, select search by image.
8. Scroll down until you find a green placard with white writing. Select Division 2.2 – non-flammable gases, Guide 120.
9. Guide 120 states gases – inert (including refrigerated liquids.)

HOW TO USE THIS GUIDEBOOK

RESIST RUSHING IN!
APPROACH INCIDENT FROM UPWIND, AND UPHILL AND/OR UPSTREAM
STAY CLEAR OF ALL SPILLS, VAPORS, FUMES, SMOKE, AND POTENTIAL HAZARDS

WARNING: DO NOT USE THIS FLOWCHART if more than one hazardous material/dangerous good is involved. Immediately call the appropriate emergency response agency telephone number listed on the inside back cover of this guidebook.



BEFORE AN EMERGENCY - BECOME FAMILIAR WITH THIS GUIDEBOOK!

First responders must be trained in the use of this guidebook.

Name____

Activity 1.2.2 Plan of Action

Purpose

No matter how much you plan, accidents occur. Because accidents do happen, you should have a plan of action when they do. That plan of action includes understanding first aid procedures. First aid procedures are ways to provide medical attention to victims before professional help arrives.

Many injuries are possible in the laboratory, greenhouse, or shop. Which do you believe are the most common? How can you be prepared if they occur? What do you need to know to provide first aid when they occur?

Materials

Per student:

- 8½″x11″ sheet of paper
- *Agriscience Notebook*
- Device with internet access
- Pencil
- Scissors

Per Pair of Students:

- Colored pencils

Procedure

Develop a first-aid reference book to keep with you if an accident occurs. This reference book will provide systematic information on the first aid actions you should take if certain accidents occur.

Part One – Accident Brainstorm

1. Your teacher will lead your class in a brainstorming session to determine the most common injuries you believe will occur in your agriculture department.
2. Use the information from the PowerPoint® presentation, *First Aid*, to help you.
3. Work as a class with your teacher to narrow your list to the top six.
4. Record your top six injuries in Table 1.

Table 1. ***Top Six Injuries***

1.	
2.	
3.	
4.	
5.	
6.	

Part Two – First Aid Booklet

Follow the steps below to create a small booklet out of one piece of paper.

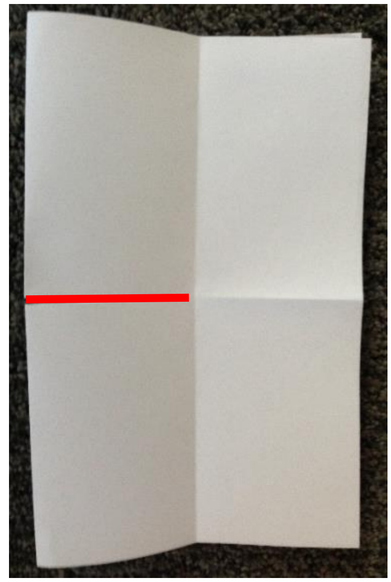


Figure 1. Cut in Fold

1. Gather materials as instructed by your teacher.
2. Fold the paper inward half lengthwise (hotdog style), then open the paper.
3. Fold the paper again in half the other direction (hamburger style).
4. Fold the paper in half again.
5. Reopen the paper. The paper should have eight sections.
6. Refold hamburger style.
7. Cut halfway through the middle of the fold, leaving the first and last sections intact, as seen in Figure 1.
8. Open your paper and refold hotdog style.
9. While the paper is folded lengthwise with the cut fold facing you, open the center two cut sections while folding into a booklet form.
10. On the cover, write “My Mini Book of First Aid.”
11. On the inside cover, write “Assess the Situation” at the top.
12. Using the information from the presentation, First Aid, record the steps you should take before applying any first aid to a victim on the inside cover.

Part Three – Accident Research

1. On top of each of the six remaining pages, put an injury from Table 1. that your class determined to be most likely in your agricultural department.
2. Research each injury and write the first-aid procedure for each in your booklet.
3. Use the following resources to help you with your research.
   - Mayo Clinic first aid: **http://www.mayoclinic.org/first-aid**
   - WebMD first aid and emergencies: **http://www.webmd.com/first-aid/**

Part Four – Class Review

1. Review the first aid procedures for the top six injuries with your teacher.
2. Add information to your booklet if it is incomplete.
3. Keep your booklet in your *Agriscience Notebook* for reference in case of an accident.

Conclusion

1. What is the purpose of first aid?

2. What should be your first response in every situation requiring first aid?

3. What should you do if the victim is in danger, and helping them would also put you in danger?

Name____

Activity 1.2.3 Fight or Flee

Purpose

You may have heard of the fire triangle before, but what is needed for a fire to occur? The fire triangle has four requirements, as seen in Figure 1. Oxygen, heat, and fuel are the three sides of the triangle. The last requirement is a chemical reaction or a fire; all four items must coincide for a fire to exist.

Many actions can help extinguish fires. Fire extinguishers each contain different chemical compositions to extinguish fires. There are five fire extinguisher classes for different types of fires. Some extinguishers are interchangeable depending on the type of fire; others are not. Fire blankets are another tool used to extinguish a fire. It is possible to extinguish cooking and clothing fires using a fire blanket. By removing oxygen from the fire triangle, fire blankets remove one of the sides of the fire triangle. If a food lab fire should occur, if you are safely able, you can place a lid on the pan to smother the fire.

Fire emergency equipment, such as fire extinguishers, require regular inspection intervals and servicing of damaged or outdated components. You can use equipment inspection forms as a deliberate process to ensure equipment checks are completed at required intervals at your school's facilities along with school personnel. Fire emergency equipment inspections are completed monthly in the workplace. For example, the inspection requirement is mounting heights based on the weight of the extinguisher. In addition, the number of extinguishers per square foot and the maximum travel distance to reach a fire extinguisher is between 30 feet and 75 feet, depending on room makeup and extinguisher type.

Figure 1. The fire triangle

If smoke or fire should appear, the fire alarm is activated by using a pull station. Pull stations are manually operated devices used to initiate a fire alarm signal.

Would you know how to use a fire extinguisher if a fire occurred in a lab space or shop? What fire safety requirements does a facility need to meet?

Material

Per group of four students:

- Tape measure, 100'

Per pair of students:

- *Activity 1.2.3 Fire Extinguisher Cards*

Per student:

- *Agriscience Notebook*
- Pencil
- Safety glasses

Procedure

Review the classes of fire extinguishment devices and how they are best utilized. Next, decide from scenarios which extinguishment device to select to control an emergency. Lastly, inspect a lab space or shop location for fire safety requirements.

Part One – Take Presentation Notes

1. Record notes on class, use, disadvantages, fire triangle component, and the PASS method in Table 1, *Extinguishment Devices Presentation Notes*, as your teacher presents the *Fire Extinguisher Safety* PowerPoint®.

Part Two – Scenarios

1. Work with your partner to review the *Fire Extinguisher Cards* provided by your teacher to determine the proper fire extinguishment device. Refer to your notes from Part One.
2. For your scenarios, select the recommended extinguishment device and list your reason for choosing the extinguishment device in Table 2, *Extinguishment Device Selection*.
3. Repeat Step 2 for scenarios 2–7.

Figure 2. Fire Extinguisher Inspection

Part Three – Inspection

1. Join another pair to make a group of four and gather a 100' tape measure.
2. Your teacher will assign a location to your group.
3. Once at your location measure the length and width and record it in Table 3. *Fire Inspection Worksheet.*
4. In the fire extinguisher inspection section, refer to Figure 2. for guidance.
5. Use the remainder of Table 3. *Fire Inspection Worksheet* to check the appropriate box or provide the response for each section.
6. On the bottom portion of the worksheet, mark the location as either pass or fail. If the location should fail, provide a list of any deficiencies.

Conclusion

1. Why do different classes of fire extinguishers exist?

2. What are two reasons to use a fire extinguisher inspection form?

3. What is the acronym for the use of a fire extinguisher?

Name____

Activity 1.2.3 Extinguisher Inspection Worksheet

Table 1. *Extinguishment Presentation Notes*

Name	Class Letter	Uses	Disadvantages	Fire triangle component
Water Extinguisher				
Carbon Dioxide Extinguisher				
Powder Extinguisher				
Wet Chemical Extinguisher				
Fire Blanket				
Smothering				
Fire Suppression System				
PASS	P______________	A______________	S______________	S______________

Table 2. ***Extinguishment Device Selection***

Scenario	Extinguishment Class/Device Selected	Reasoning for Extinguishment Device Selection
1		
2		
3		
4		
5		
6		
7		

Table 3. *Fire Extinguisher Inspection*

Location Assigned:	☐ Classroom ☐ Greenhouse ☐ Agriscience Lab ☐ Shop ☐ Other: List___________________		
Room Length in Feet:	#:___________________	Room Width in Feet:	#:___________________
Room is a 2:1 Ratio (L/W):	☐ Yes ☐ No ☐Greater Than ☐ Equal To ☐ Less Than (Check all that apply in this box)		
Total Square Footage of Room:	#:___________________	Total Number of Fire Extinguishers:	#:___________________
List types of extinguishers found. (Write the number of each in the box)	☐A ☐B ☐C ☐D ☐K	Are extinguisher classes appropriate for the room?	☐ Yes ☐ No
What are the distances between extinguishers and points in the room?	☐ >25’ ☐ 25’ to 49’ ☐ 50’ ☐ 51’ to 74’ ☐ 75’ ☐ 76 to 99’ ☐ Equal to or greater than 100’ (Check all that apply)		
Is the pin and tamper seal intact?	☐ Yes ☐ No	Does the pressure gauge read fully charged? (Needle in Green Zone)	☐ Yes ☐ No
Is the extinguisher hanging in the designated place, clearly visible, and not blocked by equipment, coats, or other objects?	☐ Yes ☐ No	Is the extinguisher in good condition with no damage, corrosion, or leakage?	☐ Yes ☐ No
Mounted height of 40lbs and under extinguishers shall be no more than 5’ high and must be at least 4” from the floor.	☐ Yes ☐ No	Mounted height of extinguishers over 40lbs shall be no more than 3.5’ high and must be at least 4” from the floor.	☐ Yes ☐ No
Are operation instructions legible and outward on the nameplate?	☐ Yes ☐ No	Have all ABC extinguishers been gently rocked during inspection from top to bottom to make sure the powder is not packed.	☐ Yes ☐ No
Total Number of pull stations:	#:___________________	Are all pull stations accessible?	☐ Yes ☐ No
Does your assigned location meet all requirements?	☐ Yes ☐ No	Location Pass/Fail:	☐ Pass ☐ Fail
Other Comments:			
If no boxes are checked above, provide additional details, and report to the proper personnel.			
Group Member Names:			

Activity 1.2.3 Fire Extinguisher Cards

Scenario 1

Your class is working in the food science lab and testing various cooking oils. As a student walks by, their sleeve catches a panhandle and spills the warming cooking oil on top of the stove into the open cooking flame. The burning oil covers the entire cooking top with fire.

Scenario 2

You and a partner are heating different metal materials attached to a wand. One member holds the wand with thermal gloves, and you place the torch's flame in the center of the wand as your activity instructs. A magnesium rod was accidentally heated. After a few seconds, the magnesium rod starts to spark; the classmate pulls the wand back out of the fire, and the magnesium rod drops off onto the table with other magnesium rods and catches fire.

Scenario 3

In your precision agriculture course, you are wiring your electricity boards. You have completed a wiring module, and your teacher tells you to plug it in to test the board. When you plug in the board, you flip the single pole switch, and the light bulb turns on and then pops. The bulb breaks open and starts the board and wiring on fire while still connected to the power source.

Scenario 4

The metals/small engine lab is next to the woods lab. You use the metal chop saw to cut pieces of metal as the other equipment is unavailable. As you start cutting, the wind blows the sparks from the chop saw on the floor across the shop. The sparks begin to smoke and catch a pile of sawdust, used as oil dry, on fire.

Scenario 5

A beaker of isopropyl alcohol is heated using a double boiling method on a small hot plate inside a fume hood, removing the heated vapor. The hot plate is on the highest setting for rapid heating. A student takes the beaker off for inspection. Upon finishing their inspection, they place the beaker next to the hot plate on the countertop. The beaker shatters from the extreme temperature difference between the hot plate and the cool countertop. The heated piece of equipment catches the isopropyl alcohol on fire.

Scenario 6

In the advanced welding course, a student uses a plasma torch. While working, the student has their earbuds in, unable to hear anything around them. The student is also wearing a very frayed pair of jeans. Sparks from the plasma cutter catch the frayed jeans on fire. A student sees this and yells to alert them, but they can't hear the alert due to the earbuds. The wick-like frays have moved upward, catching their clothes on fire.

Scenario 7

In Ag Exploration, a team of students is testing fabrics for their heat resistance. One sample, upon lighting, burns and smokes very quickly. In reaction to the flames, a student stands and spills the pail of water across the floor. You do not have any water available.

Name____

Activity 1.2.4 Hearing Protection

Purpose

Have you ever attended a concert, sporting event, or fireworks show? After the event, you may have had ringing in your ears. The ringing is a sign of potential hearing damage or loss. Hearing loss is nearly always preventable. Hearing protection devices (HPDs) are available to protect your hearing. The different HPDs available have benefits, drawbacks, lifespan, and cost. HPDs aim to lower the sound level to or below 90 dB and ideally below 85 dB per eight-hour workday. Sound levels are measured in decibels (dB). Noise intensity is the decibel sound level. With each increase of 6 dB, the noise level doubles.

Noise duration is the time a person is exposed to the sound level. Today, earbuds for music listening are relatively common but do not provide sound level protection and may add to hearing loss if the volume is not kept at a safe level, especially when used for a long time. Earbuds, even noise canceling, do not provide adequate protection and may lead to potential injuries. They work against the user in hearing instructions or warnings of announcements and directions in lab spaces.

The Noise Reduction Rating (NRR) is a number assigned to HPDs by the National Institute of Occupational Safety and Health (NIOSH). The NRR unit of measure is also dB. The highest protection level assigned to earplugs is an NRR of 33 dB. An NRR of 33 dB means that if the sound level is 130 dB, the NRR protection reduces the sound level to 97 dB. A level of NRR 36 may be achieved by people wearing both earplugs and earmuffs simultaneously. According to OSHA, Figure 1. 90 dB is the threshold for HPDs.

The ability to wear all types of hearing protection devices for proper fit varies from person to person. This means the easiest-to-use and best-fitting HPD are earmuffs. Earmuffs are often overlooked in warm environments due to their bulky nature. Formable ear plugs must first be rolled, pulled up on the ear, inserted correctly in the ear canal, then held in place as the plug expands.

A sound level meter (SLM) is a device that measures sound duration and level. NIOSA has created an application to measure and record sound levels from a digital device. A SLM provides accurate data measuring the noise intensity and duration you experience. Data should be recorded at ear level.

When you correctly wear and install hearing protection devices, what level of protection will you receive?

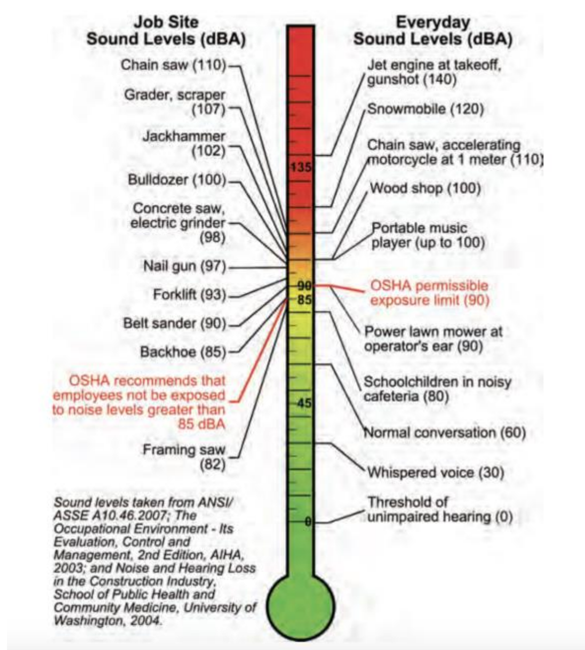


Figure 1. dB's of common activities.

Materials

Per group of four students:

- (2) Board, 2"x4"x3'
- (7) Nail, 4d

Per student:

- *Agriscience Notebook*

- Ear canal caps, semi-insert banded
- Ear plugs, custom molded
- Ear plugs, formable
- Ear plugs, pre-molded
- Earmuffs
- Hammer, claw
- Sander, powered
- Sandpaper
- Digital device (cell phone or Chromebook)
- Hearing protection
- Other PPE as appropriate by equipment usage
- Pencil
- Safety glasses

Procedure

Inspect the various types of hearing protection devices and the rated level of protection they provide. Then, using a sound level meter application, measure noise levels in several school locations while operating common equipment to determine the level of protection needed for the assigned activity.

Part One – Level of Protection

1. Gather hearing protection devices from your teacher.
2. Predict the level of protection each device will provide and record in Table 1. *Level of Protection*.
3. Look for the NRR number or decibel protection level with your group on the packaging. If the packaging is unavailable, look online for the manufacturing NRR specifications.
4. Record the specified protection level as rated by the manufacturer for each type of device provided in Table 1.
5. Use Figure 3. to answer Part One analysis questions.

Part Two – Setting the Baseline

1. Put on PPE and tie back your long hair.
2. Assign one group member to download the NIOSH Sound Level Meter (SLM) from the App Store on one digital device.
3. Assign one group member to record the results.
4. Assign one group member to be a safety person and ensure all group members and those nearby properly wear PPE.
5. Using the SLM in your classroom, take one 15-second reading and record the reading in Table 2, *Setting the Baseline* on the student worksheet.
6. Using the SLM, record your results for time, max level (dB), and projected dosage (%).
7. Repeat steps 3–4 for the two remaining classroom baseline trials.
8. After taking the three baseline readings, use a calculator to find the average for each column and record your results in Table 2.
9. Repeat steps 3–6 for your assigned locations 2 and 3.

Part Three – Common Lab Operations

1. Gather materials and additional PPE as instructed by your teacher.
2. Assign one group member to operate the SLM application.
3. Assign one group member to record results.

4. Assign one group member to be a safety person and ensure all group members and those nearby properly wear PPE.
5. Assign one of the group members to use a claw hammer to nail for 15 seconds.
6. With the timing person ready, have the student hammering nails begin nailing in to only one side of the 2”x4” board.
7. Record your results for time, max level (dB), and projected dosage (%) after 15 seconds in Table 3. *Common Lab Operations* – ***Hammering a Nail***.
8. Repeat steps 6-7 for the two remaining *Hammering a Nail* trials.
9. After completing the three *Hammering a Nail* trials*,* use a calculator to find the average for each column and record your results in Table 3.
10. Repeat steps 1–4.
11. Assign one of the group members to use a sander to sand for 15 seconds.
12. With the timing person ready, have the student assigned to the sander begin sanding using the unnailed side of the 2”x4” board.
13. Record your results for time, max level (dB), and projected dosage (%) after 15 seconds in Table 3. *Common Lab Operations* – ***Indoor Sander Operation.***
14. Repeat steps 12-13 for the two remaining *Indoor Sander Operation* trials.
15. After completing the three *Indoor Sander Operation* trials, use a calculator to find the average for each column and record your results in Table 3.
16. Take your materials to the assigned open area as instructed by your teacher.
17. Repeat steps 1–4.
18. Assign one of the group members to use a sander to sand for 15 seconds.
19. With the timing person ready, have the student assigned to the sander begin sanding using the unnailed side of the 2”x4” board.
20. Record your results for time, max level (dB), and projected dosage (%) after 15 seconds in Table 3. *Common Lab Operations* – ***Outdoor Sander Operation.***
21. Repeat steps 19-20 for the two remaining *Outdoor Sander Operation* trials.
22. After completing the three *Outdoor Sander Operation trials,* use a calculator to find the average for each column and record your results in Table 3.
23. Complete Part Three Analysis Questions.

Conclusion

1. How is hearing loss preventable?

2. How can digital applications provide health data related to noise levels?

3. Which organizations provide hearing protection guidelines?

4. What is your preferred method of hearing protection device and why?

Name____

Activity 1.2.4 Student Worksheet

Table 1. ***Level of Protection***

Hearing Protection	Prediction Protection (NRR)	Actual Protection (NRR)
Ear Plugs Pre-Molded		
Ear Plugs Custom Molded		
Ear Plugs Formable		
Ear Canal Caps		
Earmuffs		

Part One Analysis Questions

Q1 What are the advantages of using earmuffs?

Q2 What are the disadvantages of using formable earplugs?

Q3 Which Hearing Protection Device provides the highest level of protection?

Table 2. ***Station Two – Setting the Baseline***

Classroom	Measurement Time (Secs.)	Max Level (dB)	Projected Dose (%)
Trial 1			
Trail 2			
Trail 3			
Average			
Location 2	**Measurement Time (Secs.)**	**Max Level (dB)**	**Projected Dose (%)**
Trial 1			
Trail 2			
Trail 3			
Average			
Location 3	**Measurement Time (Secs.)**	**Max Level (dB)**	**Projected Dose (%)**
Trial 1			
Trail 2			
Trail 3			
Average			

Table 3. ***Station Three – Common Lab Operations***

Hammering a Nail	Measurement Time (Secs.)	Max Level (dB)	Projected Dose (%)
Trial 1			
Trail 2			
Trail 3			
Average			
Indoor Sander Operation	**Measurement Time (Secs.)**	**Max Level (dB)**	**Projected Dose (%)**
Trial 1			
Trail 2			
Trail 3			
Average			
Outdoor Sander Operation	**Measurement Time (Secs.)**	**Max Level (dB)**	**Projected Dose (%)**
Trial 1			
Trail 2			
Trail 3			
Average			

Part Three Analysis Questions

Q4 How does the location of equipment operation affect noise level?

Q5 Which of your trials had the highest max level?

Q6 What hearing protection device is required for station three noise level?

DURATION OF TIME PERMITTED AT VARIOUS SOUND LEVELS	
Duration per day (in hours)	***Sound level (dB)***
8	90
6	95
3	97
2	100
1.5	102
2	105
.5	110
.25 or less	115
None	Over 115

DECIBEL (dB) LEVELS OF COMMON SOUNDS AT TYPICAL DISTANCE FROM SOURCE	
Sound level (dB)	***Common Sound***
0	Acute threshold of hearing
15	Average threshold of hearing
20	Quiet whisper
30	Leaves rustling, very soft music
40	Average residence
60	Normal speech, background music
70	Noisy office, inside vehicle traveling at 60 mph
80	Heavy traffic
85	Inside acoustically insulated protective tractor cab in field, lawnmower
88	Electric drill
90	OSHA limit – hearing damage from excessive exposure to noise above 90 dB
92	Garden tractor
98	Shop vacuum
100	Noisy tractor, power mower, ATV, snowmobile, motorcycle, inside subway car, table saw
105	Chickens (inside building)
115	Chainsaw
120	Thunderclap, jackhammer, basketball crowd, amplified rock music
130	Squealing pig
140	Threshold of pain – shotgun, near jet taking off, 50-hp siren (100')
Data provided by OSHA.	

Figure 4. Duration and Distance of Sound Levels

Name____

Activity 1.2.5 CTE Spacing

Purpose

If you have ever watched or participated in an athletic contest, you know that each sport has different requirements for playing surfaces that vary in size and purpose. Each space is planned and constructed to meet the needs of the activity. The same goes for agricultural education facilities. Facilities are built to meet the activity's purpose, along with the occupancy load limits.

According to the International Building Code (IBC), several considerations go into setting occupancy load limits. If state or local municipalities do not have a specific code, many will reference the IBC. For educational facilities, the IBC requires that the figure be set with the net factor, meaning the total square footage of the space subtracted from the space taken up by furniture and equipment, as shown in Figure 1.

Floor Space Requirement	
Space	ft^2 (net)
Classroom	45
Shop Lab	100 -150

Figure 1. International Building Code (IBC)

Classrooms require a minimum of 45 ft^2 per student, excluding equipment, storage, or supplies square footage, as a room occupancy load limit. Shops or work areas require a minimum range of 100–150 ft^2 per occupant, excluding equipment, storage, or supplies square footage.

Older facilities may have been built to a lower standard or recommendation. Newly constructed facilities should meet or exceed the recommendations for a safe workspace.

Do your school facilities align with current recommendations for educational Career and Technical Education (CTE) spacing?

Materials

Per group of four students:

- Calculator
- Highlighter, Pink
- Highlighter, Green
- Highlighter, Yellow
- Tape measure, 100'

Per student:

- *Agriscience Notebook*
- Pencil
- Printed *MN CTE Safety Manual*
- PPE appropriate for each space

Procedure

Examine school facilities by measuring the available space. Then, provide a report of your findings comparing current CTE recommendations to your school's existing facility.

Part One – School Facilities

1. Your teacher will assign your group a facility to measure.
2. In your group, complete *Activity 1.2.5 Student Worksheet* for your assigned location by checking yes or no and providing measurements or a number.
3. After completing the checkbox portion of the student worksheet, provide additional information where any of the no boxes were checked.

Part Two – Space Recommendations

1. Compare each section of your results from the student worksheet with the corresponding information provided in *Figure 2. Minimum Facility Square Footage.*
2. While comparing your results and Figure 2, use the highlighters to mark your findings as follows.
    - Meets or exceeds recommendation – Green
    - Does not meet recommendation – Pink
    - Unclear if it meets the recommendation – Yellow
3. Complete Part Two Analysis Questions.
4. Be prepared to summarize your findings and provide suggestions to your class regarding your assigned facility.

Conclusion

1. Why do spaces have occupancy ratings?
2. How does the net factor affect square footage in education facilities?
3. How does a room's purpose impact require square footage requirements?

Name____

Activity 1.2.5 Student Worksheet

Table 1. *CTE Space Survey*

Location assigned	☐ Classroom ☐ Greenhouse ☐ Agriscience Lab ☐ Shop ☐ Other: List____________		
Room length in feet	#:____________________	Room width in feet	#:____________________
Room is a 2:1 ratio (L/W)	☐ Yes ☐ No ☐Greater Than ☐ Equal To ☐ Less Than (Check all that apply in this box)		
Gross square footage of room	#:____________________	Net square footage (Gross ft^2 – furniture and equipment ft^2)	#:____________________
Total square footage of space taken up by furniture or equipment	#:____________________	Prep room and storage available	☐ Yes ☐ No
Aisle minimum of three feet wide	☐ Yes ☐ No	Aisle four feet wide	☐ Yes ☐ No
Main Aisles are clearly marked with yellow or white paint	☐ Yes ☐ No	Are tool rooms and emergency equipment adjacent to the main aisles	☐ Yes ☐ No
Handicapped accessible for wheelchair	☐ Yes ☐ No	Handicapped accessible for crutches	☐ Yes ☐ No
Machines, benches, and equipment have three feet of clear space	☐ Yes ☐ No	Large open areas for project assembly, demonstrations, and activities or projects	☐ Yes ☐ No
Sufficient open floor space near doorways, tool cribs, tool panels, and material storage areas.	☐ Yes ☐ No	Window surface area not less than 1/5 of the area of floor	☐ Yes ☐ No
Ceiling height is between 10.5 and 14 feet	☐ Yes ☐ No	Utility lines inside floor or walls for cleaning purposes	☐ Yes ☐ No
Appropriate space ratios for the number of students	☐ Yes ☐ No	Number of students does not exceed 24	☐ Yes ☐ No
Blind spots	☐ Yes ☐ No	4 ft or taller machines placed along exterior walls	☐ Yes ☐ No
Washbasin with hot and cold water	☐ Yes ☐ No	Appropriate ventilation	☐ Yes ☐ No
Appropriate light by task	☐ Yes ☐ No	Gas and oxygen cylinders at least 20 ft apart	☐ Yes ☐ No
Does your assigned location meet all requirements	☐ Yes ☐ No	With current recommendations, does your assigned location	☐ Pass ☐ Fail
Part Two - Which category does this room best fit according to the MN CTE safety PDF	☐ Lecture classroom ☐ Computer lab ☐ Modular lab/shop ☐ Lab/shop using equipment and tools ☐Other		
If any no boxes are checked above, provide additional detail below.			

Part Two Analysis Questions

Q1 Did your assigned facility pass or fail? Why or why not?

Q2 How many no-check marks?

Q3 Can changes be adopted for the facility to pass? If so, what changes? If not, why?

Q4 Can lowering class size allow the facility to pass? If so, what class size do you recommend?

Space Detail	Preferred (Units)	Not Less Than (Units)	Specific Notes
Building Ratio (LxW)		More than 2:1	Supervision purposes
Aisle Spacing	4’	3’	
Main Aisle Marking Color	Yellow	White	
Machines, Benches, and Equipment Space	Specific machines may require additional space needs	3’ all around	
Demonstration, Assembly, Activity and Project Space	Large open area		
Lighting	By specific tasks	70-100 foot candles	
Windows Space		1/5 of floor space	
Ceiling Heights	By planned usage	10.5’ to 14’	
Utility Placement	Floor or wall		
Floor Covering	Compatible with activity	Easy cleaning and maintenance	
Load Bearing Cap.	Four times static load	Six times moving load	
Lab/Shop Exits	Wide enough for the largest-sized project or activity	Two exits	
Exit High Hazard Activity		75’ from exit	
Exit Medium to Low Activity		100’ to 150’ from exit	
Space Requirements sq. ft. per student			
Lecture Classroom (Basic Classroom)	45 ft^2		
Computer Lab	50 Sq. ft^2		
Modular Lab/Shop	75 Sq. ft^2		
Lab/Shop using Tools/Equipment	100-150 ft^2		
Student-to-Teacher Ratio	24:1	Reduce for younger or students with special needs	
How many washbasins per 20 students	20:1		
Receptacles	All GFCI	Within 6’ of water GFCI	
Ventilation		Change 6X per hour	Separated from main building
Dust/Fume/Exhaust		Must be OSHA 1926.57 compliant	
Dust Collection	Ambient collectors	Point source collection	
Illumination	Most tasks	Point of operation	Flexible/mobile lamps

Figure 2. Minimum Facility Square Footage

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CURRICULUM FOR AGRICULTURAL SCIENCE EDUCATION

Laboratory and Shop Safety

First Aid

Unit 1 – Lesson 1.2 The Hazards Around You

First Aid

- Provide immediate medical help for the victim before professional help arrives.
- Basic procedures that could save a person's life.

Steps before Professionals Arrive

- Remain calm
- Inform your instructor
- Call 911 if injury is serious
- Never move the injured person
- Assess the situation
- Assess the person
- Perform first aid
  - Only for injuries you have been trained to treat

Assess the Situation

- Is it safe?
- Do not assist the victim if you are at risk.
- Get professional medical assistance immediately.

Assess the Person

- Keep the person as safe as possible
- Check for the ABC's
  - Airway open
  - Breathing
  - Circulation
- Ask the victim what injuries they are experiencing
  - If they are unresponsive, observe for signs of injury

When to Perform First Aid

First Aid can be provided only when:

1. The situation has been assessed.
2. The person has been assessed.
3. Consent has been given by the victim.
4. You have been trained in the first aid you are providing.

Potential Injuries

- Electrical shock
- Bleeding
- Burns
- Choking
- Poisoning
- Head injury
- Broken bones
- Cuts and scrapes
- Puncture wounds

References

- Koel, L., & Mazur, G. A. (2013). *Agricultural technical systems and mechanics*. Orland Park, IL: American Technical Publishers.
- Mayo Clinic. (2014, January 1). *First aid*. Retrieved from http://www.mayoclinic.org/first-aid

Presentation Review

- Mark or highlight three key points.
- List two ideas or concepts related to previous knowledge.
- List questions you have about this topic.
- Keep notes organized and available for use throughout the course.

case learning

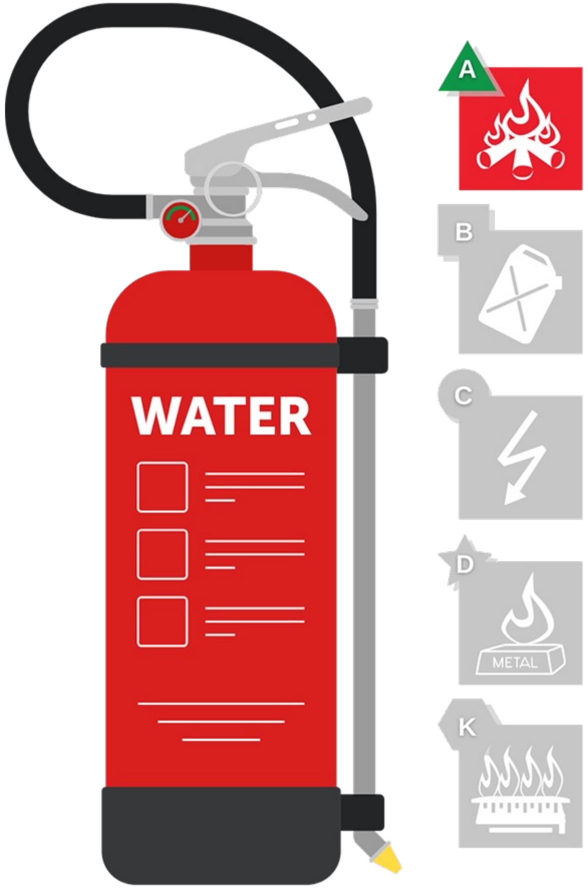
CURRICULUM FOR AGRICULTURAL SCIENCE EDUCATION

Laboratory and Shop Safety

Fire Extinguisher Safety

Unit 1 – Lesson 1.2 The Hazards Around You

Class A Water Extinguisher



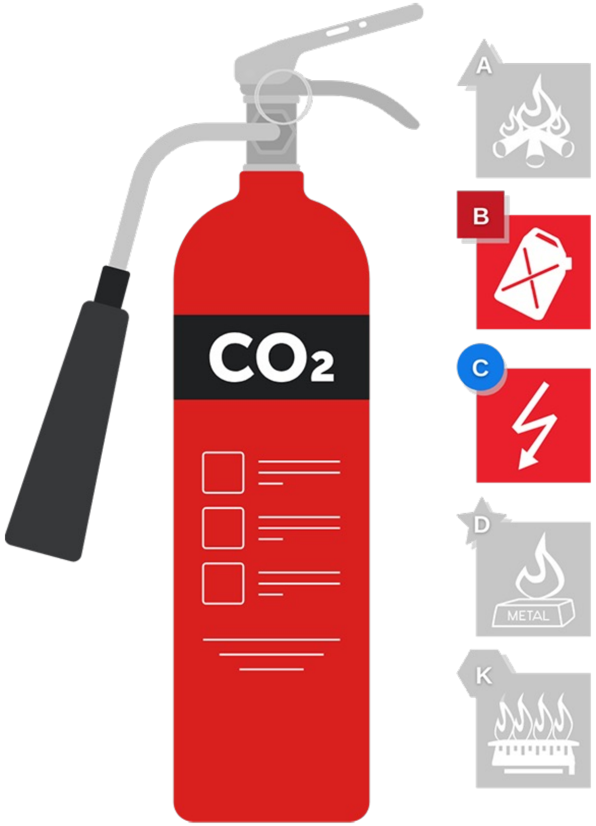
Uses: wood, cloth, paper, etc.

Not optimal for freezing conditions

Antifreeze option may be available

Clean-Up: Easy

Class B & C CO_2 Extinguisher



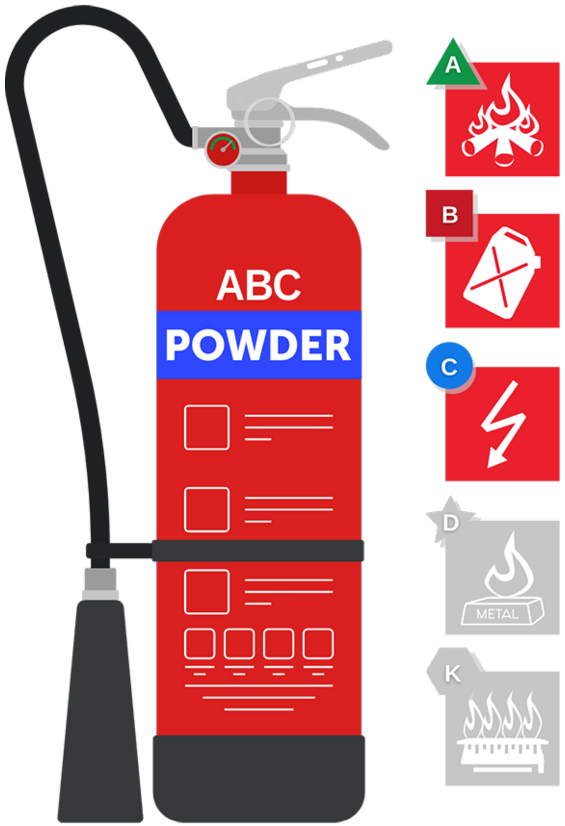
Uses: Flammable Gases & Liquids. Greases, Oils, Solvents, alcohols, etc.

Blast of cold area to remove oxygen.

Cleanup: No Residues after use.

Perfect for electronics, food prep. areas, and print shops.

Class ABC Powder Extinguisher



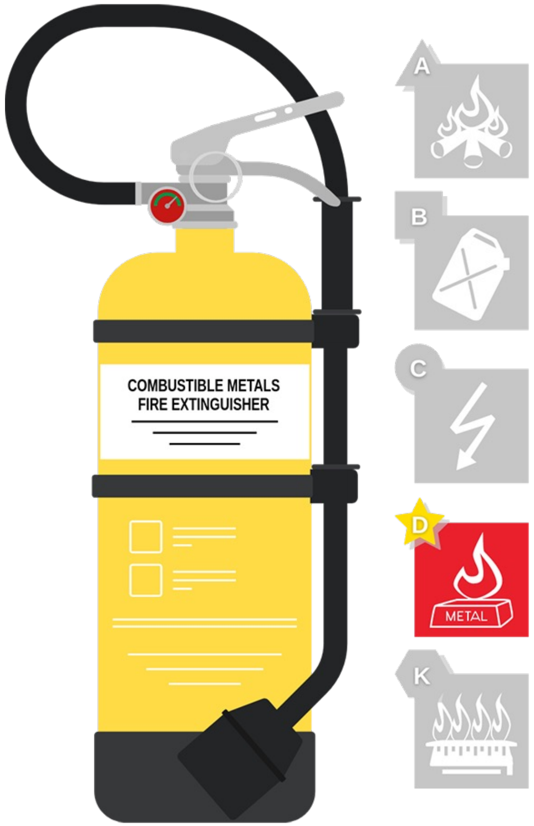
Uses: **A-** Ash Producing Items, **B-** Burnable Liquids, or **C-** Electrical Circuits

Most common type of fire extinguisher

Inhalation hazard

Clean-Up: Hard

Class D Powder Extinguisher

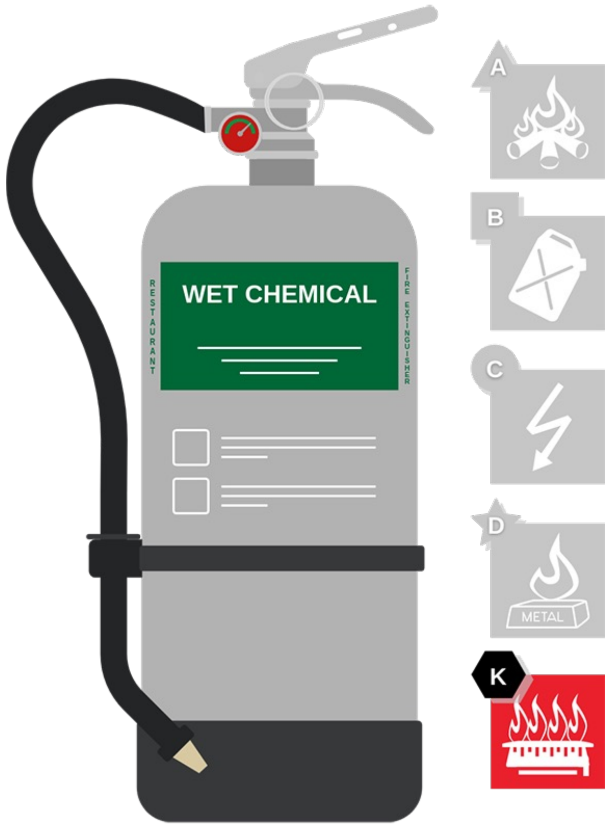


Uses: Combustible Metals e.g. lithium or magnesium

Excludes oxygen by forming crust with help of the heat

Class D Extinguishers are dangerous to use on other fire types

Class K – Wet Chemical Extinguisher



- Uses: Food fires in kitchens e.g. fatty acids in fats, oils, or grease
- Combined with powder, create a soapy foam layer that holds vapors and steam
- The chemical is an alkaline mixture

Using the PASS Method

- **P**ULL… Pull the pin
- **A**IM… Aim at the base of the fire
- **S**QUEEZE… Squeeze the handle
- **S**WEEP… Sweep from side to side

Fire Extinguisher - Inspections

Are All Extinguishers

- Accessible
- Visible
- Mounted to wall at correct height
- Correct type for area
- Appropriately sized
- Appropriately distanced
- Right locations

Smothering a Fire

- Cutting off the oxygen supply will starve the fire
- Removes one side of the triangle
- Place lid on the pan or close the door on fume hood

Fire Blanket

- Many different options are available
- Kitchen style to smother stove fires
- Larger size for human use if clothing is on fire

Cooking Fire Suppression System

- Suppression system for commercial kitchen stoves or fryers
- Suppression systems can be started automatically or manually and apply wet chemical
- Some automatic systems tie into ventilation to clear smoke and turn off gas

References

- AFP. (2023, November 27). *The ultimate guide to fire extinguishers for business*. Allegiant Fire Protection. https://allegiantfire.net/news/fire-extinguishers-for-business/
- Christina, A. S. (2022, February 7). *Fire suppression in a ductless fume hood: An added layer of protection*. https://www.airscience.com/fire-suppression-in-a-ductless-fume-hood-an-added-layer-of-protection
- *Fire extinguishers*. City of De Pere, Wisconsin. (n.d.). https://www.deperewi.gov/topic/index.php?topicid=27&structureid=11
- Fire Protection, A. (2023, November 27). *The ultimate guide to fire extinguishers for business*. Allegiant Fire Protection. https://allegiantfire.net/news/fire-extinguishers-for-business/
- Hero, P. (2023, August 31). *Prepared hero fire blanket reviews - worth buying or cheap emergency fire fighter solution?*. Islands' Sounder. https://www.islandssounder.com/reviews/prepared-hero-fire-blanket-reviews-worth-buying-or-cheap-emergency-fire-fighter-solution/
- Restoration, A. (n.d.). El Paso; American Restoration.
- Sentry Protection, F. (n.d.). *Portable fire extinguishers*. Fire Sentry Protection Services Website. http://www.firesentryprotectionservicesinc.com/portable-fire-extinguishers.html
- Supply Depot, F. (n.d.). *Fire Blanket Photo*. Google image result for https://cdn11.bigcommerce.com/s-tumf4kk1l4/images/stencil/1280x1280/products/3493/8386/ee37c__01028.1704305744.jpg?c=1?imbypass=on. https://www.google.com/imgres?imgurl=https%3A%2F%2Fcdn11.bigcommerce.com%2Fs-tumf4kk1l4%2Fimages%2Fstencil%2F1280x1280%2Fproducts%2F3493%2F8386%2FEE37C__01028.1704305744.jpg%3Fc%3D1%3Fimbypass%3Don&tbnid=SodU0jxynXy-WM&vet=12ahUKEwjUytKXt7OEAxWAxMkDHWLgCEcQMygiegUIARCzAw..i&imgrefurl=https%3A%2F%2Fwww.firesupplydepot.com%2Ffire-blanket-wall-mount-case.html&docid=jNkpwdPGb18YgM&w=1280&h=1280&q=fire+blanket&ved=2ahUKEwjUytKXt7OEAxWAxMkDHWLgCEcQMygiegUIARCzAw

Presentation Review

- Mark or highlight three key points.
- List two ideas or concepts related to previous knowledge.
- List questions you have about this topic.
- Keep notes organized and available for use throughout the course.

Lesson 1.2 Glossary

B

Building code – A collection of regulations adopted by a city to govern the construction of buildings.

C

Career and Technical Education (CTE) – courses (high school level) and (college level) programs that focus on the skills and knowledge required for high-wage, high-skill careers.

D

Decibel (dB) – A unit of measurement of the volume of sounds.

E

Ear canal cap – Canal caps resemble earplugs on a flexible plastic or metal band. Not all canal caps have tips that adequately block all types of noise.

Ear plugs – A device of pliable material for insertion into the outer opening of the ear (to keep out water or deaden sound).

Earmuffs – One pair of ear coverings connected by a flexible band and worn as noise protection.

Emergency Response Guide (ERG) – A reference used by first responders and hazardous materials technicians.

F

Fire blanket – A fireproof or flameproof material used for smothering small fires.

Fire extinguisher – A portable container usually filled with special chemicals for putting out a fire.

First aid – Help for a victim immediately after an injury and before professional medical help arrives.

H

Hazardous material – A material capable of posing a health, safety, or property risk.

Health hazard – The likelihood of a material to cause, either directly or indirectly, temporary or permanent injury or incapacitation due to acute exposure by contact, inhalation, or ingestion.

I

International Building Code (IBC) – A model building code developed by the International Code Council.

O

Occupational Safety and Health Administration (OSHA) – A federal agency that requires all employers to provide a safe environment for their employees.

P

Pull station – a manually operated device to initiate a fire alarm signal.

S

Safety data sheet (SDS) – Printed documentation used to relay hazardous material information from the manufacturer, formerly known as material safety data sheet (MSDS).

Sound level meter (SLM) – An apparatus for comparing sound-intensity levels, usually in decibels.

N

National Institute of Occupational Safety and Health (NIOSH) – A federal research agency focused on the study of worker safety and health and empowering employers and workers to create safe and healthy workplaces.

Noise duration – the time a person is exposed to the sound level.

Noise intensity – The decibel sound level.

Noise reduction rating (NRR) – A number assigned to hearing protection devices.

Name____

Lesson 1.2 Check for Understanding

1. List three of the sixteen sections of a Safety Data Sheet and what information each provides.

2. How can an Emergency Response Guide (ERG) be used in agricultural education courses?

3. What is first aid?

4. Why must you assess the situation before giving a victim first aid?

5. Match the fire extinguisher type with the proper class of item it can extinguish.

______ Class – Water
______ Class – Multi Purpose usage
______ Class – Burnable Liquids or Circuits
______ Class – Combustible Metals
______ Class – Animal Fats or Grease

A.	B/C
B.	D
C.	A
D.	ABC
E.	K

6. List two items besides fire extinguishers discussed in class that can assist in putting out fires.

7. Which of the following items provide hearing protection, if used properly?
   a) Headphones
   b) Formable ear plugs
   c) Ear Buds
   d) Hands

8. What commonly heard noises can cause hearing loss? (Circle all that apply)
    a) Power Tools
    b) Lawn Mowers
    c) Vacuum Cleaners
    d) Pig squeal

9. Calculate the occupancy rating for a classroom that is 30'x40', with an equipment net factor of 125' and a recommended square footage of 45 per person.

10. Explain how occupancy ratings are related to laboratory or shop safety.

Lesson 1.2 Check for Understanding Answer Key

1. List three of the sixteen sections of a Safety Data Sheet and what information each provides.

Answers will vary.
Any of the 16 SDS Sections can be listed along with what information that section provides.
Examples may include:
Product & Company Information: Item name and uses
Hazards identification: Labels & pictograms, along with specific hazards
Composition/Information on ingredients: Formula & Ingredients

2. How can an Emergency Response Guide (ERG) be used in agricultural education courses?

Answers may vary.
An ERG can be utilized in agricultural education courses by providing health hazards, fire or explosion, and public safety guidance.

If there should be an accident, the ERG can provide initial guidance for isolation distancing.

3. What is first aid?

Providing immediate care until professional medical help arrives.

4. Why must you assess the situation before giving a victim first aid?

To protect you from harm. To protect the victim from additional harm

5. Match the fire extinguisher type with the proper class of item it can extinguish.

Answer	Class		Options
C	Class – Water	A.	B/C
D	Class – Multi Purpose usage	B.	D
A	Class – Burnable Liquids or Circuits	C.	A
B	Class – Combustible Metals	D.	ABC
E	Class – Animal Fats or Grease	E.	K

6. List two items besides fire extinguishers that were discussed in class that can assist in putting out fires.

Fire blanket
Kitchen fire compression system
Smothering a Fire with a cooking lid or fume hood door
Answers may vary depending on the discussion held in class.

7. Which of the following items provide hearing protection if used properly?

   a) Headphones
   b) Formable ear plugs
   c) Ear Buds
   d) Hands

8. What commonly heard noises can cause hearing loss? (Circle all that apply)

   a) Power Tools
   b) Lawn Mowers
   c) Vacuum Cleaners
   d) Pig squeal

9. Calculate the occupancy rating for a classroom that is 30'x40', with an equipment net factor of 125' and a recommended square footage of 45' per person.

30'x40'=1200 sq. ft. classroom

1200' – 125' = 1075 net square feet
classroom space – equipment net square feet factor = net square feet of usable space

1075'/45'=23.89' ~23-person recommended occupancy rating.
Net square feet of usable space / recommended 45 sq. ft. allotment

10. Explain how occupancy ratings are related to laboratory or shop safety.

Answers may vary.
Occupancy ratings are based on available net square footage with the type of activity taking place in the space considered a safe amount.

Lesson 1.2 Materials

Unit 1 – Lesson 1.2 The Hazards Around You

APP	Qty/ 20	Qty/ 30	Unit	Item Specifications	Vendor
1.2.1	10	15	Pair	*Activity 1.2.1 ERG Cards*	CASE Teacher Notes
	10	15	Pair	Digital device with internet access	Local
	10	15	Pair	*ERG 2020 digital application*	Digital application store
	10	15	Pair	ERG flowchart PDF	CASE Teacher Notes
	20	30	Each	SDS form, ethanol	CASE Teacher Notes
	20	30	Each	SDS form, oil	CASE Teacher Notes
1.2.2	20	30	Each	8½"x11" sheet of paper	Local
	10	10	Set	Colored pencils	Local
	20	30	Each	Digital device with internet access	Local
	20	30	Pair	Scissors	Local
1.2.3	10	15	Pair	*Activity 1.2.3 Fire Extinguisher Cards*	CASE Teacher Notes
	20	30	Pair	Safety glasses	Wards
	5	7	Each	Tape measure, 100'	Local – Tools
1.2.4	10	15	Each	Board,12' 2"x4", 3' length	Local – Tools
	5	7	Pair	Digital device (cell phone or chromebook)	Local
	5	7	Each	Ear canal caps, semi-insert banded	Amazon
	5	7	Each	Ear plugs, custom molded	Amazon
	20	30	Pairs	Ear plugs, formable	Amazon
	5	7	Each	Ear plugs, pre-molded	Amazon
	5	7	Each	Earmuffs	Amazon
	5	7	Each	Hammer, claw	Local – Tools
	35	49	Each	Nail, 4d	Local – Tools
	20	30	Each	PPE appropriate for each space	Local
	20	30	Pair	Safety glasses	Wards
	5	7	Each	Sander, powered	Local – Tools
	5	7	Each	Sandpaper	Local – Tools
1.2.5	5	7	Each	Calculator	Local
	5	7	Each	Highlighter, green	Local
	5	7	Each	Highlighter, pink	Local
	5	7	Each	Highlighter, yellow	Local
	20	30	Each	*MN CTE Safety Manual pg. 19-22*	CASE Teacher Notes
	20	30	Each	PPE appropriate for each space	Local
	5	7	Group	Tape measure, 100'	Local

Lesson 2.1 Safe Setting

Preface

Agricultural careers are some of the most rewarding professions to pursue. Yet some agricultural career areas are also the most dangerous. Safety is important to understand in any job setting, especially in the agricultural industry. People working in the agricultural industry expose themselves to many dangers and hazards.

Standards must be set, and guidelines must be followed to ensure a safe workplace. Inspectors assess work areas for potential hazards and recommend improvements to create a safe working environment. Even though someone may consider a shop safe, accidents still happen. Employees can reduce the number of accidents by understanding the root cause. For example, the root cause of an accident may not be an unsafe machine, but an untrained person using the improper procedure. Workers can prevent a majority of accidents if they identify the root causes.

In this lesson, students will proactively approach being safe in a shop setting. They will evaluate the shop for safety hazards according to OSHA regulations.

Concepts	Performance Objectives
Students will know and understand	*Students will learn concepts by doing*
1. Site-specific safety policies and procedures are in place for agricultural mechanic shops and labs.	• Identify workplace hazards and the causes of accidents. (Activity 2.1.1) • Develop a standard set of safety requirements for an agricultural shop. (Project 2.1.2)
2. Safety must be planned and systematic for effective identification and management in a laboratory or shop.	• Assess a shop to determine if safety standards are being met and make recommendations for changes. (Project 2.1.3)

National AFNR Common Career Technical Core Standards Alignment

Career Ready Practices
1. Act as a responsible and contributing citizen and employee.
• CRP.01.02: Evaluate and consider the near-term and long-term impacts of personal and professional decisions on employers and community before taking action.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
• CRP.08.02: Investigate, prioritize and select solutions to solve problems in the workplace and community.
Agriculture, Food, and Natural Resources Career Cluster
3. Examine and summarize importance of health, safety, and environmental management systems in AFNR organizations.
• AG 3.1: Examine health risks associated with a particular skill to better form personnel safety guidelines.
• AG 3.4: Examine required regulations to maintain/improve safety, health and environmental management systems and sustainable business practices.
• AG 3.5: Enact procedures that demonstrate the importance of safety, health, and environmental responsibilities in the workplace.
• AG.3.7: Demonstrate application of personal and group health and safety practices.
Power, Structural and Technical (AG-PST)
2. Operate and maintain mechanical equipment related to AFNR power, structural, and technical systems.
• AG-PST 2.1: Maintain machinery and equipment by performing scheduled service routines.

Essential Questions

1. What are the most dangerous jobs in the United States?
2. Why does the agricultural industry have some of the most dangerous jobs?
3. What makes a job dangerous?
4. What are the common injuries that occur on a job site?
5. What are the major causes of accidents?
6. Who sets standards for safe working environments?
7. How do you assess a work environment for safety?
8. What hazards might you find in an agricultural mechanics workplace?
9. What preventive measures can you take to make a work environment safe?
10. What materials or items should be available in a work environment in case an accident occurs?

Key Terms

Accident	**Accident report**	**Danger**
Hazardous material	**Health hazard**	**Injury**
Lockout/tag-out	**Occupational Safety and Health Administration (OSHA)**	**Root cause**
Safety cabinet	**Safety can**	**Safety data sheet (SDS)**
UL (Underwriters Laboratory Inc.)	**Ventilate**	

Day-to-Day Plans
Time: 6 days

Refer to the Teacher Resources section for specific information on teaching this lesson, in particular, ***Lesson 2.1 Teacher Notes****,* ***Lesson 2.1 Glossary****,* ***Lesson 2.1 Materials****, and other support documents.*

Day 1:

- Present the **Concepts and Performance Objectives**, **Essential Questions**, and **Key Terms** to provide a lesson overview.
- Provide students with a copy of **Activity 2.1.1 Ouch!**.
- Students work individually to complete *Activity 2.1.1 Ouch!*.
- Students turn in Table 4 of *Activity 2.1.1 Student Research* as a safety contract for the teacher to sign, copy, file, and return to the student.

Day 2:

- Provide students with a copy of **Project 2.1.2 Setting the Standard** and **Safety Standards Evaluation Rubric**.
- Students work in pairs to complete *Project 2.1.2 Setting the Standard* using the **Safety Standards Template**.

Day 3:

- Provide students with a copy of **Project 2.1.3 All Clear** and **Project 2.1.3 Evaluation Rubric.**
- Students exchange *Safety Standard Templates* and work in pairs on Part One and Part Two of *Project 2.1.3 All Clear*.

Day 4:

- Students work on their presentations for *Project 2.1.3 All Clear*.

Day 5:

- Students present their safety topic for *Project 2.1.3 All Clear*.
- Students complete *Project 2.1.3 All Clear* individually during the student presentations.
- Assess the presentations using *Project 2.1.3 Evaluation Rubric*.

Day 6:

- Distribute **Lesson 2.1 Check for Understanding**.
- Students complete *Lesson 2.1 Check for Understanding* and submit for assessment.
- Use **Lesson 2.1 Check for Understanding Answer Key** to evaluate student assessments.

Instructional Resources

Student Support Documents

Lesson 2.1 Glossary

Activity 2.1.1 Ouch!

Project 2.1.2 Setting the Standard

Project 2.1.3 All Clear

Teacher Resources

Lesson 2.1 Safe Setting (PDF)

Lesson 2.1 Teacher Notes

Lesson 2.1 Materials

Lesson 2.1 Check for Understanding

Answer Keys and Assessment Rubrics

Lesson 2.1 Check for Understanding Answer Key

Safety Standards Evaluation Rubric

Project 2.1.3 Evaluation Rubric

Student Project Development Template

Safety Standards Template

Reference Sources

Herren, R. (2006). *Agricultural mechanics fundamentals and applications*. (5th ed.). Clifton Park, NY: Thomson Delmar Learning.

Herren, R. V., & Donahue, R. L. (2000). *Delmar's agriscience dictionary with searchable CD-ROM*. Albany, NY: Delmar.

Koel, L., & Mazur, G. A. (2013). *Agricultural technical systems and mechanics*. Orland Park, IL: American Technical Publishers.

Mayo Clinic. (2014, January 1). *First aid*. Retrieved from **http://www.mayoclinic.org/first-aid**

Nonprofit Risk Management Center. (2005). *Workplace safety toolkit*.

Oregon OSHA. (n.d.). *Workplace inspection checklists*. Retrieved from **http://www.orosha.org/standards/checklists.html**

SafetyToolboxtopics.com. (n.d.) *Seven common accident causes*. Retrieved from **http://safetytoolboxtopics.com/General/seven-common-accident-causes-2.html**

SAE for All

Foundational SAE

All students in an agricultural education program are expected to have a Foundational SAE. Students completing the APP and extensions listed below will meet the Foundational SAE qualification for the *Advanced (Grades 10-11) level*. Students should place all documented evidence in their *Agriscience Notebook* along with the **SAE for All Foundational Checksheet**.

SAE Workplace Safety Standards

- Activity 2.1.1 Ouch!
    - CS.03.01.01.b. Execute health, safety, and environmental procedures to comply with regulatory and safety standards.
- Activity 2.1.2 Setting the Standard
    - CS.03.01.01.b. Execute health, safety, and environmental procedures to comply with regulatory and safety standards.
    - CS.03.04.01.b. Analyze and demonstrate adherence to protective equipment requirements when using various AFNR tools and equipment.
    - CS.03.04.03.b. Assess and demonstrate appropriate operation, storage, and maintenance techniques for AFNR tools and equipment.
- Activity 2.1.3 All Clear
    - CS.03.01.01.b. Execute health, safety, and environmental procedures to comply with regulatory and safety standards.
    - CS.03.04.01.b. Analyze and demonstrate adherence to protective equipment requirements when using various AFNR tools and equipment.
    - CS.03.04.03.b. Assess and demonstrate appropriate operation, storage, and maintenance techniques for AFNR tools and equipment.

Access the **SAE for All Educator Resources** site for additional teacher and student resources.

Lesson 2.1 Teacher Notes

Lesson 2.1 Safety Setting

In preparation for teaching this lesson, review Concepts, Performance Objectives, Essential Questions, and Key Terms, along with the PowerPoint® presentations. Also, review all activities, project directions, expectations, and work students complete.

Students receive an introduction to the safety requirements in a shop setting. Note that the term shop, agricultural department, and agricultural classroom are synonyms in this lesson when referring to the setting. You can modify activities and projects in this lesson to meet the needs of your department. Each APP includes notes below for places to make modifications to the lesson.

Activities, Projects, and Problems

Activity 2.1.1 Ouch!

Students identify why accidents occur on the job site and how they can prevent accidents. Their research helps them to identify the root cause, which is the actual cause of the injury. Accidents are less likely to occur if students identify and address the actual causes of injuries. For example, a student may say the cause of a cut finger is the sharp blade on the machine. However, the root cause may be misusing the machine or operating the machine when distracted, which are both root causes of the accident.

Teacher Preparation

Before class, go to **Seven Common Accident Causes** (http://safetytoolboxtopics.com/General/seven-common-accident-causes-2.html) and print 20 copies of

The following are resources students can use as references for the activity. Provide to students if they struggle with internet research.

- **The 10 Most Dangerous Jobs in America**
- **Common Injuries - Ten Most Common Workplace Injuries**

Student Performance

Part One

Students use the internet to identify the most dangerous jobs in the world. One of them will be agricultural production. Once they know which jobs are dangerous, they need to explain why.

Part Two and Three

Students will identify the types of injuries that occur at places of work identified in *Part One*. Then, they will determine the cause of those common injuries.

Part Four

Students read the root causes of accidents and determine how to prevent accidents and injuries.

Results and Evaluation

Example completed tables and potential responses to analysis questions are listed in Tables 1 and 2. The students will write a safety contract for the final part of the activity on *Activity 2.1.1 Student Research*. Collect the contracts and sign them. Make a copy of the agreements, keep one on file, and return the other for students to keep in their *Agriscience Notebook*.

Table 1. ***Example Jobs***

Job	Types of Injuries
Fishing	Fisherman entanglement in fishing lines. Fisherman fall off the boat. Head injuries occur from slipping on the dock.
Logging	Workers cut by the equipment. Trees fall on loggers. Workers have strains due to repetitive motions.
Airline pilot	Pilot fatalities occur due to crashes.
Refuse/recycling collector	Workers become ill from contact with the hazardous material. Workers are cut by broken material.
Roofer	Workers sustain broken bones from falling off a roof.
Iron/steelworker	Burns and cuts caused by handling hot metal.
Construction worker	Cuts and bruises from operating equipment and handling material.
Farmer/rancher	Farm Fatalities caused by overturned tractors. Cuts and bruises from equipment and machines.
Truck driver	Broken bones, bruises, and head injuries caused by traffic accidents.
Miner	Miners are injured from falling objects.

Part One Analysis Questions and Potential Responses		
Q1	Where does agriculture rank in the most dangerous jobs?	*Answers will vary based upon the resource used, 8 -10.*
Q2	What do the most dangerous jobs have in common?	*They all involve an active job with equipment. Each job has different types of risks because of the environment where the job occurs.*
Q3	Why do you think people want to have these dangerous jobs?	*Work outdoors, adventurous, enjoy the activity.*

Table 2. ***Example Injuries***

Injuries	Cause
Overexertion	Workers doing more physical activity than their bodies can withstand.
Slipping/tripping	Workers are not paying attention to what is occurring around them.
Falling from heights	Not paying attention or wearing the proper protective gear.
Reaction injuries	Workers are not paying attention to their environment.
Falling object injuries	Improper storage of materials. Not wearing proper protective gear.
Walking into objects	Workers not paying attention or
Vehicle accidents	Not driving safely or paying attention to what is around them.
Machine entanglement	Clothing, shoes, fingers, and hair are caught by equipment when no precaution is taken.
Repetitive motion	Improper posture and
Violence at the workplace	Physical injuries caused by office politics and arguments on the job.

Part Two Analysis Questions and Potential Responses		
Q4	Of those injuries you listed, which do you believe would be the most common in a shop or lab setting?	*Answers will vary. Machine entanglement and repetitive motion.*
Q5	Why do you believe the injuries you identified would be the most common in your agriculture department?	*Answers will vary. Agriculture involves using equipment and repetitive motions throughout the day.*

Project 2.1.2 Setting the Standard

Students will develop a checklist to determine if the shop or agriculture department is meeting safety standards.

Teacher Preparation
Students will use provided websites for resources that have example checklists. The ten topics are suggested. Review the topics listed below and modify them depending upon your school's shop. Use the resources listed to find other topic areas that may fit.

1. Topics
    - Personal protective equipment
    - Materials handling and storage (Including SDS sheets, safety cabinets, and safety containers)
    - Fire hazards (Including fire extinguishers and fire blankets)
    - Electrical
    - Lockout/tag-out
    - Medical/first aid and recordkeeping (Including first aid kit and wash stations)
    - Walking-working surfaces and work environment
    - Ventilation and noise
    - Compressed gas and air
    - Exit routes and emergency action plans
2. Resources
    - **Occupational Health and Safety Administration Regulations** (https://www.osha.gov/laws-regs/regulations/standardnumber/1910)
    - **Oregon OSHA Checklists** (https://osha.oregon.gov/Pages/topics/inspection.aspx)
    - **California Agricultural Teachers' Essential Guide to Safety** (https://www.shsu.edu/academics/agricultural-sciences-and-engineering-technology/documents/SafetyGuide.pdf)
3. The checklist should be pertinent to your department setting. Students may need to observe the setting to determine which standards are a concern and which are not.

Student Performance
Students are assigned a safety topic to research with his or her partner. They work with his or her partner to develop a safety checklist on the **Safety Standards Template**. The checklist will have yes or no questions pertinent to the assigned safety topic and the shop setting. Table 3 contains examples of yes or no questions students could ask. A "yes" response to the questions is the desired result, and a "no" response is unsafe.

Results and Evaluation
The students will use the *Safety Standards Template* to make their checklists. They should print a copy of the checklist to use in the next project. Evaluate the checklist using **Safety Standards Evaluation Rubric**.

Table 3. *Example Safety Standard Questions*

Are SDS sheets easily accessible to all students?
Are fuel-gas cylinders and oxygen cylinders separated by distance, fire-resistant barriers, or other means while in storage?
Are cylinders stored or transported in a manner that prevents them from creating a hazard by tipping, falling, or rolling?
Are bulk materials stored or stacked in a manner to prevent potential hazards?
Are the walkways through the shop clearly marked and free of clutter?
Are Exit doors marked with Exit signs?
Are walking surfaces dry or slip-resistant?

Project 2.1.3 All Clear

Students evaluate the shop for safety using the *Safety Standards Template* and report their findings to the class.

Teacher Preparation

Review and evaluate the *Safety Standards Templates* developed by students in *Project 2.1.2 Setting the Standard* before starting this project. If there are significant flaws or errors, students will need to correct them before starting *Project 2.1.3 All Clear*. Students will need access to a shop or lab facility they can use to evaluate.

Student Performance

The students will work in the same pairs as in *Project 2.1.2, Setting the Standard* to evaluate the agricultural department or shop for safety. They use a checklist another pair wrote in *Project 2.1.2 Setting the Standard*. Students will present their findings to the class. Students must meet all the presentation criteria listed.

- A tour of department areas, including photos addressing the topic
- Location of safety items related to the students' topic with pictures.
- Explanation of all standards on the template and if they were met.
- Explanation of needed tasks to meet standards.
- The presentation is three to five minutes in length.

Students will learn the location of safety items and the safety features of the shop through these presentations. They will record information about each topic in Table 1 of *Project 2.1.3 Student Worksheet*.

Results and Evaluation

Score the presentations using **Project 2.1.3 Evaluation Rubric**.

Assessment

Lesson 2.1 Check for Understanding

Lesson 2.1 Check for Understanding is included for you to use as an assessment tool for this lesson. Use **Lesson 2.1 Check for Understanding Answer Key** for evaluation purposes.

Name____

Activity 2.1.1 Ouch!

Purpose

You may have seen television shows about trucking over ice, logging, or gold mining. What makes these shows exciting to watch? Many of these jobs are some of the most dangerous in the United States. The danger draws audiences in to watch. Some say the work is the cause of injuries. Yet workers can prevent most injuries by understanding the root cause.

People in the mechanical industry have identified seven common causes of accidents. These root causes are the source of a majority of all accidents that occur. Often, the cause of an injury is not the job or the tool. A worker's attitude, attention to detail, and ability to follow instructions all affect the worker's safety. The root cause of an accident may occur before the job begins. You may be injured if you lack training on how to use a tool or do not pay attention to the task at hand.

Have you been injured while completing a job or task at home? What caused the injury to occur? Why did it happen? How could you have prevented it? The agricultural mechanics area exposes you to many risks and hazards that could cause injury. You can avoid many of those injuries if you are aware of the root causes. What are the root causes of injury?

Materials

Per student:

- *Agriscience Notebook*
- Device with internet access
- Pencil
- *Seven Common Accident Causes*

Procedure

Explore the most dangerous jobs in the United States. Then, identify the types of injuries that occur and determine the cause. Finally, you will research the root cause of accidents and write a contract of rules you will follow to be safe in the agricultural classroom and shop.

Part One – Dangerous Jobs

Search for the "top 10 most dangerous jobs" using a device with internet access. Complete Table 1 on *Activity 2.1.1 Student Research* by identifying the job and two types of injuries you believe could occur on those job sites. Answer *Part One Analysis Questions* after completing your research.

Part Two – Common Injuries

Research the "most common workplace injuries" using a device with internet access. List the injuries and the cause of each in Table 2 on *Activity 2.1.1 Student Research*. Then answer the *Part Two Analysis Questions.*

Part Three – Cause of Accidents

Your teacher will provide you with a copy of the *Seven Common Accident Causes* article. Read the root causes of accidents and determine how you can prevent them from occurring. Complete Table 3 using your research. Use the internet for additional research if needed.

Part Four – Prevent Injury in the Shop

Develop a safety contract with seven rules you will follow in the shop. Each rule will address a different root cause of injury. Record your rules in Table 4. Sign the contract and turn in *Activity 2.1.1 Student Research* for your teacher to sign and make a copy to keep on file. Place your safety contract from Part Four in your *Agriscience Notebook*.

Conclusion

1. Why does agriculture rank as one of the most dangerous job areas?

2. What types of injuries can occur in an agricultural mechanics setting?

3. What preventative actions will you take to stay safe while working in the shop or laboratory?

Name____

Activity 2.1.1 Student Research

Table 1. ***Dangerous Jobs***

Job	Types of Injuries

Part One Analysis Questions

Q1 Where does agriculture rank in the most dangerous jobs?

Q2 What do the most dangerous jobs have in common?

Q3 Why do you think people want to have these dangerous jobs?

Table 2. ***Common Injuries***

Injuries	Cause

Part Two Analysis Questions

Q4 Of those injuries you listed, which do you believe would be the most common in a shop or lab setting?

Q5 Why do you believe the injuries you identified would be the most common in your agriculture department?

Table 3. ***Causes of Accidents***

Root Cause	Prevention

Table 4. ***Safety Contract***

<table>
<tr><th colspan="2">Safety Rules</th></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2">I agree to follow the rules above to prevent the root causes of injury and keep myself and others safe in the agricultural mechanics shop and classroom.</td></tr>
<tr><td>Student Signature</td><td></td></tr>
<tr><td>Teacher Signature</td><td></td></tr>
</table>

Name____

Project 2.1.2 Setting the Standard

Purpose

Have you ever worked in or seen an unsafe work environment? How did you know it was dangerous?

Governing bodies have set standards to provide safe environments for workers in the industry. These governing bodies ensure the workplace is safe with a minimal possibility of accidents. One of those governing bodies is the Occupational Safety and Health Administration (OSHA). OSHA visits workplaces to inspect the working environment, including schools, businesses, and industries. Standards are set for all types of safety issues ranging from electrical and fire hazards to proper emergency exits. For example, if a walkway is blocked and you cannot walk out of an emergency exit, safety regulation is broken, and the area is unsafe.

Employers must be knowledgeable about safety standards. They have access to the standards set by OSHA and are responsible for following all of OSHA's expectations. Many businesses have a safety committee that works together to monitor all standards. The committee will inspect the workplace for preventable safety hazards and identify standards they are not meeting. Identifying hazards can be difficult without researching the standards and having written guidelines.

How would you inspect your agriculture department? Is your agricultural department meeting all the expected standards?

Materials

Per pair of students:

- Device with internet access and word processing programs

Per student:

- *Agriscience Notebook*
- Pencil
- *Safety Standards Evaluation Rubric*
- *Safety Standards Template*

Procedure

Determine safety standards for a specific topic in your agricultural department. These standards must be clear, concise, and easy to understand so that anyone can use them to evaluate a workplace for safety. Your teacher will assign you and your partner one of the following topics.

- Personal protective equipment
- Materials handling and storage (Including SDS sheets, safety cabinets, and safety containers)
- Fire hazards (Including fire extinguishers and fire blankets)
- Electrical
- Lockout/tag-out
- Medical/first aid and recordkeeping (Including first aid kit and wash stations)
- Walking-working surfaces and work environment
- Ventilation and noise
- Compressed gas and air
- Exit routes and emergency action plans

Develop a safety checklist for your assigned topic. Describe your safety topic and record your questions on the *Safety Standards Template.* The checklist should ask a minimum of 10 safety questions about your assigned topic in a yes or no format. An example question would be, “Are the walkways through the shop marked and clutter-free?” Use the suggested resources to develop the checklist. Do not fill in the recommendation or check yes or no. You will complete the recommendation and check yes or no during the next project.

- Note: Write the questions so that the answer “yes” is a desired and safe outcome.

Print the *Safety Standards Template* once complete. Your teacher will use the *Safety Standards Evaluation Rubric* to assess your safety checklist. The checklist should meet the following criteria.

- Include a description of the assigned topic area.
- Requirements are relevant to the agricultural department. You may need to ask your instructor to view certain areas of the department to make sure your question is relevant.
- Asks a minimum of ten yes or no questions.

Suggested Resources:

- **Occupational Health and Safety Administration Regulations** (https://www.osha.gov/laws-regs/regulations/standardnumber/1910)
- **Oregon OSHA Checklists** (https://osha.oregon.gov/Pages/topics/inspection.aspx)
- **California Agricultural Teachers’ Essential Guide to Safety** (https://www.shsu.edu/academics/agricultural-sciences-and-engineering-technology/documents/SafetyGuide.pdf)

Conclusion

1. Why are there safety standards in a shop?

2. How can employers use a safety standards checklist?

Name____

Safety Standards Evaluation Rubric

Areas with Room for Improvement	Criteria	Areas that Meet or Exceed Expectations
	Topic Description The students identify and thoroughly describe the topic in two or more sentences.	
	Questions The students write ten or more questions. Questions are easily answered, yes or no. The students write the questions so that a yes response is positive, and a no response requires action.	
	Addressing Safety Concerns Questions are appropriate and cover all safety concerns in the shop surrounding the assigned topic.	
	Relevancy All questions are relevant to the shop setting at school and the topic.	

Name____

Project 2.1.3 All Clear

Look around your classroom. What hazards do you see that could cause an injury? Safety inspectors use a systematic process to determine the dangers of the workplace. People could easily miss many of the dangers with just a glance. Because of this, inspectors use standard checklists and guidelines to be sure they do not overlook those hazards. A proper inspection will ensure a work environment is clear of preventable hazards.

Are there any hazards in your agriculture department? Is your agriculture department “all clear” of preventable hazards?

Materials

Per pair of students:

- Clipboard
- Device with camera
- Device with word processing and presentation programs
- *Safety Standards Template* from *Project 2.1.2 Setting the Standard*

Per student:

- *Agriscience Notebook*
- Pencil
- *Project 2.1.3 Evaluation Rubric*

Procedure

Exchange your *Safety Standards Template* completed during *Project 2.1.2 Setting the Standard* with another pair. Use your new checklist to determine if the shop is meeting all the standards listed. Report your findings to the class with recommendations to make the learning environment safe.

Part One – Ag Department Evaluation

1. Attach the standards checklist to a clipboard.
2. Go to the shop when instructed by your teacher.
3. Use the safety standards to evaluate the shop by answering the yes or no questions.
4. If there is a question where you answer no, make a recommendation for changes to meet the standard. You may need to rely on resources used for completing *Project 2.1.2, Setting the Standard,* to make a recommendation.
5. Take digital photos of areas and specific items related to your standards.

Part Two – Shop Report and Recommendations

Develop a presentation with your partner to present your findings. Your presentation will be evaluated using *Project 2.1.3 Evaluation Rubric.* The presentation should meet the following criteria.

- A tour of department areas that includes photos addressing your topic.
- Location of safety items your topic addressed with pictures.
- Explanation of all standards and whether they were met.
- Explanation of how to meet the standards that were not met.
- The presentation is three to five minutes in length.

Part Three – Presentations

1. Your teacher will determine the order the class will be making presentations.
2. You and your partner will make a three to five-minute presentation reporting your findings.
3. As other teams are making their presentations, describe each topic, and record the standard you believe to be most important in Table 1 of *Project 2.1.3 Student Worksheet.*

Conclusion

1. What safety concerns are present in your agriculture department?
2. Why is it important to have safety standards?
3. What safety items should everyone be able to locate?

Project 2.1.3 All Clear

Table 1. ***Safety Topic Description and Standard***

Topic	Description	Important Standard

Name____

Project 2.1.3 Evaluation Rubric

Areas with Room for Improvement	Criteria	Areas that Meet or Exceed Expectations
	Department Photos Eight or more of the standards are addressed with a neat and accurate photograph with a detailed explanation.	
	Safety Questions Thoroughly and clearly states all safety questions related to the topic. The student explains the questions in detail.	
	Standards Each question is answered correctly regarding the shop. Questions with a “no” response are addressed with a detailed explanation of how to meet the standard.	
	Organization Excellent introduction and conclusion of the safety topic. The standards are in a logical sequence.	
	Delivery Effectively and creatively answers the safety questions while staying on topic and considering the audience. The student demonstrates speaking skills, including voice, presence, power of expression, and effect.	

Lesson 2.1 Glossary

A

Accident – An unfortunate happening that occurs unintentionally and usually results in harm.

Accident report – A document that details the facts about an accident in the facility.

D

Danger – Liability or exposure to harm or injury.

H

Hazardous material – A material capable of posing a risk to health, safety, or property.

Health hazard – The likelihood of a material to cause, either directly or indirectly, temporary or permanent injury or incapacitation due to acute exposure by contact, inhalation, or ingestion.

I

Injury – Harm or damage that is done or sustained.

L

Lockout/tag-out – The process of removing the source of electrical power and installing a lock that prevents the power from being turned on.

O

Occupational Safety and Health Administration (OSHA) – A federal agency that requires all employers to provide a safe environment for their employees.

R

Root cause – The most basic cause that can be reasonably identified.

S

Safety cabinet – A double-walled steel cabinet specifically designed for the storage of flammable liquid containers.

Safety can – A UL approved container, not exceeding five gallons, that has a spring padded lid on the spout to prevent the escape of explosive vapors but allow the relief of internal pressure.

Safety data sheet (SDS) – Printed documentation used to relay hazardous material information from the manufacturer and formerly known as material safety data sheet (MSDS).

U

UL (Underwriters Laboratory Inc.) – An independent organization that tests equipment and products to verify conformance to national codes and standards.

V

Ventilate – To provide fresh air in place of air that has been used or contaminated.

Name____

Lesson 2.1 Check for Understanding

1. What is the purpose of governing bodies such as OSHA regarding safety?

2. Why are safety standards important to follow?

3. List three root causes of injury and an example of how you can prevent each of those causes.

Root Cause	Example

4. What are three features of a shop that protect you and keep you safe?

Name____

Lesson 2.1 Check for Understanding Answer Key

1. What is the purpose of governing bodies such as OSHA in regards to safety?

   OSHA sets the standard policies to keep employees safe in the shop or lab.

2. Why are safety standards important to follow?

   To protect workers from preventable hazards and injury.

3. List three root causes of injury and an example of how you can prevent each of those causes.

   Three causes from the following table

Root Cause	Example
Taking shortcuts	**Follow step-by-step plans.**
Being overconfident	**Consider the risk with every machine, no matter how often you use it.**
Starting a task with incomplete instruction	**Ask questions on how to complete a task if you do not know.**
Poor housekeeping	**Keep storage areas clean.**
Ignoring safety procedures	**Follow safety procedures**
Mental distractions	**Take a break if you cannot focus.**
Failure to pre-plan the work	**Plan your entire work schedule.**

4. What are three features of a shop that protect you and keep you safe?

   Answers may vary but may include any three of the following.
   Eyewash
   Shower
   Fire extinguisher
   Fire blanket
   Ventilation system
   Marked walking and working areas
   First aid kit
   Emergency exit map

Lesson 2.1 Materials

Unit 2 – Lesson 2.1 Safe Setting

APP	Qty/ 20	Qty/ 30	Unit	Item Specifications	Vendor
2.1.1	20	30	Each	Device with internet access	Local
	20	30	Each	*Seven Common Accident Causes*	Printed
2.1.2	20	30	Each	Device with internet access and word processing programs	Local
2.1.3	10	15	Each	Clipboard	Local
	10	15	Each	Device with camera	Local
	10	15	Each	Device with word processing and presentation programs	Local

Lesson 2.2 Understanding Safety by Doing

Preface

Mechanics and technicians in agriculture use a wide variety of tools, which also means they must know safe operational procedures. For tools to be safe, they need to be in good working condition and guarded to protect workers from injury.

An operator should assess a tool for safety requirements and understand the operating procedure before using a tool. The operating procedure begins with getting the tool from storage and ends with returning it. Before performing any maintenance for the safety of the person doing the repairs and those using the equipment, the lockout tagout system must be utilized. Predictable steps can be taken when working on equipment when those in the area are aware of the standard operating system.

In this lesson, Students evaluate a power tool to determine if it is safe and write a procedure for operating it. To close out the lesson, students work through the proper steps of the lockout tagout system.

Concepts	Performance Objectives
Students will know and understand	*Students will learn concepts by doing*
1. A tool or machine's design affects how a person operates them.	• Identify the components of a power tool and determine any hazards present by using a safety evaluation form. (Activity 2.2.1)
2. Operating procedures for machines and tools keep the operator safe and the machine or tool in good working order.	• Write an operating procedure for using a power tool safely. (Activity 2.2.2)
3. Lockout tagout systems alert workers when equipment is out of service or undergoing maintenance.	• Demonstrate lockout tagout on a piece of equipment. (Activity 2.2.3)

National AFNR Common Career Technical Core Standards Alignment

Career Ready Practices
4. Communicate clearly, effectively and with reason.
• CRP.04.02: Produce clear, reasoned, and coherent written and visual communication in formal and informal settings.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
• CRP.08.02: Investigate, prioritize, and select solutions to solve problems in the workplace and community.
11. Use technology to enhance productivity.
• CRP.11.01: Research, select and use new technologies, tools, and applications to maximize productivity in the workplace and community.
Agriculture, Food, and Natural Resources Career Cluster
1. Analyze how issues, trends, technologies and public policies impact systems in the Agriculture, Food & Natural Resources Career Cluster.
• AG 1.1: Explain how regulations and major laws impact management of AFNR activities.
3. Examine and summarize importance of health, safety, and environmental management systems in AFNR organizations.
• AG 3.1: Examine health risks associated with a particular skill to better form personnel safety guidelines.
• AG 3.3: Identify hazards and acquire first aid skills to promote environmental safety.

• AG 3.4: Examine required regulations to maintain/improve safety, health and environmental management systems and sustainable business practices.
• AG 3.5: Enact procedures that demonstrate the importance of safety, health, and environmental responsibilities in the workplace.
• AG 3.6: Demonstrate methods to correct common hazards.
• AG.3.7: Demonstrate application of personal and group health and safety practices.
Power, Structural and Technical (AG-PST)
1. Apply physical science principles and engineering applications related to mechanical equipment, structures, and biological systems to solve problems and improve performance in AFNR power, structural, and technical systems.
AG-PST 1.2: Use hand and power tools commonly required in power, structural, and technical systems
2. Operate and maintain mechanical equipment related to AFNR power, structural, and technical systems.
• AG-PST 2.1: Maintain machinery and equipment by performing scheduled service routines.
• AG-PST 2.3: Operate machinery and equipment while observing all safety precautions.

Essential Questions

1. What are the three components of all power tools?
2. Why are guards in place on power tools?
3. What are the hazardous motions and actions of a power tool?
4. What are common safety concerns when operating a power tool?
5. How are operating procedures for power tools similar?
6. What does a lockout tagout system entail?
7. What is the purpose of lockout tagout?
8. When is a time when only tagout would be used?

Key Terms

Bending	**Diagonal–cutting pliers**	**Guard**
In-running nip points	**Lockout**	**Lockout device**
Lockout hasp	**Lockout Tagout (LOTO)**	**Operating controls**
Point of operation	**Punching**	**Reciprocating**
Rotating	**Shackle**	**Shearing**
Standard Operating Procedure (SOP)	**Tagout**	**Tagout device**
Transversing		

Day-to-Day Plans
Time: 6 days

*Refer to the Teacher Resources section for specific information on teaching this lesson, in particular, **Lesson 2.2 Teacher Notes**, **Lesson 2.2 Glossary**, **Lesson 2.2 Materials**, and other support documents.*

Day 1:

- Present the **Concepts and Performance Objectives**, **Essential Questions**, and **Key Terms** to provide a lesson overview.
- Provide students with a copy of **Activity 2.2.1 Safe to Use**.
- Students work individually to complete Part One of *Activity 2.2.1 Safe to Use*.

Day 2:

- Provide students with a copy of **Tool Safety Checklist**.
- Students use *Tool Safety Checklist* to evaluate the safety features of a power drill.
- Students complete *Activity 2.2.1 Safe to Use*.

Day 3:

- Provide students **Presentation Notes** pages to be used throughout the presentation to record notes and reflections. Students add these pages to their *Agriscience Notebook*.
- Present PowerPoint® **Operating Procedure**.
- Students take notes using the *Presentation Notes* pages provided by the teacher.
- Provide students with a copy of **Activity 2.2.2 Safe Operation**.
- Students develop an operation procedure for a power drill using the **Tool Operation Template**.

Day 4:

- Students complete their *Tool Operation Template*.
- Demonstrate how to use the power drill.
- Students update and submit their *Tool Operation Template.*
- Copy *Tool Operation Template* and return a copy for students to keep in their *Agriscience Notebook*.
- Students complete *Activity 2.2.2 Safe Operation*.

Day 5:

- Provide students with a copy of **Activity 2.2.3 Lockout Tagout.**
- Prepare **Activity 2.2.3 Tagout Blanks** for students to use in Parts Two and Three.
- Students complete Parts One and Two of *Activity 2.2.3 Lockout Tagout* in pairs.
- Students individually complete Part Three of *Activity 2.2.3 Lockout Tagout,* demonstrating the Lockout Tagout procedure for their teacher.

Day 6:

- Distribute **Lesson 2.2 Check for Understanding**.
- Complete *Lesson 2.2 Check for Understanding* and submit for assessment.
- Use **Lesson 2.2 Check for Understanding Answer Key** to assess student understanding.

Instructional Resources

PowerPoint® Presentations

Operating Procedure

Student Support Documents

Lesson 2.2 Glossary

Presentation Notes

Activity 2.2.1 Safe to Use

Activity 2.2.2 Safe Operation

Activity 2.2.3 Lockout Tagout

Activity 2.2.3 Tagout Blanks

Teacher Resources

Lesson 2.2 Understanding Safety by Doing PDF

Lesson 2.2 Teacher Notes

Lesson 2.2 Materials

Lesson 2.2 Check for Understanding

Answer Keys and Assessment Rubrics

Lesson 2.2 Check for Understanding Answer Key

Student Project Development Template

Tool Safety Checklist

Tool Operation Template

Reference Sources

Dictionary.com. (n.d.). Dictionary.com. https://www.dictionary.com/

Herren, R. V., & Donahue, R. L. (2000). *Delmar's agriscience dictionary with searchable CD-ROM*. Albany, NY: Delmar.

Koel, L., Mazur, G. A., Moniz, B. J., & Radcliff, R. B. (2019). Chapter 2 Safety and Health (2nd ed., pp. 48–50). Textbook, American Technical Publishers.

Lockout Tagout Supplies. ULINE. (n.d.). http://www.uline.com/

Minnesota DOE. (2022). Minnesota CTE School Laboratory/Shop Safety Manual. In *Safety Disciplines for Instructor, Facility Regulations, and District Procedures* (1st ed., pp. 19–22). essay, MDE. Retrieved January 2024, from https://education.mn.gov/MDE/dse/cte/safety/.

OSHA. (n.d.). *Control of Hazardous Energy (Lockout/Tagout) - overview*. Occupational Safety and Health Administration.

SAE for All

Foundational SAE

- All students in an agricultural education program are expected to have a Foundational SAE. Students completing Lesson 2.2 will meet the following Foundational SAE qualifications for the *Awareness or Intermediate (Grades 9-10) level*.

SAE Workplace Safety Standards

- Activity 2.2.1 Safe to Use
  - CS.03.01.01.b. Execute health, safety, and environmental procedures to comply with regulatory and safety standards.
  - CS.03.04.01.b. Analyze and demonstrate adherence to protective equipment requirements when using various AFNR tools and equipment.
  - CS.03.04.03.b. Assess and demonstrate appropriate operation, storage, and maintenance techniques for AFNR tools and equipment.
- Activity 2.2.2 Safe Operation
  - CS.03.01.01.b. Execute health, safety, and environmental procedures to comply with regulatory and safety standards.
  - CS.03.04.02.b. Complete the setup and adjustment for tools and equipment related to AFNR tasks.
  - CS.03.04.01.b. Analyze and demonstrate adherence to protective equipment requirements when using various AFNR tools and equipment.
  - CS.03.04.03.b. Assess and demonstrate appropriate operation, storage, and maintenance techniques for AFNR tools and equipment.

- Activity 2.2.3 Lockout Tagout
    - CS.03.01.01.b. Execute health, safety, and environmental procedures to comply with regulatory and safety standards.
    - CS.03.04.01.b. Analyze and demonstrate adherence to protective equipment requirements when using various AFNR tools and equipment.
    - CS.03.04.03.b. Assess and demonstrate appropriate operation, storage, and maintenance techniques for AFNR tools and equipment.

Access the **SAE for All Educator Resources** site for additional teacher and student resources.

Lesson 2.2 Teacher Notes

Lesson 2.2 Understanding Safety by Doing

In preparation for teaching this lesson, review the Concepts, Performance Objectives, Essential Questions, and Key Terms along with the PowerPoint® presentation before beginning the lesson with students. In addition, review all activities to familiarize yourself with the student directions, expectations, and the work students will complete.

In this lesson, you introduce students to the components of power equipment tools, how to operate them safely, and how to use the lockout tagout system before equipment repair. Students begin learning the major components of power tools, how they function, and how they are guarded to prevent injury. Finishing the lesson, students perform the steps of locking out and tagging out.

In this lesson, students use the *Tool Safety Checklist* and *Tool Operation Template* to record information about tool safety and operation. Students will use these templates when you introduce new tools throughout the course. Students store all completed templates in their *Agriscience Notebook*. Because all tools have very specific guidelines and operation procedures, it is your responsibility to know the safety procedures and operations for the tools.

PowerPoints®

Operating Procedure

Use this presentation to teach the major operating procedures for using a power tool. The slides are meant to correct any misconceptions of previous knowledge and fill in knowledge gaps about using power tools. Students use their presentation notes as a guide for completing operating procedures using the *Tool Operation Template* for tools.

Activities, Projects, and Problems

Activity 2.2.1 Safe to Use

Students determine if a power tool is safe to use. Introduce the *Tool Safety Checklist*, which can be used throughout the course as additional tools are used in class. In this activity, students use the checklist to evaluate a power drill.

Teacher Preparation

Review the **OSHA website - Machine Guarding eTool** to familiarize you with the terminology students will research. You are responsible for knowing the safety features of the drill and providing the students with proper instructions on how to use the tool.

Student Performance

Students use an OSHA website to review the terminology when evaluating tool safety features. Next, they identify safeguards in place on each operational component of the tool. Then, they use the *Tool Safety Template* to identify the hazards associated with a power drill.

Results and Evaluation

Students will turn in a completed checklist for the power drill. Review the checklist for correctness. Copy and return the checklist for students to keep in their *Agriscience Notebook*. Keep a copy on file for safety records.

Activity 2.2.2 Safe Operation

Students apply what they learned from the presentation *Operating Procedures* by developing a procedure for operating a power drill. The procedure will be written using the *Tool Operation Template*.

Teacher Preparation

1. Present *Operating Procedure* before starting this activity.
2. Review how to use the power drill properly. You are responsible for knowing the proper operating procedure for the drill.
3. Print copies of *Minnesota Schools General Laboratory/Shop Safety Resource Student Materials.*
4. Be prepared to provide students with printed copies of the **Minnesota Schools General Laboratory/Shop Safety Resource: Student Materials PDF** *(https://education.mn.gov/mdeprod/idcplg?IdcService=GET_FILE&dDocName=PROD059259&RevisionSelectionMethod=latestReleased&Rendition=primary).*

Student Performance

Students review the general operating procedures they learned from the presentation Operating Procedures and research operating instructions for a power drill using the *Minnesota Schools General Laboratory/Shop Safety Resource: Student Materials PDF* or Chapter 4 of the *Agricultural Technical Systems and Mechanics textbook.* They record the operating procedure for a power drill on the Tool Operation Template. You will demonstrate to students how to use a power drill. Students record any additional notes they have missed and revise their procedure for submittal.

Results and Evaluation

Students turn in a copy of their operating procedure for a power drill. Review the procedure for correctness. Copy and return the procedure for students to keep their *Agriscience Notebook*. Keep your copy on file for safety records.

Activity 2.2.3 Lockout Tagout

Students demonstrate the lockout tagout (LOTO) system by going through the steps of lockout and then tagout with a corded drill. Finally, students complete the lockout tagout system with their teacher approving the process.

Teacher Preparation

1. Review LOTO procedures. You may need to give students a demonstration before working with their partner. If you are unfamiliar with LOTO, you can watch the YouTube video **The Lockout Tagout Procedures: https://www.youtube.com/watch?v=Q9InwdBbRao**.
2. Print on cardstock four copies of *Activity 2.2.3 Tagout Blanks* for each student. Each copy provides one tag.

Student Performance

Part One

Students work with a partner to practice the lockout steps of the LOTO system procedure. Once the student successfully completes the lockout steps, their partner will sign off.

Part Two

Students work with a partner to practice the tagout steps of the LOTO system procedure. Once the student successfully completes the lockout steps, their partner will sign off. Students use the completed tag for Part Three.

Part Three
Students demonstrate the entire LOTO system procedure for their teacher. Once the student successfully completes LOTO, their teacher will sign off.

Results and Evaluation
Students can successfully demonstrate the lockout tagout system procedure for their partner and teacher. Table 1 contains analysis questions and potential responses.

Table 1. *Analysis Questions and Potential Responses*

Q1	What is the difference between a lockout device and a padlock?	*A lockout device prevents energy from being restored by attaching to a breaker or the end of a power cord. The devices require a lock to prevent the removal of the lockout protection it provides.* *A padlock is a locking mechanism attached to another item, such as a hasp, to prevent the operation of another item that can open with a key. For most instances, a padlock alone does not prevent the equipment from being locked out.*
Q2	What is another way not mentioned in the activity to verify that the equipment power is isolated?	*Answers may vary.*
Q3	Why is verifying the isolation of the piece of equipment is essential?	*Verifying power isolation a second time is important, even after locking out, to ensure the correct breaker or cord was locked out, or that energy has not been restored.*
Q4	Where should the tagout tag be placed when implementing the Lockout Tagout process?	*The tagout tag should be secured to the padlock shackle.*
Q5	Where should the tagout tag be placed if the equipment cannot be locked out?	*If lockout cannot be performed, the tagout tag should be placed at or on the source to restore energy.*
Q6	Why should both lockout and tagout be utilized together?	*Although there are two independent actions, LOTO should be combined, as the tag provides written notice, and the lock provides physical prevention.*

Assessment

Lesson 2.2 Check for Understanding

Lesson 2.2 Check for Understanding is included for you to use as an assessment tool for this lesson. Use **Lesson 2.2 Check for Understanding Answer Key** for evaluation purposes.

Name____

Activity 2.2.1 Safe to Use

Purpose

Have you ever finished a job that would have been easier with a more powerful tool? You may have learned about hand tools at home or in a previous class. Some jobs require a power tool. Power tools present a higher risk due to their fast movement and high power. If you are familiar with the components of a power tool, you will be able to determine if they are safe.

The point of operation, power transmission, and operating controls are the three fundamental components of a power tool. Power tools can produce up to eight motions and actions that could cause injury. These motions and actions occur in a wide variety of combinations in machines. Guards are put in place to prevent injuries caused by the movements and actions of the equipment. Operators consider the machine's motion when selecting which guards to use.

What are the power tool components, and how can you determine if they are safe?

Materials

Per Class:

- Power Drill

Per student:

- *Agriscience Notebook*
- Clipboard
- Device with camera
- Device with internet access
- Pencil
- Safety glasses
- *Tool Safety Checklist*

Procedure

Use internet resources to identify the components, hazardous motions, and guards on a power drill. Then, evaluate a power tool in the shop, identify its safety components, and determine if it is safe to use.

Part One – Operational Worksheet

1. Put on safety glasses and tie back long hair.
2. Go to a computer with internet access as instructed by your teacher.
3. Access the **Machine Guarding eTool** (**https://www.osha.gov/etools/machine-guarding/introduction**) website.
4. Click on **Introduction to Machine Guarding**.
5. Read the information. Describe the point of operation, power transmission, and operating controls in Table 1 of *Activity 2.2.1 Student Worksheet*.
6. Click on **Hazardous Motions and Actions**.
7. Select the possible motions or actions of a power tool listed on the website. Sketch or describe each motion or action and explain potential hazards in Table 2.
8. Click on **Introduction** and then **Guards**. Describe the advantages and limitations of each guard listed in Table 3.

Part Two – Safety Analysis of a Power Tool

Now that you understand the basic safety features of any power tool, analyze a power tool in the shop. DO NOT operate the tool.

1. Obtain a copy of the *Tool Safety Checklist* from your teacher.
2. Attach the *Tool Safety Checklist* to the clipboard.
3. Analyze the tool using the following list and the *Tool Safety Checklist*.

   Non-Mechanical Hazards

   - Observe the tool for potential non-mechanical hazards, such as noise and dust.
   - Record your observations on the *Tool Safety Checklist.*
   - Make recommendations for all PPE needed.

   Components

   - The power source is the electrical power that is powering the tool. Check the power source for loose fittings, broken prongs on the plug, and frayed wires. Record your findings on the *Tool Safety Checklist*.
   - Inspect the power transmission, operating controls, and point of operation areas. Look for exposed areas where guards should be or might be damaged.
   - Record the actions or motions you see and the guards in place.
   - Make recommendations for changes if you can make the tool safer.

   Teacher Presentation

   - Your teacher will review how to evaluate the power drill for safety.
   - Make additions to your *Tool Safety Checklist* as your instructor presents information.
   - Complete the template electronically.
   - Print the template and turn it in for your teacher to copy.
   - Keep a copy in your *Agriscience Notebook*.

Conclusion

1. Why should you evaluate a tool for safety before using it?

2. What protects you from hazards when using a power tool?

3. Why do injuries still occur when all safeguards on a power tool are in place?

Name____

Activity 2.2.1 Student Worksheet

Table 1. ***Fundamental Areas of a Machine***

Areas	Description
Point of Operation	
Power Transmission	
Operating Controls	

Table 2. ***Motions and Actions***

Motion/Action	Description/Sketch	Hazard
Rotating		
In-Running Nip Points		
Reciprocating		
Transversing		
Cutting		
Punching		
Shearing		
Bending		

Table 3. ***Machine Guarding***

Guard Type	Advantages	Limitations
Fixed		
Interlocked		
Adjustable		
Self-adjusting		

Name____

Tool Operation Template

Record the information for each step of the tool operation process.

Name of the Tool:____________________

PPE Requirements
Record the PPE needed and a reason for each.
Clothing and Grooming Requirements
Explain how and where loose clothing and hair could be caught in the tool.
Environment
Explain the environmental requirements for safe use, such as lighting and ventilation.
Tool Attachments
List the attachments, such as bits and blades used and purpose of each.
Material
What type of materials does this tool work on?
Fastening
Explain how material should be fastened before working on it with the tool.

Settings
Describe the settings on the machine and list the steps for setting them.
Power Supply
Explain how to inspect the power supply for risk of injury. Describe how and when you turn the machine on.
Personal Positioning
Where should you stand while turning on and operating the machine? Where should others be standing?
Use
How do you properly operate the machine?
Shutting Down
How and when do you shut down the machine?
Storage
How do you clean, inspect, and store the tool?

Name____

Activity 2.2.2 Safe Operation

Purpose

All tools have a safe operating procedure to follow. Not following a procedure is one of the seven root causes of injury. What are the consequences of not following a procedure? When does this procedure begin and end? As you learned in the presentation *Operating Procedures*, all power tools have similar operating requirements. How will you apply those requirements to a specific tool?

Materials

Per Class:

- 5 Power Drills

Per student:

- *Agricultural Technical Systems and Mechanics Textbook (optional)*
- *Agriscience Notebook*
- Clipboard
- Device with internet and word processing capabilities
- *Minnesota Schools General Laboratory/Shop Safety Resource: Student Materials PDF*
- Pencil
- Safety glasses
- *Tool Operation Template*

Procedure

Develop a safe operating procedure for the power drill you evaluated in *Activity 2.2.1 Safe to Use*. You have access to the machine, but it will NOT have power, and you will NOT use the machine. Research the operation procedure and care of the tool. Finally, record your information using the *Tool Operation Template*, observe a demonstration, and revise your operating procedure if needed.

Part One – Research

1. Use the *Minnesota Schools General Laboratory/Shop Safety Resource: Student Materials PDF*, Chapter 4 of the *Agricultural Technical Systems and Mechanics* textbook, and recommended internet resources to develop a safe operating procedure for the power drill.
    - Recommended internet resources:
        - Power tool safety is specific: **http://www.powertoolinstitute.com/pti_pdfs/PTI_Safety.pdf**
        - Teaching power tool safety: **https://www.powertoolinstitute.com/pti_pdfs/Teach-Ref-Guide-Final-05-2016.pdf**
    - Refer to the presentation *Operating Procedure* for the components you should research.
        - PPE requirements
        - Grooming and clothing requirements
        - Environment
        - Tool attachments
        - Material
        - Fastening
        - Settings
        - Power supply
        - Personal positioning
        - Use
        - Shutting down
        - Storage

Part Two – Demonstration

Your teacher will demonstrate the power drill's proper use and operation. As your teacher demonstrates the tool's use, add information to the procedure you missed while doing your research.

Part Three – Revised Procedure

Revise your operating procedure based on the demonstration. Print and submit your revised version to your teacher. Your teacher will make a copy and return one copy to you to keep in your *Agriscience Notebook*.

Conclusion

1. What are the similar operating procedures for all power tools?

2. Why is there a specific operating procedure for each tool?

3. Why should you inspect the tool before and after each use?

Name____

Tool Safety Checklist

Tool Name: ______________________

Non-Mechanical Hazards

Is there a potential noise hazard?	☐**Yes**	☐**No**	If yes, what PPE is needed?
Is there a potential hazard of harmful substances produced using the machine?	☐**Yes**	☐**No**	If yes, what PPE is needed?

Power Source			**Power Transmission/Operating Controls**			**Point of Operation**		
Are there loose conduits or fittings?	☐**Yes**	☐**No**	Are there any unguarded gears, sprockets, pulleys, or flywheels?	☐**Yes**	☐**No**	Is there a point of operation safeguard for the machine?	☐**Yes**	☐**No**
Is the machine properly grounded?	☐**Yes**	☐**No**	Are any exposed belts or chain drives?	☐**Yes**	☐**No**	Does it keep the operator's hand, fingers, and body out of danger?	☐**Yes**	☐**No**
Is the power supply correctly fused and protected?	☐**Yes**	☐**No**	Are starting and stopping controls within reach of the operator?	☐**Yes**	☐**No**	Have safeguards been tampered with or removed?	☐**Yes**	☐**No**

Place a check by any motions or actions that are potential hazards for each component. Record the PPE that should be worn and the type of guard in place to prevent injury from that action or motion.

	Power Transmission			**Point of Operation**		
Action or Motion		**Recommended PPE**	**Type of Guard in Place**		**Recommended PPE**	**Type of Guard in Place**
Rotating	☐			☐		
In-Running Nip Points	☐			☐		
Reciprocating	☐			☐		
Transversing	☐			☐		
Cutting	☐			☐		
Punching	☐			☐		
Shearing	☐			☐		
Bending	☐			☐		

What are the recommended changes to the components before using the tool?

What hazards should the operator be aware of before using the tool?

Name____

Activity 2.2.3 Lockout Tagout

Purpose

Before beginning maintenance work on equipment, one essential step is to use the lockout tagout (LOTO) system. It is essential to know that the LOTO system does not remove machinery from power by itself, and turning off a breaker or unplugging must still be completed before locking out and tagging out. A worker mostly performs the actions of locking out and tagging in unison, but each process requires separate devices and steps to secure.

Lockout removes a source of electrical power and installs a padlock that prevents the power from being turned on. Lockout systems often consist of a lockout hasp, shown in Figure 1, to add additional padlocks to the same power source. The hasp allows multiple employees to lock equipment out with their own locks attached at the hasp. Each padlock for the lockout system is individually keyed so that other individuals cannot remove the lock. Many different configurations of lockout enclosures are available. These may include a lightweight device that will resist weather conditions to secure electrical plugs, circuit breakers, cable lockouts, gate valves, and ball valves.

Figure 1. Lockout Hasp

Tagout places a tag on the source of electrical power that indicates the equipment must only be operated once the tag is removed. The tagout tag, as shown in Figure 2, requires the worker's name, date of tag installation, company or department name, phone number, estimated project completion time, and project being completed. The tag must stand up to hazardous environments and must be secured by a nonreusable method, such as a zip tie. Tagout is the only method used for equipment that cannot physically be locked out.

Figure 2. Tagout Tag

The lock and tag must be removed only by the worker who installed them. The Occupational Safety and Health Administration (OSHA) provides a standard operating procedure (SOP) for implementing lockout and tagout.

SOPs for lockout include the following.

1. Prepare for machinery shutdown.
2. Shut down machinery.
3. Isolate machinery or equipment.
4. Apply lockout and/or tagout.
5. Release stored energy.
6. Verify the isolation of machinery or equipment.

SOPs for implementing tagout include the following.

1. Complete both sides of the tagout tag.
2. Locate energy source.
3. Secure tag to lockout lock shackle, if used, with a zip tie.
4. If there is no lockout lock, attach a tagout tag to the point of the power source connection with a zip tie.

Preparing equipment for service involves more steps than just turning off the power. What considerations must be taken when removing equipment from operation, and how does LOTO help ensure a repair is completed safely?

Materials

Per pair of students:

- (8) Zip tie
- Drill, electric-powered
- Electrical plug lockout device
- Lockout hasp
- Padlock, keyed
- Permanent marker, black
- Scissors

Per student:

- *Agriscience Notebook*
- Clipboard
- Pencil
- Safety glasses

Per class:

- Scotch tape

Procedure

Work through removing equipment from service and power by applying a padlock, lockout device, and tagging out.

Part One – Lockout

Practice your lockout skills. If done successfully, your partner will confirm with their signature.

1. Put on PPE type and tie back long hair.
2. In pairs, pick up materials as assigned by your teacher.
3. At your workstation, review the steps in the *Purpose* for lockout.
4. Practice the six lockout steps below while your partner reviews your work.
    - Prepare the electrically powered drill for shutdown.
        - Release the trigger.
    - Shut down equipment or machinery.
        - Slide the position switch to the middle or off position, if applicable.
    - Isolate equipment or machinery.
        - Unplug the drill from the wall.
    - Apply lockout system.
        - Install the lockout device and padlock on the drill.
    - Verify the isolation of machinery or equipment.
        - Pull the trigger to ensure no power to the drill.
5. After you have successfully completed the lockout process, have your partner sign *Table 1. Verification Signatures* on the *Student Worksheet.*
6. The partner who verified previously then repeats steps 4 – 5.

7. Answer *Part One Analysis Questions* on *Activity 2.2.3 Student Worksheet.*

Part Two – Tagout

Practice your tagout skills. If done successfully, your partner will confirm with their signature.

1. At your workstation review the steps in the *Purpose* for tagout.
2. Cut out the solid line along the outside edge of both sides of the blank tagout tags provided by your teacher.
3. Fold the two tags together along the dashed line so the sides with writing face out.
4. Tape the unfolded side of the two tags together.
5. Use a black permanent marker on the side of the tag with danger on it to fill out the tagout tag legibly with the information provided below.
   - Name: write your *first and last name*.
   - Department: write *Agriculture*.
   - Expected completion: write today's date in this format: *00/00/0000*.
   - Phone: write the phone number of your school in this format *(XXX) XXX-XXXX*.
6. Turn the tag over to the unused side, and then fill out the tagout tag with the information provided below.
   - Date of installation: write yesterday's date in this format: *00/00/0000*.
   - Company name: write *Ag Supply & Service*.
   - Project being completed: write *Lockout/Tagout Practical.*
7. If you should make any mistakes, use one of your remaining blank tagout tags to start over.
8. Do not attach this tag to anything at this time.
9. Keep this tagout tag for Part Three.
10. After you have successfully completed the tagout process, have your partner sign the task in *Table 1. Verification Signatures* on the *Student Worksheet.*
11. The partner who verified previously then repeats steps 1 – 8.

Part Three – Putting it together

Put Part One and Two together to complete the entire LOTO process. If done successfully, your teacher will confirm with their signature.

1. Return any unused tags or zip ties to your teacher.
2. When your teacher requests, demonstrate the Lockout process from Part One, steps 1 – 3.
3. Use the tag from Part Two to demonstrate the tagout process.
4. Secure the tag to the padlock shackle by using a zip tie.
5. After you have successfully completed both the lockout and tagout processes, your teacher will verify LOTO on *Table 1. Verification Signatures* on the *Student Worksheet*.
6. Cut the tag zip tie with side cutters and dispose of the tag and zip tie in the trash.
7. Remove the padlock and the lockout device from the drill's electrical cord plug.
8. The second member of the pair then repeats steps 1 – 8.
9. Return all LOTO equipment to your teacher as directed.
10. Answer *Part Three Analysis Questions* on the student worksheet.

Conclusion

1. Give an example of when the lockout tagout system should be used.

2. What is the purpose of the lockout tagout system?

3. What steps should be taken to lockout and tagout a piece of equipment?

Name____

Activity 2.2.3 Student Worksheet

Part One Analysis Questions

Q1 What is the difference between a lockout device and a padlock.

Q2 What is another way not mentioned in the activity to verify the equipment power is isolated?

Q3 Why is verifying the isolation of the piece of equipment is important.

Part Three Analysis Questions

Q4 Where should the tagout tag be placed when implementing the lockout tagout process?

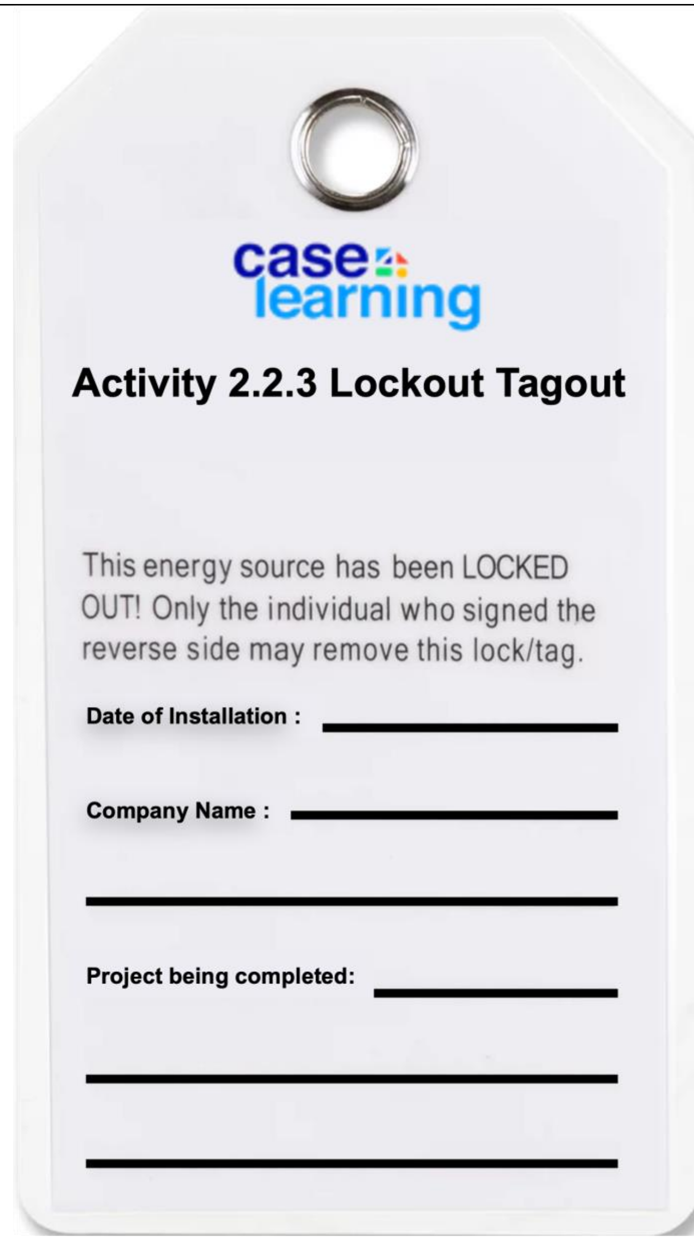
Q5 Where should the tagout tag placed if the equipment is unable to be locked out?

Q6 Why should both lockout and tagout be utilized together?

Table 1. – ***Verification Signatures***

Part One
I verify that my partner ________________________ has successfully performed the six steps of lockout.
Signed: ______________________ Printed: ______________________ Date: ____________________
Part Two
I verify that my partner ______________________ has successfully performed the four steps of tagout.
Signed: ______________________ Printed: ______________________ Date: ____________________
Part Three
Teacher verifies that________________________ has successfully performed the ten steps of LOTO.
Signed: ______________________ Printed: ______________________ Date: ____________________

Activity 2.2.3 Tagout Blanks

Front	Back
	

case learning

CURRICULUM FOR AGRICULTURAL SCIENCE EDUCATION

Operating Procedure

Operating Procedure

Unit 2 – Lesson 2.2 Understanding Safety by Doing

Power Tool Operation

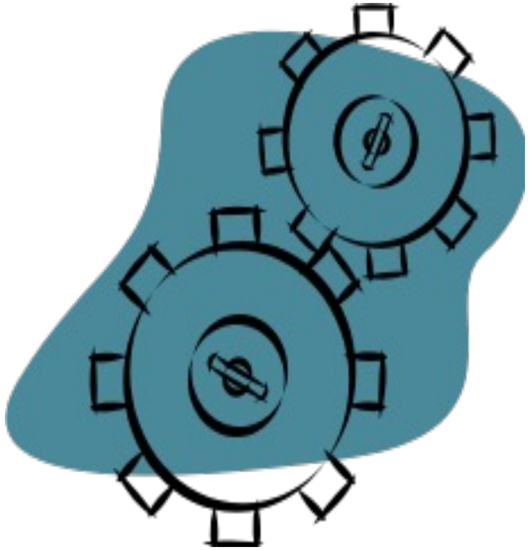
- All tools have basic operational steps to follow.
- Those steps begin with handling the tool and end with putting the tool away.
- A basic procedure can be applied to any power tool.

PPE Requirements

- Identify the potential hazards.
- Determine the type of PPE needed to protect yourself from those hazards.

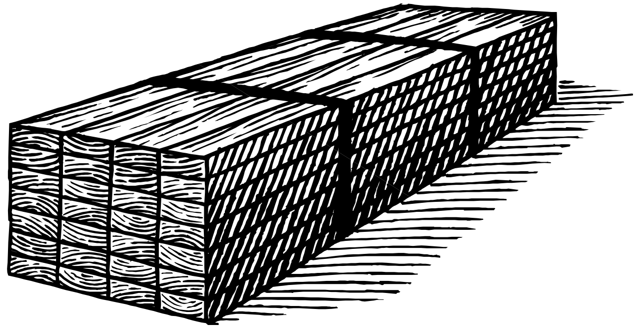
Clothing and Grooming

- What type of clothing should or should not be worn?
  - Loose fitted
  - Torn
  - Flammable
  - Rings
- Does hair need to be tied back to prevent entanglement?



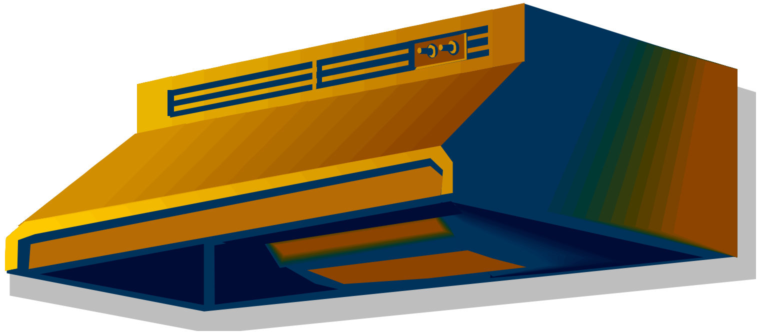
Material

- What type of material should the tool work on?
- Size and shape of material will determine how the tool will be used.



Environment

- What are the environmental conditions needed for operating the tool?
  - Ventilation
  - Noise protection for others
  - Curtains to protect others



Attachments and Accessories

What are the attachments and accessories appropriate for this tool?

- Blades for a saw
- Cooling liquids or lubricants
- Bits for a drill

Fastening

- How is the material going to be fastened safely?
- What tools are needed to fasten the material?

Settings

- What are the settings on the tool?
- How should the settings be adjusted based upon the material that is going to be used?

Power Supply

Power Supply

- Inspect the cord for nicks or loose fittings.
- Be sure that the tool is grounded or UL-protected to prevent electrical shock.

On/Off Switch

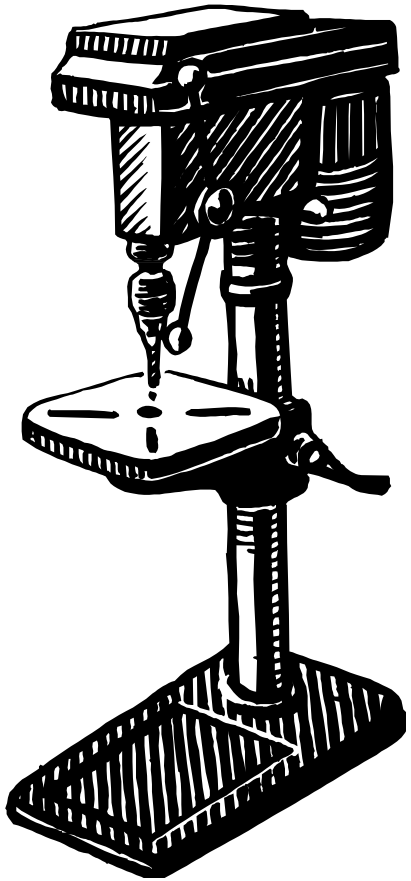
- Locate the on/off switch.
- Identify the off position.
- Be sure the machine is off before being plugged in.

Personal Positioning

- Where do you stand while turning on the machine?
- Where do you stand while operating the machine?
- Where should others be while you are operating the machine?

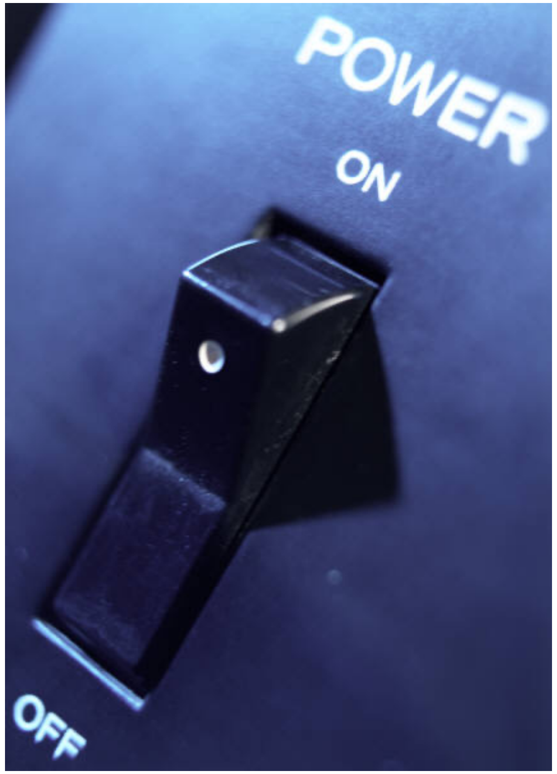
Use

- What is the procedure for operating the machine on the material?
- What speed should the machine be set to?
- Do not force the machine through the material.
- How could the machine damage the material if not operated correctly?



Shut Down

- How is the machine shut down?
- Does it have to be cleaned?
- Where should it be inspected for damage?
- How is it properly stored?



References

- Herren, R. (2006). *Agricultural mechanics fundamentals and applications*. (5th ed.). Clifton Park, NY: Thomson Delmar Learning.
- Koel, L., & Mazur, G. A. (2013). *Agricultural technical systems and mechanics*. Orland Park, IL: American Technical Publishers.

Presentation Review

- Mark or highlight three key points.
- List two ideas or concepts related to previous knowledge.
- List questions you have about this topic.
- Keep notes organized and available for use throughout the course.

Lesson 2.2 Glossary

B

Bending – To force an object from a straight form to a curved or angular one.

D

Diagonal–cutting pliers – Pliers used to cut wire and light-gauge nails and bolts.

G

Guard – A device, appliance, or attachment that prevents injury or loss.

I

In-running nip points – Pinch points where machine parts move towards each other or when one part moves past a stationary object.

L

Lockout – Removes a power source and installs a padlock that prevents the power from being turned on.

Lockout device – A lightweight enclosure that allows the lockout of a standard control device.

Lockout hasp – A is a multiple-lockout/tagout device.

Lockout Tagout (LOTO) – The practices and procedures necessary to disable machinery or equipment, thereby preventing the release of hazardous energy while employees perform servicing and maintenance activities.

O

Operating controls – A device for regulating and guiding a machine.

P

Point of operation – Where work is performed on material.

Punching – To strike or hit in operation.

R

Reciprocating – To move alternatively back and forth.

Rotating – To turn around on an axis.

S

Shackle – A metal link, typically U-shaped, closed by a bolt, used to secure a chain or rope to something.

Shearing – To cut or clip with a sharp instrument.

Standard Operating Procedure (SOP) – A set of written instructions that describes the step-by-step process that must be taken to perform a routine activity properly.

T

Tagout – Places a tag on the source of electrical power that indicates the equipment must only be operated once the tag is removed.

Tagout device – A prominent warning device, such as a tag and a means of attachment, which can be securely fastened to an energy-isolating device in accordance with an established SOP to indicate that the energy-isolating device and the equipment being controlled may not be operated until the tagout device is removed.

Transversing – Movement in a straight, continuous line.

Name____

Lesson 2.2 Check for Understanding

1. What are the three fundamental areas of a power tool?

2. Where should guards be in place on a power tool?

3. Match the name of the hazardous motion or action with the correct example.

_______	Cutting	A.	Shaft or pulley moving in a circular motion
_______	Punching	B.	Gear operating a chain
_______	Shearing	C.	Belt on a pulley moving in a straight line
_______	Bending	D.	Power is applied to stamp metal that makes a hole
_______	Rotating	E.	Hydraulic power used to cut metal with a slicing motion
_______	In-Running Nip Points	F.	Power is applied to stamp the metal that changes its shape
_______	Reciprocating	G.	A rotating drill bit that bores a hole
_______	Transversing	H.	Back and forth motion

4. List five components of an operating procedure that technicians should include for a power tool.

5. What is the purpose of lockout tagout? (Select all that apply)
   a) When a piece of equipment must be taken out of service.
   b) Provide a protocol to restrict the powering up of equipment during maintenance.
   c) Steps taken when you are locked out of your vehicle.
   d) When you are locked out of a piece of equipment, you complete a tagout request for key access.

6. List an example of a piece of equipment you would use to lockout tagout and list the lockout tagout equipment that would be needed.

Lesson 2.2 Check for Understanding Answer Key

1. What are the three fundamental areas of a power tool?

Point of operation
Power transmission device
Operating controls

2. Where should guards be in place on a power tool?

Where moving parts can come in contact with the operator.

3. Match the name of the hazardous motion or action with the correct example.

G	Cutting	A.	Shaft or pulley moving in a circular motion
D	Punching	B.	Gear operating a chain
E	Shearing	C.	Belt on a pulley moving in a straight line
F	Bending	D.	Power is applied to stamp metal that makes a hole
A	Rotating	E.	Hydraulic power used to cut metal with a slicing motion
B	In-Running Nip Points	F.	Power is applied to stamp the metal that changes its shape
H	Reciprocating	G.	A rotating drill bit that bores a hole
C	Transversing	H.	Back and forth motion

4. List five components of an operating procedure that technicians should include for a power tool.

Answers may include any of the following.
PPE
Clothing and grooming
Handling the tool
Materials that it works on
Attachments
Power supply
Fastening of material
Positioning while operating
Settings for the machine
Storage of machine

5. What is the purpose of lockout tagout? (Select all that apply)

a) When a piece of equipment must be taken out of service.
b) Provide a protocol to restrict the powering up of equipment during maintenance.
c) Steps taken when you are locked out of your vehicle.
d) When you are locked out of a piece of equipment, you complete a tagout request for key access.

6. List an example of a piece of equipment you would use to lockout tagout and list the lockout tagout equipment that would be needed.

Answers will vary.
Tool: Electric drill
Lockout device
Padlock
Tagout tag
Zip tie
Permanent marker

Lesson 2.2 Materials

Unit 2 – Lesson 2.2 Understanding Safety by Doing

APP	Qty/ 20	Qty/ 30	Unit	Item Specifications	Vendor
2.2.1	20	30	Each	Clipboard	Local
	10	15	Each	Device with digital camera	Local
	10	15	Each	Device with internet access	Local
	5	5	Each	Drill, hand, power	Local
2.2.2	20	30	Each	Clipboard	Local
	20	30	Each	Device with internet and word processing capabilities	Local
	20	30	Each	*Minnesota Schools General Laboratory/Shop Safety Resource: Student Materials PDF*	**MN DOE CTE Safety**
	20	30	Each	Safety glasses	Local
2.2.3	20	30	Each	*Activity 2.2.3 Lockout Tags*	CASE Teacher Notes
	20	30	Each	Clipboard	Local
	10	15	Each	Drill, hand, electric-powered	Local – Tools
	10	15	Each	Electrical plug lockout device Fits most 110 and 220-volt plugs	**Amazon**
	10	15	Pair	Lockout hasp	**Amazon**
	1	1	Each	Lockout tagout 42-piece kit – Optional 6 lockout hasps 4 keyed different padlocks 1 ball-valve lockout 2 electrical plug lockouts 1 steel cable lockout 10 individual circuit breaker lockouts 16 tagout tags and zip ties	**Amazon**
	10	15	Pair	Padlock, keyed	**Amazon**
	10	15	Each	Permanent marker, black	Local
	20	30	Each	Safety glasses	Wards
	20	30	Pair	Scissors	Local
	4	6	Each	Side cutters	Local – Tools
	80	120	Each	Zip tie, black, 6”	**Amazon**

Lesson 3.1 Lab Safety and Measurement

Preface

Safety and measurement are essential practices in agriscience. To utilize the science in agriculture, students must be familiar with measuring equipment used to conduct experiments and scientific research. Lab activities in the workplace do not end at the completion of the lab. Proper sanitation is needed after the work is completed to ensure the safe handling of spaces and materials and to prevent possible impacts on human health.

In this lesson, students will identify tools and equipment found in a laboratory. Then, students practice several forms of proper measuring. Finally, students work to calculate a disinfectant solution for the lab clean-up.

Concepts	Performance Objectives
Students will know and understand	*Students will learn concepts by doing*
1. Laboratory equipment has specific uses in scientific experiments.	• Identify and describe the uses of common laboratory equipment. (Activity 3.1.1) • Collect data using laboratory equipment. (Activity 3.1.2)
2. Reading and understanding laboratory procedures are essential to conducting a laboratory experiment safely.	• Complete a laboratory exercise by following written procedures. (Activity 3.1.2)
3. Mass, volume, temperature, and density are common laboratory measurements.	• Measure distance, volume, mass, temperature, and density using the appropriate tools and scale. (Activity 3.1.2)
4. Biological hazards are reduced through proper use of PPE, disposal, and post-lab cleaning.	• Create a sanitizing solution for disposal of Petri dishes, Petrifilm®, cleaning, sanitizing equipment (wipe or a sanitizing solution). (Activity 3.1.3)

National AFNR Common Career Technical Core Standards Alignment

Career Ready Practices
7. Employ valid and reliable research strategies.
• CRP.07.01: Select and implement reliable research processes and methods to generate data for decision-making in the workplace and community.
• CRP.07.02: Evaluate the validity of sources and data used when considering the adoption of new technologies, practices and ideas in the workplace and community.
11. Use technology to enhance productivity.
• CRP.11.01: Research, select, and use new technologies, tools, and applications to maximize productivity in the workplace and community.
12. Work Productively in teams while using cultural/global competence.
• CRP.12.02: Create and implement strategies to engage team members to work toward team and organizational goals in a variety of workplace and community situations (e.g., meetings, presentations, etc.).
Agriculture, Food, and Natural Resources Career Cluster
3. Examine and summarize importance of health, safety, and environmental management systems in AFNR organizations.
• AG 3.1: Examine health risks associated with a particular skill to better form personnel safety guidelines.

• AG 3.4: Examine required regulations to maintain/improve safety, health and environmental management systems and sustainable business practices.
• AG 3.5: Enact procedures that demonstrate the importance of safety, health, and environmental responsibilities in the workplace.
• AG.3.7: Demonstrate application of personal and group health and safety practices.
Biotechnology Systems Career Pathway Content Standards
BS.02: Demonstrate proficiency by safely applying appropriate laboratory skills to complete tasks in a biotechnology research and development environment (e.g., standard operating procedures, record keeping, aseptic technique, equipment maintenance, etc.).
• BS.02.02: Implement standard operating procedures for the proper maintenance, use and sterilization of equipment in a laboratory.
• BS.02.03: Apply standard operating procedures for the safe handling of biological and chemical materials in a laboratory.
• BS.02.04: Safely manage and dispose of biological materials, chemicals and wastes according to standard operating procedures.
Food Products and Processing Systems (AG-FD)
1. Develop and implement procedures to ensure safety, sanitation, and quality in food product and processing facilities.
• AG-FD 1.3: Employ safety and sanitation procedures for the handling, processing, and storage of food products.
Natural Resource Systems (AG-NR)
4. Demonstrate responsible control and management procedures and techniques to protect or maintain natural resources.
• AG-NR 4.2: Employ appropriate techniques to prevent the spread of animal and plant diseases affecting natural resource systems.

Essential Questions

1. What equipment is commonly used in the laboratory?
2. Why is it important to follow laboratory procedures?
3. Why are measurement units important?
4. What are the different types of measurement?
5. How do you calculate density?
6. What is needed to mix a sanitizing solution?
7. What steps are needed to mix a sanitizing solution?
8. What is the difference between sanitizing and disinfecting?

Key Terms

Accuracy	**Biological hazards**	**Bleach**
Chlorine	**Clean**	**Concentrated**
Contact time	**Data**	**Density**
Disinfect	**Disposal**	**Distance**
Environmental damage	**Experiment**	**Heat**
Mass	**Observation**	**Petri dish**
Petrifilm®	**Procedure**	**Sanitize**
Sodium hypochlorite	**Solution**	**Temperature**

Test strips	**Volume**

Day-to-Day Plans
Time: 6 days

Refer to the Teacher Resources section for specific information on teaching this lesson, in particular ***Lesson 3.1 Teacher Notes****,* ***Lesson 3.1 Glossary****,* ***Lesson 3.1 Materials****, and other support documents.*

Day 1:

- Present the **Concepts and Performance Objectives**, **Essential Questions**, and **Key Terms** to provide a lesson overview.
- Provide students with a copy of **Activity 3.1.1 Lab Tech Training.**
- Students complete *Activity 3.1.1 Lab Tech Training*.
- Students complete Part One individually.
- Students complete Part Two as a class.

Day 2:

- Present PowerPoint® **How to Measure**.
- Students take notes using the **Presentation Notes** pages provided by the teacher.
- Provide students with a copy of **Activity 3.1.2 Measure Me.**
- Students complete Part One of *Activity 3.1.2 Measure Me* individually.

Day 3:

- Students complete Parts Two through Four of *Activity 3.1.2 Measure Me* individually.

Day 4:

- Students complete Part Five of *Activity 3.1.2 Measure Me.*
- Provide students with a copy of **Activity 3.1.3 Clean, Sanitize, or Disinfect.**
- Students Complete Part One of *Activity 3.1.3 Clean, Sanitize, or Disinfect* in groups.

Day 5:

- Students complete Parts Two – Three of *Activity 3.1.3 Clean, Sanitize, or Disinfect* in groups.

Day 6:

- Distribute **Lesson 3.1 Check for Understanding**.
- Students complete *Lesson 3.1 Check for Understanding* and submit for evaluation.
- Use **Lesson 3.1 Check for Understanding Answer Key** to evaluate student assessments.

Instructional Resources

PowerPoint® Presentations

How to Measure

Student Support Documents

Lesson 3.1 Glossary

Presentation Notes

Activity 3.1.1 Lab Tech Training

Activity 3.1.2 Measure Me

Activity 3.1.3 Clean, Sanitize, or Disinfect

Teacher Resources

Lesson 3.1 Lab Safety and Measurement (PDF)

Lesson 3.1 Teacher Notes

Lesson 3.1 Materials

Lesson 3.1 Check for Understanding

Answer Keys and Assessment Rubrics

Lesson 3.1 Check for Understanding Answer Key

Reference Sources

Dictionary.com. (n.d.). Dictionary.com. **http://www.dictionary.com/**

Feldkamp, S. (Ed.). (2002). *Modern biology*. Austin, TX: Holt, Rinehart, and Winston.

Gagliardi, M. (n.d.). *Bleach dilution ratio for disinfecting*. www.clorox.com. https://www.clorox.com/learn/bleach-dilution-ratio-chart/

Herren, R. V., & Donahue, R. L. (2000). *Delmar's agriscience dictionary with searchable CD-ROM*. Albany, NY: Delmar.

Iowa State University, C. (2023). *Disinfection 101*. Center for Food Security and Public Health. https://www.cfsph.iastate.edu/Disinfection/Assets/Disinfection101.pdf

Johnson, R.L., Stahmer-DeMoss, G., & Sorensen, R. (2007). *Earth science with Vernier*. Beaverton, OR: Vernier Software & Technology.

Lynch, K. (2020, November 18). *Safe sanitizing and Disinfecting*. Safe Food & Water. https://www.canr.msu.edu/resources/safe-sanitizing-and-disinfecting

Reardon, M., & Derner, S. (2004). *Strategies for great teaching*. Chicago, IL: Zephyr Press.

Redding, K., & Masterman, D. (2007). *Biology with Vernier*. Beaverton, OR: Vernier Software & Technology.

Ward's Science. (2014, January). *Pouring plates from prepared bottled media*. Pouring Plates from Prepared Bottle Media. https://www.wardsci.com/assetsvc/asset/en_US/id/16920402/contents

SAE for All

Foundational SAE

All students in an agricultural education program are expected to have a Foundational SAE. Students completing the APP and extensions listed below will meet the Foundational SAE qualification for the *Awareness or Intermediate (Grades 9-10) level*. Students should place all documented evidence in their *Agriscience Notebook* along with the **SAE for All Foundational Checksheet**.

SAE Workplace Safety Standards

- Activity 3.1.1 Lab Tech Training
  - CS.03.04.01.a. Identify and differentiate the appropriate protective equipment for the safe use and operation of specific tools and equipment (e.g. PPE, etc.).
- Activity 3.1.2 Measure Me
  - CS.03.04.01.b. Analyze and demonstrate adherence to protective equipment requirements when using various AFNR tools and equipment.
  - CS.03.04.03.a. Read and interpret operating instructions related to the operation, storage, and maintenance of tools and equipment related to AFNR tasks.
- Activity 3.1.3 Clean, Sanitize, or Disinfect
  - CS.03.01.01.b. Execute health, safety, and environmental procedures to comply with regulatory and safety standards.

- CS.03.04.03.b. Assess and demonstrate appropriate operation, storage, and maintenance techniques for AFNR tools and equipment.

Access the **SAE for All Educator Resources** site for additional teacher and student resources.

Lesson 3.1 Teacher Notes

Lesson 3.1 Lab Safety and Measurement

In preparation for teaching this lesson, review Concepts, Performance Objectives, Essential Questions, and Key Terms, along with the PowerPoint® presentation. Also, review all activity directions, expectations, and work students complete.

Throughout this lesson, students learn how to work safely in a lab. They begin the lesson by identifying scientific equipment. Using the *How to Measure PowerPoint,* students will learn about measuring, which leads to the next measurement activity. Then, students practice measurement and data collection. Students complete the lesson by calculating, measuring, and mixing a chlorine solution to ensure proper disinfection protocol for Petri dishes or Petrifilm®.

PowerPoints®

How to Measure

Use this presentation to teach basic measurement skills. Students learn how to use a metric ruler, measure volume, and tare an electronic balance before applying to *Activity 3.1.2 Measure Me.*

Activities, Projects, and Problems

Activity 3.1.1 Lab Tech Training

Students learn and share information about science laboratory equipment.

Teacher Preparation

Print and cut out **Activity 3.1.1 Lab Tech Cards** before starting this activity. Set up all equipment listed below on a table in a convenient location within the lab or classroom.

- Apron
- Alcohol burner
- Beaker
- Hot hand protector
- Burette clamp
- Dropper
- Electronic balance
- Gloves, disposable
- Graduated cylinder
- LabQuest or Graphical Analysis App
- Microscope
- Petri dish
- Pipet
- Ring stand
- Safety goggles
- Sensor
- Support ring
- Test tube
- Thermometer
- Weighing dish

Student Performance

Students individually identify the equipment on their cards using the activity material list to help determine the proper name. Then, students record a description of the item and its use. Next, students share their clues and descriptions with the entire class. Students record descriptions and uses for each item as their classmates share.

Results and Evaluation

Use Table 1 to guide students through the matching process and review after the activity.

Table 1. ***Lab Equipment Key***

What am I? __Lab apron or coat____________ • Safety item • Worn when working with chemicals and preserved materials • Used to protect clothes and body	**What am I? _LabQuest or Graphical Analysis App_** • Observation tool • Used to collect data • Has functions similar to a computer
What am I? __Alcohol burner_____ • Made of glass • Used to produce heat • Can be used to compare fuel sources	**What am I? _Microscope___________** • Observation tool • Often requires power • Magnifies very small objects
What am I? _Beaker_____________ • Made of glass • Used to hold liquids • Can measure, not a high degree of accuracy	**What am I? _Petri dish____________** • Made of glass or plastic • Shallow dish • Used to culture microbial colonies
What am I? _Gloves________ • Safety item • Worn when working with chemicals, preserved materials • Protects hands	**What am I? _Pipet______________** • Made of plastic • Used to transfer liquids • High degree of accuracy
What am I? _Burette clamp________ • Tool • Used with ring stand • Holds test tube and other small items	**What am I? _Ring stand___________** • Support stand for lab apparatus • Used to suspend and secure items • Made of metal
What am I? _Weighing dish_________ • Measurement tool • Open container • Used to weigh a sample	**What am I? _Safety goggles________** • Safety item • Worn when working with chemicals, preserved materials, and fire • Protects eyes
What am I? _Dropper_____________ • Made of glass or plastic • Used to transfer liquids • Low accuracy, mostly used for individual drops	**What am I? _Sensor______________** • Measurement tool • Used in data collection • Used with LabQuest
What am I? _Electronic balance____ • Measurement tool • Accurate • Used to determine mass	**What am I? _Support ring__________** • Tool • Used with a ring stand • Used to support or suspend large items
What am I? _Hot hand protectors_______ • Safety item • Worn when working with hot items • Protects hands	**What am I? _Test tube_____________** • Made of glass • Curved bottom • Typically holds small quantities
What am I? _Graduated cylinder____ • Made of glass or plastic • Used to hold liquids • Provides accurate measurement of liquids	**What am I? _Thermometer _________** • Measuring device • Used to determine temperature • Common scales are Celsius and Fahrenheit

Activity 3.1.2 Measure Me

Individually, students use a series of measurements to build a box and mix a solution. Then, they remove the solid mixture and take more measurements.

Teacher Preparation
Present *How to Measure* to begin the activity.

While the chemicals used in the lab are very safe, students do not initially know. Emphasize the importance of safety when working with unknown chemicals. Before students enter the lab, place four boxes of Jell-O® in a clean bowl or dish and label it *Dry Chemical Powder*. Avoid using sugar-free varieties as it will alter the results of the experiment.

You may preheat the water in a microwave for students if time is limited. Glass beakers are better than plastic for this activity due to the heating methods. Students need various pieces of PPE at different steps.

Student Performance
Part One
Students begin building a paper box by following directions on measuring, drawing, cutting, and folding their boxes. As students complete their boxes, check each to ensure they have taped the corners securely to enable the box to hold liquid.

Part Two through Four
Students use what they learned in the *How to Measure* presentation to determine the mass of the *Dry Chemical Powder.* Then, they take the temperature of tap water and boil it. Next, students mix the *Dry Chemical Powder* and boiling water until dissolved. Once dissolved, they let the solution sit for ten minutes while they clean up their area. Finally, students pour the liquid solution into the cubes from Part One. Have students place their experiments on a metal tray after Part Four and put it in a refrigerator overnight. Be sure the tray has sides to catch Jell-O® that leaks from boxes.

Part Five
On day three of this lab, students retrieve their boxes from the refrigerator to complete the activity. They begin by removing the paper from the cube. Then, students record measurements and calculate the density of the solid cube.

Results and Evaluation
Access students' ability to measure mass, volume, and density by reviewing student work for accuracy and completion. Use the analysis question responses in Table 3 to assess student understanding.

Table 2. *Analysis Questions and Potential Responses*

Q1	What were three measurements that were essential to the success of this experiment?	*All measurements are essential, but the size of the box, water volume, water temperature, and wait time are crucial.*
Q2	What problems could inaccurate measurements have caused when building your cube?	*Problems with the squareness of the box could lead to the solution leaking.*

Activity 3.1.3 Clean, Sanitize or Disinfect

Students work in groups to prepare a bleach-based sanitizing solution. Then, students sanitize Petri dishes or Petrifilm® to ensure proper disposal.

Teacher Preparation
This Activity will work best following another CASE course activity where items require sanitizing or disinfection. For additional background on cleaning, disinfection, and sanitation visit **Iowa State University Disinfection 101** *(https://www.cfsph.iastate.edu/Disinfection/Assets/Disinfection101.pdf)*. See Table 3 below for further guidance for activities that will fit well before this activity. This activity can also be done with unused Petri dishes if you do not have any items that need sanitizing.

Table 3. *Suggested CASE APPs*

CASE Course	Activity
AgXploration (AgX)	Before meal prep for *Activity 8.2 Field to Fork**
Ag Food & Natural Resources (AFNR)	*Activity 5.6.2 Chill to Be Safe*
Animal & Plant Biotechnology (APB)	*Activity 1.2.3 Making Percent Solutions*
Ag Science Animal (ASA)	*Activity 2.3.2 Biosecurity: Managing Risk*
Ag Science Plant (ASP)	*Activity 8.2.2 Spying on Bacteria*
Food Science & Safety (FSS)	*Activity 1.2.5 Controlling Pathogens**
*Before meal prep, use chlorine solution on food prep surfaces. Let food prep surfaces set for five minutes of contact time. After five minutes, the surface should be rinsed with a clean water rinse.	

Part One

- Check the **Chlorine Dilution Calculator** link to ensure it works**.** (**https://www.publichealthontario.ca/en/health-topics/environmental-occupational-health/water-quality/chlorine-dilution-calculator**)

Part Two

HANDLING Hypochlorite solutions are corrosive to eyes, skin, and mucous membranes. Read and understand the **SDS** (**https://www.thecloroxcompany.com/wp-content/uploads/2021/07/USA001229-Clorox-Disinfecting-Bleach_1-1.pdf**) and wear all appropriate personal protective equipment. This activity can have some potential hazards. It is important that students wear proper PPE. Emphasize that all labels should be read, and the concentration percentage should be understood before measuring and mixing chemicals for this activity. Below are important information points for Part Two before, during, and after class.

Before Class

- Ensure you read the read the bleach label before class.
- Bleach with 8.25% sodium hypochlorite is preferred as it requires less bleach. Bleach with a lower percentage of sodium hypochlorite may be used but will require a higher quantity of bleach.

During Class

- Due to the splash hazard, this activity requires safety goggles, not glasses.
- Ensure you reiterate that the bleach is poured into the water when mixing the chlorine solution, not vice versa. When water is added to a concentrated (bleach), the reaction is exothermic, and the amount of heat generated may cause the mixture to splash out and cause burns.

After Class

- After the required five-minute surface contact time, the Petri dish or Petrifilm® may be disposed of in the trash or according to your school district policy.

Student Performance

Part One

Students calculate the chlorine solution using the **Chlorine Dilution Calculator** by recording the measurements of bleach and water needed for Part Two. The calculations are recorded in *Table 1.* of *Activity 3.1.3 Student Worksheet.*

Part Two

Groups will complete tasks measuring and mixing the chlorine sanitizing solution under the direction of the teacher. See *Table 4* for *Chlorine Dilution Calculations.* Students will verify NaOCl concentration and place the percent on the student worksheet, Table 4.

Part Three

Students will sanitize their group's Petri dish or Petrifilm® from a previous activity. Use an unused dish on hand if no dirty ones are available. After the five-minute contact time in the sanitizing solution, the sanitized items should be rinsed in clean water and air-dried for reuse. If using disposable Petri dishes or Petrifilm®, dispose of them in the trash or according to your school district policy.

Results and Evaluation
Assess students on measuring and reading measurement devices when mixing a chlorine-based cleaning solution by verifying measurements and ensuring the correct length of contact time for disinfecting Petri dishes or Petrifilm®. Table 5 contains analysis questions and potential responses.

Table 4. ***Chlorine Dilution Calculations***

In a 1000mL beaker, make 750mL of a 20% sanitizing solution, starting with an 8.25% bleach concentrate.
To make your chlorine solution, measure 19mL of 8.25% bleach.
To make your chlorine solution, measure 730mL of cool tap water.
Assuming 8.25% sodium hypochlorite is used, this is equivalent to 7.90% available chlorine.

Table 5. ***Analysis Questions and Potential Responses***

Part One		
Q1	How can an online calculator assist in calculating chlorine solutions?	*Answers will vary.* *The online calculator will assist in calculating if you aren't sure what the equation is or double-checking an answer you have manually calculated.*
Q2	What information must be put into the dilution calculator to make a sanitizing solution?	*The following items are needed:* *Concentration of Bleach Product* *Desired Concentration of chlorine solution* *Desired volume of chlorine solution.*
Q3	How can the chlorine dilution calculator assist in making different amounts of sanitizing solutions?	*After inputting the requested solution, the Chlorine Dilution Calculator provides specific measurements with adjustable units based on need.*
Part Two		
Q4	Why are the measurements of fluids verified by another group member?	*This is one additional check in the mixing process to ensure proper measurements of the cleaning solution.*
Q5	Why is a 1000mL beaker used when we only want to make 750mL of cleaning solution?	*The 1000mL beaker allows a larger capacity to hold the Petri dishes or Petrifilm® and allows extra room for mixing the bleach and water.*
Q6	Why does the test strip bottle list a sanitizing and disinfecting ppm range below the level we use in class?	*Answers may vary.* *The test strips may be set for everyday use, requiring a lower PPM cleaning solution.*

Assessment

Lesson 3.1 Check for Understanding

Lesson 3.1 Check for Understanding is included for you to use as an assessment tool for this lesson. Use **Lesson 3.1 Check for Understanding Answer Key** for evaluation purposes.

Name____

Activity 3.1.1 Lab Tech Training

Purpose

In a science lab, you may see many pieces of equipment and tools. Each piece of equipment has specific uses. Anyone working in a laboratory must know the appropriate uses. When preparing a lab, do you use a beaker or a graduated cylinder? What are the proper instruments for measuring volume versus length?

Safety is a primary concern for everyone, and we must have an attitude of safety when working. One component of an attitude of safety is knowing and using the right tools for the job. Another is wearing the appropriate personal protective equipment for the materials you will be using. Today, you will begin an extensive training journey as a laboratory technician.

Materials

Per class:

- Alcohol burner
- Beaker, 100ml
- Burette clamp
- Dropper
- Electronic balance
- Gloves, disposable
- Graduated cylinder
- Hot hand protector
- Lab apron or coat
- LabQuest
- Microscope
- Petri dish
- Pipet
- Ring stand
- Safety goggles
- Support ring
- Test tube
- Thermometer
- Vernier, temperature sensor
- Weighing dish

Per student:

- *Activity 3.1.1 Lab Tech Cards*
- *Agriscience Notebook*
- Pencil

Procedure

Use clues to determine which item from the supply table matches your card's description, and then present your item to the class.

Part One – What am I?

Your teacher will provide you with a card describing one lab equipment item. Read your card and determine which item matches the clues on your card. Use the *Materials* list to help determine the proper name of the item. Once you have found your item, record what it *Looks Like* and its *Uses* Table 1 on *Activity 3.1.1 Student Worksheet.* Be very descriptive in your answers.

Part Two – Sharing

When called upon by your teacher, read the clues from your card to the class. The class will use clues to determine the item you are describing. After the class has correctly guessed your item, share the information for your item from Part One. As your classmates share their items, record what each item looks like and is used for.

Conclusion

1. Why is knowing what items look like and how they are used important for laboratory safety?

2. What are three items used for measurement?

3. What are three items used for collecting data?

Name____

Activity 3.1.1 Student Worksheet

Table 1. ***Looks Like and Its Uses***

Lab Equipment	Looks Like	Uses
Alcohol burner		
Apron		
Beaker		
Burette clamp		
Dropper		
Electronic balance		
Gloves, disposable		
Graduated cylinder		
Hot hand protector		
LabQuest		
Microscope		
Petri dish		
Pipet		
Ring stand		
Safety glasses		
Sensor		
Support ring		
Test tube		
Thermometer		
Weighing dish		

Activity 3.1.1 Lab Tech Cards

What am I? ___________________ • Safety item • Worn when working with chemicals and preserved materials • Used to protect clothes and body	**What am I?** ____________________ • Observation tool • Used to collect data • Has functions similar to a computer
What am I? ___________________ • Made of glass • Used to produce heat • Can be used to compare fuel sources	**What am I?** ____________________ • Observation tool • Often requires power • Magnifies very small objects
What am I? ____________________ • Made of glass • Used to hold liquids • Can measure volume, not a high degree of accuracy	**What am I?** ____________________ • Made of glass or plastic • Shallow dish • Used to culture microbial colonies
What am I? ____________________ • Safety item • Worn when working with chemicals, preserved materials • Protects hands	**What am I?** ____________________ • Made of plastic • Used to transfer liquids • High degree of accuracy
What am I? ____________________ • Tool • Used with ring stand • Holds test tube and other small items	**What am I?** ____________________ • Support stand for lab apparatus • Used to suspend and secure items • Made of metal

What am I? ____________________ • Measurement tool • Open container • Used to weigh a sample	**What am I?** ____________________ • Safety item • Worn when working with chemicals, preserved materials, and fire • Protects eyes
What am I? ____________________ • Made of glass or plastic • Used to transfer liquids • Low accuracy, mostly used for individual drops	**What am I?** ____________________ • Measurement tool • Used in data collection • Used with LabQuest
What am I? ____________________ • Measurement tool • Accurate • Used to determine mass	**What am I?** ____________________ • Tool • Used with a ring stand • Used to support or suspend large items
What am I? ____________________ • Safety item • Used to carry hot glassware • Protects hands	**What am I?** ____________________ • Made of glass • Often used with heat to observe a reaction • Typically holds small quantities
What am I? ____________________ • Made of glass or plastic • Used to hold liquids • Provides accurate measurement of liquids	**What am I?** ____________________ • Measuring device • Used to quantify temperature • Common scales are Celsius and Fahrenheit

Name____

Activity 3.1.2 Measure Me

Purpose

Working in a science-related field requires specific tools and the ability to make precise and accurate measurements. The success of many laboratory experiments and your safety relies on your ability to read procedures carefully and follow them accurately. Following procedures often includes measuring a variety of compounds.

Measurements commonly used in the laboratory include distance, mass, temperature, and volume. These can be measured using metric or English systems. See Figure 1 for comparable units of measurement.

Unit	Metric	English
Distance	Centimeters (cm)	Inches (in.)
Mass	Grams (g)	Ounces (oz)
Temperature	Degrees Celsius (°C)	Degrees Fahrenheit (°F)
Volume	Cubic centimeters (cm^3)	Ounces (oz)

Figure 1. Units of Measurement

An additional measurement used in the laboratory is density. Density is the mass or weight of an object compared to its volume. See Figure 2 for the density formula.

	Example: Water
$\text{density (g/cm}^3\text{)} = \dfrac{\text{mass (g)}}{\text{volume (cm}^3\text{)}}$	$1\text{g/cm}^3 \text{ (density)} = \dfrac{1\text{g (mass)}}{1\text{cm}^3 \text{ (volume)}}$

Figure 2. Density Formula

Consider a brick compared to a like-sized piece of Styrofoam; the brick is much heavier even if they are the same size. While the volume is similar, the density of the brick is much greater. Why is measuring length, mass, temperature, volume, and density accurately important?

Materials

Per class:

- (4) Beaker, 600ml
- (4) Electronic balance
- (4) Hot hand protector
- (4) Hot plate
- (4) Masking tape
- (10) Scissors
- Stapler
- Thermometer
- Water, tap

Per student:

- *Agriscience Notebook*
- Beaker, 100ml
- Device with timer
- *Dry Chemical Powder*
- Gloves, disposable
- Graduated cylinder, 100ml
- Lab apron
- Paper, cardstock
- Pencil
- Ruler, metric
- Safety goggles
- Spoon, plastic
- Stirring rod, glass
- Weighing dish

Procedure

Work individually to mix chemicals correctly using a variety of measurements.

Part One – Linear Measurement

1. Read all procedures before beginning the lab.
2. Obtain a piece of paper from your teacher.
3. Use a ruler and pencil to draw a 15cm x 15cm square in the center of the cardstock paper.
4. Draw nine 5cm x 5cm squares inside the 15cm x 15cm square, as shown in Figure 3.
    - Be very accurate with your measurements.
5. Label the lines within your square, as shown in Figure 4.

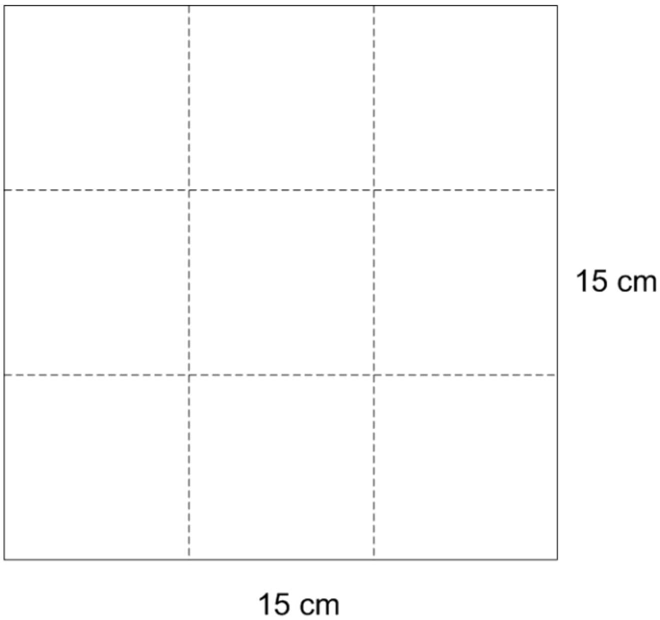


Figure 3. Nine Square Box

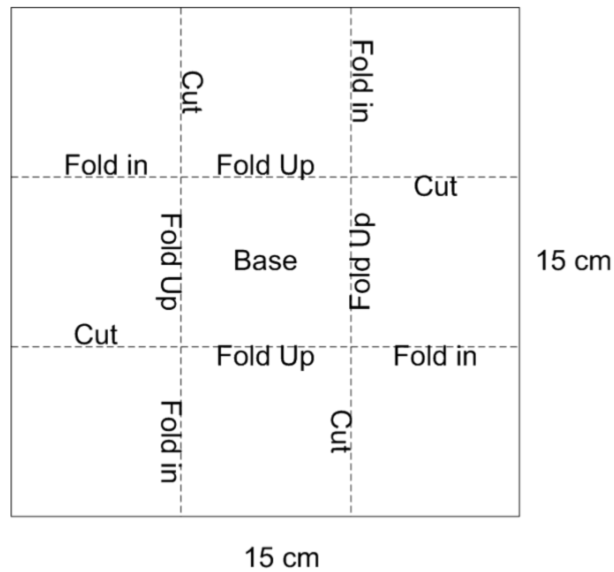


Figure 4. Labels

6. Write your name on the base.
7. Cut out the 15cm x 15cm square.
8. Cut the lines labeled cut within the square.
9. Fold the lines as labeled by your markings. Be sure the marking side is to the outside of the box.
10. Place one staple at the top of each side of the container. See Figure 5 for an example.
11. Measure 30cm of masking tape.
12. Tape the outside bottom corners to seal the edges using only the measured masking tape.

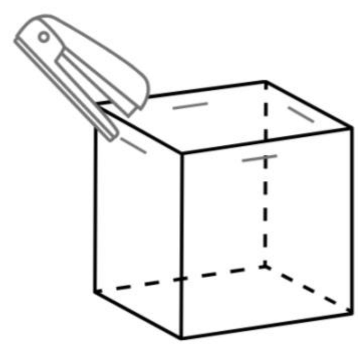


Figure 5. Staple Location

Part Two – Determining Mass

1. Put on your safety goggles, gloves, and lab apron, and tie back long hair.
    - You are working with chemical compounds for the remainder of this lab, and personal protective equipment (PPE) is required.
2. Collect a spoon and weighing dish.

3. Place the weighing dish on the electronic balance.
4. Tare the balance.
5. Use the spoon to add 34g of the *Dry Chemical Powder* to the weighing dish.

Part Three – Taking Temperature

1. Pour approximately 100ml of water into one 600ml beaker.
2. Use a hot plate or microwave to boil the water.
    - Boiling water will be bubbling.
    - Always use a hot hand protector to move hot lab equipment.
3. Use the thermometer to determine the temperature of the boiling water and record it in Table 1 on *Activity 3.1.4 Student Data*.

Part Four – Adding Volume

1. Using a hot hand protector to hold the beaker, pour 60ml of boiling water into the graduated cylinder.
2. Pour the water from the graduated cylinder into an empty 100ml beaker.
    - Take care not to spill the water.
3. Add the *Dry Chemical Powder* into the 100ml beaker with the boiling water.
4. Mix the compounds using the stirring rod until the powder dissolves completely.
5. Allow the mixture to cool for 10 minutes by monitoring a device with a timer.
6. Clean up your workstation while you wait.
7. After ten minutes, pour the mixture into the paper container you made in Part One.
8. Place the container in the refrigerator as instructed by your teacher.

Part Five – Determining Density

1. Put on your safety goggles, gloves, and lab apron, and tie back long hair.
2. Obtain your container and a piece of wax paper from your teacher.
3. Place the wax paper on the electronic balance.
4. Tare the balance.
5. Peel the paper container away from the now solid mixture and place the solid on the wax paper.
6. Use the electronic balance to measure the *Solid Mass* and record it in Table 1.
7. Use the ruler to measure the solid's length, width, and height in centimeters and record it in Table 1.
8. Calculate the volume of your cube by multiplying the length times the width times the height and show your work in Table 2.

$$\text{volume } (v) = \text{length } (l) \times \text{width } (w) \times \text{height } (h)$$

9. Calculate the density of the solid by dividing the mass of the solid by the volume of the solid—show your work in Table 3. Use the formula in Figure 2 in the procedure.

10. Dispose of all materials as instructed by your teacher.
11. Answer the *Analysis Questions* on the student data sheet.

Conclusion

1. How did reading and understanding laboratory procedures help you conduct the experiment safely?

2. Describe one everyday application for each type of measurement.
   - Distance
   - Mass
   - Temperature
   - Volume
   - Density

3. What is the density of an item with a mass of 10 grams and a volume of 10 cubic centimeters?

Name____

Activity 3.1.2 Student Data

Table 1. ***Measurements***

Temperature of boiling water				
Solid	Mass:	Length:	Width:	Height:

Table 2. ***Volume***

Show your work and include all units (l *x* w *x* h)

Table 3. ***Density***

Show your work and include all units (mass/volume)

Analysis Questions

Q1 What were three measurements that were essential to the success of this experiment?

Q2 What problems could inaccurate measurements have caused when building your cube?

Name____

Activity 3.1.3 Clean, Sanitize, or Disinfect

Purpose

What steps must be taken to clean, sanitize, or disinfect lab equipment and spaces? How do the proper procedures ensure proper clean-up and disposal procedures are set to reduce biological hazards that prevent harm to people or environmental damage?

Your teacher often takes steps to save time during the clean-up and disposal process, which allows for the focus to be on the educational content. Clean-up procedures vary between school districts, cities, counties, and states. First, look at any policies given by your district to ensure that your clean-up and disposal meet any requirements you must adhere to.

Do you need to clean, sanitize, or disinfect? The purpose for cleaning up varies as well. Cleaning should always be done before sanitizing or disinfecting. Cleaning involves warm, soapy water and removing any solids. Sanitizing reduces the bacteria on surfaces. Disinfecting kills almost all of the microorganisms. The chemical concentrations must be kept in food-safe ranges for food prep surfaces. While disinfecting, the solution should remain on items or areas for the required amount of contact time, and if appropriate, rinsed with drinking water and allow it to air dry. The directions on the label should always be followed, and the product should be checked to ensure it is food contact safe.

Sodium hypochlorite (NaOCl), or chlorine, is the active ingredient in bleach. Bleach is available to consumers in concentrations ranging from 2.75% – to 8.25%. Sanitizing solution strength requires a lower percent concentration base bleach solution. To disinfect, use the 8.25% NaOCl bleach-based concentration to make a sanitizing solution, as shown in Figure 1. Test strips are used after mixing the solution to ensure the sanitizing solution is the correct concentration. The label of 8.25% bleach is labeled as concentrated or disinfecting. According to Ward's Science, it is recommended to use a 20% sanitizing solution to kill any bacteria in the plate or film. Items should be in contact with the 20% sanitizing solution for five minutes for the solution to be effective, which varies with the chemical and goal of disinfecting. If the contact time is not adhered to, the required level of sanitation is not reached. If food prep is to follow sanitizing, there must be a clean water rinse on surfaces afterward.

Figure 1. Active ingredient

How do you ensure that your sanitizing procedures are meeting recommended guidelines?

Materials

Per Class

- Bleach, 8.25% sodium hypochlorite
- Chlorine Test strips
- Tap water, cool

Per student:

- *Agriscience Notebook*
- Gloves, disposable
- Lab apron or coat
- Pencil
- Safety goggles

Per group of four students:

- 1000mL beaker
- 100mL graduated cylinder
- Device with Internet access
- Glass stirring rod
- Petri dish or Petrifilm®, dirty
- Timing device, electronic

Procedure

Prepare a sodium hypochlorite bleach solution using an online calculator. Then, measure, verify, and mix a solution to sanitize Petri dishes or Petrifilm® as a part of the disposal process.

Part One – Calculations

As a group, you will input information into an online calculator for instructions to make 750mL of 2000 ppm NaOCl sanitizing solution.

1. Use a device with internet access to go to a bleach dilution calculator. (**https://www.publichealthontario.ca/en/health-topics/environmental-occupational-health/water-quality/chlorine-dilution-calculator**).
   - Record your data entries in Table 1 of the *Activity 3.1.3 Student Worksheet* as you enter them in the calculator.
2. In the box labeled *Concentration of bleach product* type **8.25** sodium hypochlorite (wt. %).
3. In the box labeled *Desired Concentration of chlorine solution*, type **2000** ppm, or mg/L or 20%.
4. Change the units to liters in the box labeled *Desired volume of chlorine solution* type .75.
5. In the box labeled *Desired unit of measure for bleach product*, select milliliters.
   - Locate your calculation results in the green box labeled *Your Solution*.
6. Record the calculation results in *Table 1. Chlorine Dilution Calculations* of the s*tudent worksheet*.
   - Answer *Part One Analysis Questions*.
7. Record the amount of needed bleach in milliliters in Part Two, Steps Five and Seven.

Part Two – Mixing the Clean-up Solution

Work as a group to mix a clean-up solution using the results from Part One.

1. Put on safety goggles, disposable gloves, an apron, or protective clothing, and tie back your long hair.
2. Read the bleach label to find the percentage of sodium hypochlorite.
3. Record sodium hypochlorite percentage in Table 1.
4. Measure **730mL** of cool tap water into a 1000mL beaker.
5. Measure __________**mL** of 8.25% bleach in a graduated cylinder.
6. Verify by double-checking your measurements of water and bleach in their respective containers.
7. Mix the sanitizing solution.
   - **Caution!** Always add the bleach solution to the water when preparing the solution, not vice versa.
   - Pour __________**mL** of bleach into the 1000mL beaker of cool tap water.
   - Gently stir with a glass stirring rod to thoroughly mix the bleach and water solutions.
8. Dip one active chlorine test strip into the chlorine solution in the sanitizing solution for one second.
9. Shake off excess liquid.

10. Wait one minute, then compare the pad against the color chart found on the bottle of test strips, as shown in Figure 3.
11. Record your color chart ppm reading in Table 1.
12. If your color chart ppm reading does not read 2000 ppm, retest by repeating Steps 8 – 10.
13. If the second test does not read 2000 ppm, add a small amount of bleach and retest as recommended.
14. Answer *Part Two Analysis Questions*.

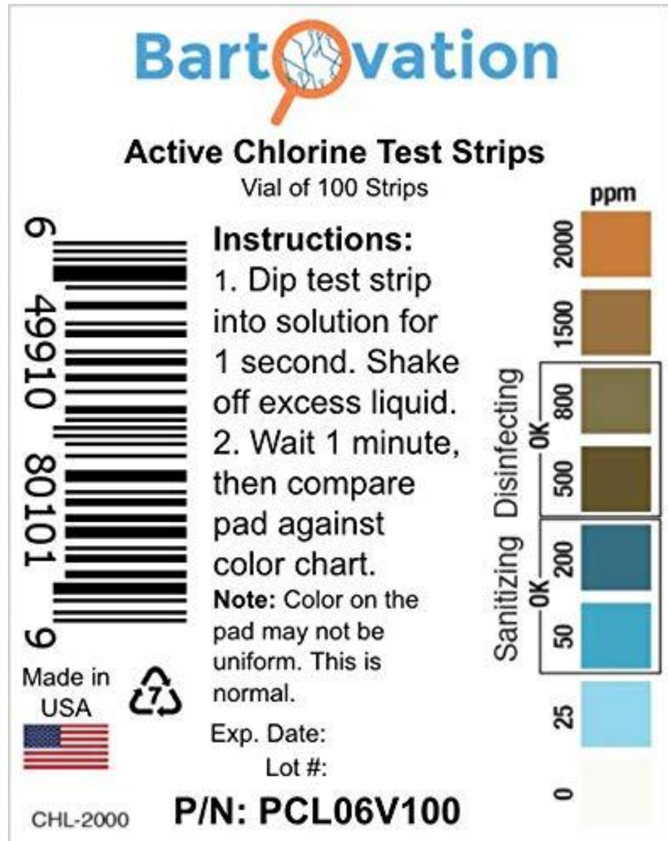


Figure 3. PPM Color Chart

Part Three – Cleaning Up

1. Select a person who will set a five-minute timer for your group on an electronic timing device.
2. When directed by your teacher, carefully place your group's Petri dish or Petrifilm® in the 1000mL sanitizing solution created in Part Two.
3. After five minutes of contact time in the sanitizing solution, the Petri dish should have a clean water rinse with tap water and then be allowed to air dry for reuse.
4. If you have disposable materials, after five minutes of contact with the solution, put the Petri dish or Petrifilm® in the regular trash.

Conclusion

1. Why is it essential to locate the percent of sodium hypochlorite when purchasing bleach?

2. What PPE should be worn during mixing, cleaning, and disposal?

3. Why should calculations and measurements be verified?

4. Why do you disinfect lab space and plates or films?

Name____

Activity 3.1.3 Student Worksheet

Table 1. ***Chlorine Dilution Calculations***

In a 1000mL beaker, make 750mL of a 20% sanitizing solution, starting with an 8.25% bleach concentrate.
To make your chlorine solution, measure ___________ mL of 8.25% bleach.
To make your chlorine solution, measure ___________ mL of cool tap water.
Assuming 8.25% sodium hypochlorite is used, this is equivalent to __________ % available chlorine.
Reading the Label
The label on the container of bleach reads ______________ percent (%) sodium hypochlorite.
Chlorine Test Strip
The available chlorine test strip reads ______________parts per million (PPM)

Part One Analysis Questions

Q1 How can an online calculator assist in calculating chlorine solutions?

Q2 What information must be put into the dilution calculator to make a sanitizing solution?

Q3 How can the chlorine dilution calculator assist in making different amounts of sanitizing solutions?

Part Two Analysis Questions

Q1 Why are the measurements of fluids verified by another group member?

Q2 Why is a 1000mL beaker used when we only want to make 750mL of cleaning solution?

Q3 Why does the test strip bottle list a sanitizing and disinfecting ppm range below the level we use in class?

CURRICULUM FOR AGRICULTURAL SCIENCE EDUCATION

Laboratory and Shop Safety

How to Measure

Unit 3 – Lesson 3.1 Lab Safety and Measurement

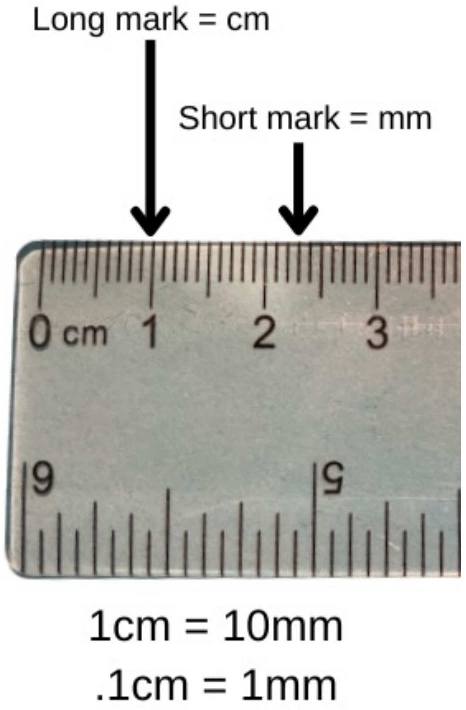
Why is accuracy important?

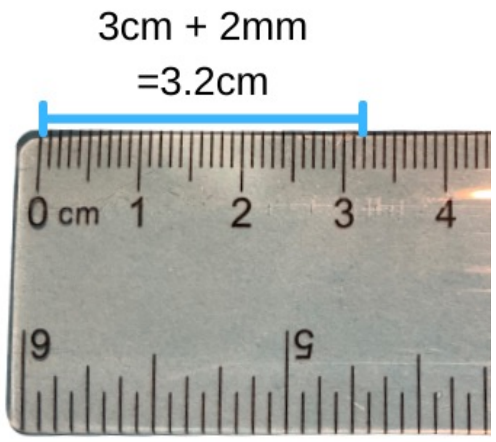
- Accuracy allows results to be unbiased and reproducible
- The more lines on lab ware or decimals in the reading, the more accurate the measurement

Distance – Length

Metric Ruler

1. Line the "0" with one end of the object
2. Read the mark nearest to the opposite end of the object
3. Record your measurement

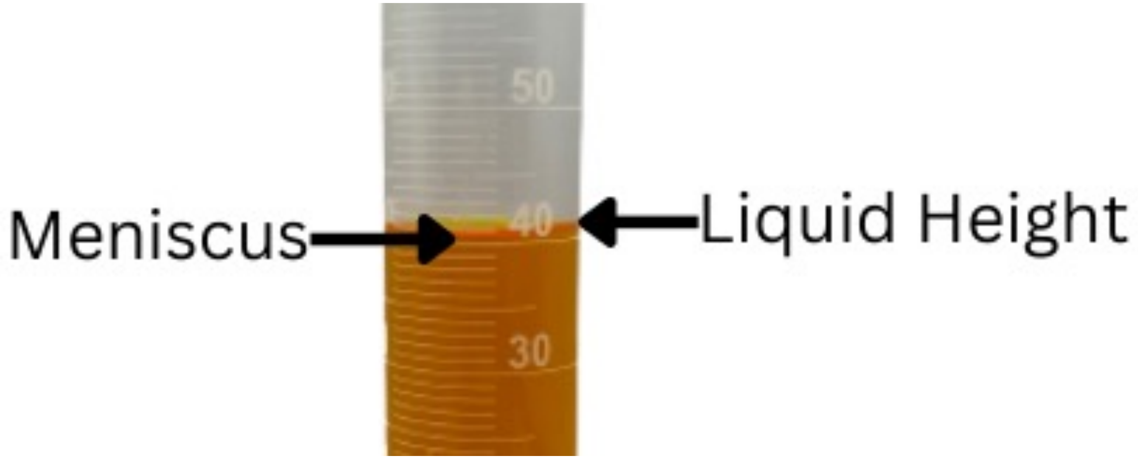




Liquid – Volume

Graduated Cylinder

1. Set empty container on a flat, level surface
2. Get on eye level with desired fill line
3. Slowly pour in liquid until the meniscus reaches the fill line



Volume is 40ml
not 41ml

Solid - Mass

Electronic Balance

1. Place the empty container you will use for the substance to be measured on the balance platform
2. Press the "Tare" or "Zero" button to deduct the weight of the container
3. Carefully add the substance to the container
4. Record the mass as indicated by the digital display

References

- Herren, R. V., & Donahue, R. L. (2000). *Delmar's agriscience dictionary with searchable CD-ROM*. Albany, NY: Delmar.

Presentation Review

- Mark or highlight three key points.
- List two ideas or concepts related to previous knowledge.
- List questions you have about this topic.
- Keep notes organized and available for use throughout the course.

Lesson 3.1 Glossary

A

Accuracy – The ability of a measurement to match the actual value of the quantity being measured.

B

Biological hazard – A hazard in food that can cause illness from microbial growth, such as bacteria, viruses, or mold.

Bleach – A chemical, typically sodium or hypochlorite, used to whiten or sterilize material.

C

Chlorine – Used to manufacture chlorine bleach, which can whiten and disinfect kitchen and bathroom surfaces.

Clean – To make an object free from dirt, grime, debris, etc. A process used to eliminate debris and some microbes from food manufacturing equipment.

Concentration – Removing a portion of water away from a product.

Contact Time – The time required by disinfectant products to have their effect. Will vary depending on product or method selected.

D

Data – Pieces of information, such as facts, statistics, or codes; an item of data.

Density – The mass per unit of volume.

Disinfect – Kills almost all of the pathogens.

Disposal – To put in a particular or suitable place.

Distance – The amount of space between two things, points, lines, etc.

E

Environmental damage – Damage to the total of any or all the external conditions that may act upon an organism or community to influence its development or existence.

Experiment – A test, trial, or tentative procedure; an act or operation to discover something unknown or test a principle or supposition.

H

Heat – The type of energy that causes the temperature of an object or environment to rise.

M

Mass – The quantity of matter as determined by its weight.

O

Observation – An act or instance of noticing or perceiving.

P

Petri dish – A shallow, circular, glass, or plastic dish with a loose-fitting cover over the top and sides for culturing bacteria and other microorganisms.

Petrifilm® – Used in many microbiology-related industries and fields to culture various microorganisms.

Procedure – One of a series of steps taken to accomplish an end.

S

Sanitize – A process used to eliminate most microbes from food manufacturing equipment.

Sodium hypochlorite – Used widely as the main component of cleaners with excellent bleaching and sterilizing effect.

Solution – A homogeneous mixture of one material is dissolved in another.

T

Temperature – A measure of the warmth or coldness of an object or substance with reference to some standard value.

Test strips – Measures total available chlorine in sanitizing solutions and gives PPM results in seconds.

V

Volume – The amount of space measured in cubic units that an object or substance occupies.

Name____

Lesson 3.1 Check for Understanding

1. Identify the following pieces of laboratory equipment and list one use of each.

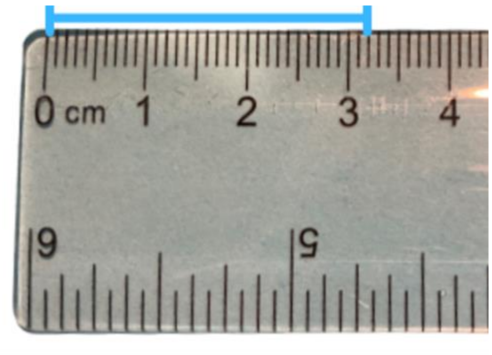
Equipment	Name	Use
		
		
		
		

2. List two pieces of equipment used to collect data.

3. What tool or equipment would be most appropriate to measure each of the following items?
    - A line on a piece of paper –
    - 28ml of water –
    - 16g of sand –
    - 165° water –

4. What is the metric measurement of the blue line?

   a) 3 inches
   b) 3 ¼ inches
   c) 33cm
   d) 3.2cm



5. Match the definition with the correct term.

______ Cleaning
______ Contact time
______ Disinfecting
______ Sanitizing
______ Sodium hypochlorite
______ Bleach solution
______ Test strips

A.	It kills almost all of the pathogens
B.	Used for checking solution ppm concentration
C.	Should be prepared daily, not too much in advance
D.	The active ingredient in chlorine
E.	Reduces bacteria on surfaces to a safe level
F.	Removing dirt or debris from a surface
G.	Minimum number of minutes area must remain saturated

6. How do cleaning, disinfecting, and sanitizing reduce biological hazards?

Lesson 3.1 Check for Understanding Answer Key

1. Identify the following pieces of laboratory equipment and list one use of each.

Equipment	Name	Use
	**Microscope**	**Observing very small objects**
	**Graduated cylinder**	**Provides accurate measurement of liquids**
	**Beaker**	**Holding, mixing, and measuring liquids (measurements are not highly accurate)**
	**Petri dish**	**Culturing microbial colonies**

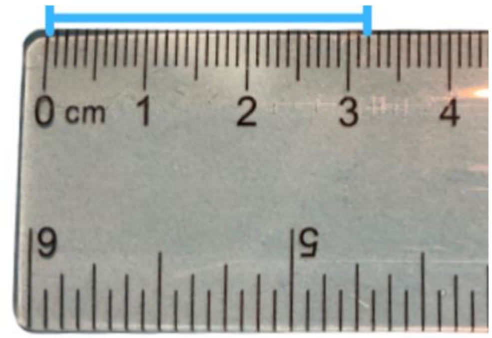
2. List two pieces of equipment used to collect data.

Answers will vary but may include LabQuest/Graphical Analysis, thermometer, ruler, electronic balance, and Vernier sensors.

3. What tool or equipment would be most appropriate to measure each of the following items?
    - A line on a piece of paper – **Ruler**
    - 28ml of water – **Graduated cylinder**
    - 16g of sand – **Electronic balance**
    - 165° water – **Thermometer or temperature sensor**

4. What is the metric measurement of the blue line?

   a) 3 inches
   b) 3 ¼ inches
   c) 33cm
   d) 3.2cm



5. Match the definition with the correct term.

__**F**__	Cleaning	A.	It kills almost all of the pathogens
__**G**__	Contact time	B.	Used for checking solution ppm concentration
__**E**__	Disinfecting	C.	Should be prepared daily, not too much in advance
__**A**__	Sanitizing	D.	The active ingredient in chlorine
__**D**__	Sodium hypochlorite	E.	Reduces bacteria on surfaces to a safe level
__**C**__	Bleach solution	F.	Removing dirt or debris from a surface
__**B**__	Test strips	G.	Minimum number of minutes area must remain saturated

6. How do cleaning, disinfecting, and sanitizing reduce biological hazards?

Answers will vary but may include proper protocols, cleaning, sanitizing, and disinfecting to reduce environmental and health hazards and impact.

Lesson 3.1 Materials

Unit 3 – Lesson 3.1 Safety and Measurement

APP	Qty/ 20	Qty/ 30	Unit	Item Specifications	Vendor
3.1.1	1	1	Each	Alcohol burner	Lab-Aids
	1	1	Each	Beaker, 100ml	Ward's
	1	1	Each	Burette clamp	Ward's
	1	1	Each	Dropper, plastic	Lab-Aids
	1	1	Each	Electronic balance	Ward's
	1	1	Pair	Gloves, disposable	Ward's
	1	1	Each	Graduated cylinder, 100ml	Ward's
	1	1	Pair	Hot hand protector	Ward's
	1	1	Each	Lab apron or coat	Ward's
	1	1	Each	LabQuest	Vernier
	1	1	Each	Microscope, compound	Ward's
	1	1	Each	Petri dish	Lab-Aids
	1	1	Each	Pipet, 3ml	Lab-Aids
	1	1	Each	Ring stand	Ward's
	1	1	Pair	Safety goggles	Ward's
	1	1	Each	Support ring	Ward's
	1	1	Each	Test tube, plastic	Lab-Aids
	1	1	Each	Thermometer	Ward's
	1	1	Each	Temperature sensor **or** Go Direct® temperature sensor	Vernier
	1	1	Each	Weighing dish, 8.5×8.5×2.4 cm	Ward's
3.1.2	20	30	Each	Beaker, 100ml	Ward's
	4	6	Each	Beaker, 600ml	Ward's
	4	6	Each	Electronic balance	Ward's
	41	61	Pair	Gloves, disposable	Ward's
	20	30	Each	Graduated cylinder, 100ml	Ward's
	4	6	Each	Hot hand protector	Ward's
	4	6	Each	Hot plate	Ward's
	4	5	Box	Jello®, large	Local
	20	30	Each	Lab apron or coat	Ward's
	3	5	Roll	Masking tape	Local
	1	2	Each	Microwave	Local
	25	40	Each	Paper, cardstock	Local
	20	30	Each	Ruler, metric	Local
	20	30	Pair	Safety goggles	Ward's
	20	30	Pair	Scissors	Local
	20	30	Each	Spoon, plastic	Local
	4	6	Each	Stapler	Local
	20	30	Each	Stirring rod, glass	Ward's
	4	6	Each	Thermometer	Ward's
	-	-	-	Water source	Local
	20	30	Each	Weighing dish, 8.5×8.5×2.4 cm	Ward's

APP	Qty/ 20	Qty/ 30	Unit	Item Specifications	Vendor
3.1.3	5	7	Each	Beaker 1000 mL	Ward’s
	1	1	Each	Bleach, 8.25% sodium hypochlorite	Local
	10	14	Each	Chlorine test strips, 100ct, 2000 ppm	**Amazon** or local
	-	-	-	Cool water source	Local
	5	7	Each	Device with Internet access	Local
	5	7	Each	Glass stirring rod	Ward’s
	41	61	Pair	Gloves, disposable	Ward’s
	5	7	Each	Graduated cylinder, 100mL	Ward’s
	20	30	Each	Lab apron or coat	Ward’s
	5	7	Each	Petri dish or Petrifilm®, dirty	Local
	20	30	Pair	Safety goggles	Ward’s
	5	7	Each	Timing device, electronic	Local

Lesson 3.2 Food Safety

Preface

Food handlers are the first line of defense in the food industry. Their duties range from processing to preparation to storage to food service. Basic food science principles begin with understanding food contamination sources, including biological, chemical, and physical hazards. Food handlers limit food contamination sources with proper handwashing and practicing knife safety.

Lesson 3.2 Food Safety is designed to introduce food safety for applicable food units within non-food classes. For a more thorough format for teaching food safety, see CASE *Food Science and Safety*.

First, students identify food safety hazards. Next, students demonstrate proper hygiene and Current Good Manufacturing Practices (CGMP). Then, the class makes salsa as students demonstrate knife safety.

Concepts	**Performance Objectives**
Students will know and understand	*Students will learn concepts by doing*
1. Food safety begins with identifying biological, chemical, and physical hazards.	• Identify biological, chemical, and physical hazards in a kitchen. (Activity 3.2.1)
2. Personal hygiene is a critical CGMP.	• Publish and present a sign for display that outlines proper protocols for a personal hygiene topic. (Project 3.2.2)
3. Knife safety is critical to maintaining a safe kitchen.	• Demonstrate knife safety skills while cutting fruits and vegetables for salsa. (Activity 3.2.3)

National AFNR Career Cluster Content Standards Alignment

Food Products and Processing Systems Career Pathway Content Standards
1. Develop and implement procedures to ensure safety, sanitation, and quality in food product and processing facilities.
• AG-FD 1.3: Employ safety and sanitation procedures for the handling, processing, and storage of food products.

Essential Questions

1. What are biological, chemical, and physical hazards in food safety?
2. Why is safety important when processing and preparing food?
3. Why is it important to wash your hands and workspace in the laboratory?
4. What are the proper procedures for handwashing?
5. How do food handlers practice knife safety?

Key Terms

Accident	**Biological hazard**	**Boning knife**
Chef's knife	**Chemical hazard**	**Current Good Manufacturing Practices (CGMPs)**
Emergency	**Mercer Rules tool**	**Pairing knife**

Physical hazard	**Potato peeler**	**Ready to eat (RTE)**
Safety	**Serrated knife**	

Day-to-Day Plans
Time: 4 days

*Refer to the Teacher Resources section for specific information on teaching this lesson, in particular **Lesson 3.2 Teacher Notes**, **Lesson 3.2 Glossary**, **Lesson 3.2 Materials**, and other support documents.*

Day 1:

- Present the **Concepts and Performance Objectives**, **Essential Questions**, and **Key Terms** to provide a lesson overview.
- Provide students with a copy of **Activity 3.2.1 Kitchen Investigators**.
- Students work independently to complete *Activity 3.2.1 Kitchen Investigators.*

Day 2:

- Provide students with a copy of **Project 3.2.2 Personal Safety Protocols** and **Project 3.2.2 Evaluation Rubric**.
- Print and post two copies of the **Glo Germ™ Comparison Chart**.
- Students work independently to complete *Project 3.2.2 Personal Safety Protocols.*
- Evaluate students with *Project 3.2.2 Evaluation Rubric*.

Day 3:

- Provide students with a copy of **Activity 3.2.3 Knife Safety**.
- Present **How to Master Basic Knife Skills–Knife Cuts 101**.
- Students take notes during Part One of *Activity 3.2.3 Knife Safety* using the **Presentation Notes** pages provided by the teacher.
- Students work in groups of four to complete Parts Two and Three of *Activity 3.2.3 Knife Safety*.

Day 4:

- Serve the salsa prepared during *Activity 3.2.3 Knife Safety* with tortilla chips.
- Administer **Lesson 3.2 Check for Understanding**.
- Assess student work using **Lesson 3.2 Check for Understanding Answer Key**.

Instructional Resources

Student Support Documents

Lesson 3.2 Glossary

Presentation Notes

Activity 3.2.1 Kitchen Investigators

Project 3.2.2 Personal Safety Protocols

Activity 3.2.3 Knife Safety

Glo Germ™ Comparison Chart

Teacher Resources

Lesson 3.2 Food Safety (PDF)

Lesson 3.2 Teacher Notes

Lesson 3.2 Materials

Lesson 3.2 Check for Understanding

Answer Keys and Assessment Rubrics

Lesson 3.2 Check for Understanding Answer Key

Project 3.2.2 Evaluation Rubric

Reference Sources

Log10. (n.d.) *Creating a Sanitation Plan at Your Facility*. Retrieved from **https://log10.com/create-facility-sanitation-plan/**

Mehas, K., & Rodgers, S. (2002). *Food science: The biochemistry of food and nutrition.* (4th ed.). New York, NY: Glencoe McGraw-Hill.

Merriam-Webster. (2015). *Online dictionary*. Retrieved from **http://www.merriam-webster.com/**

Ward, J., Ward, L., Riedel, J. (2022). *Principles of food science*. (5th ed.). Tinley Park, IL: The Goodheart-Willcox Company, Inc.

Wisconsin Department of Health Services. (2013). *Food handling and housekeeping*. Retrieved from **https://www.dhs.wisconsin.gov/publications/p4/p44970.pdf**

SAE for All

Foundational SAE

All students in an agricultural education program are expected to have a Foundational SAE. Students completing the APP and extensions listed below will meet the Foundational SAE qualification for the *Advanced (Grades 09-10) level*. Students should place all documented evidence in their *Agriscience Notebook* along with the **SAE for All Foundational Checksheet**.

SAE Workplace Safety Standards

- Activity 3.2.1 Kitchen Investigators
  - CS.03.01.01.b. Execute health, safety, and environmental procedures to comply with regulatory and safety standards.
- Activity 3.2.2 Personal Safety Protocols
  - CS.03.01.01.b. Execute health, safety, and environmental procedures to comply with regulatory and safety standards.
  - CS.03.04.01.b. Analyze and demonstrate adherence to protective equipment requirements when using various AFNR tools and equipment.
- Activity 3.2.3 Knife Safety
  - CS.03.01.01.b. Execute health, safety, and environmental procedures to comply with regulatory and safety standards.
  - CS.03.04.02.b. Complete the setup and adjustment for tools and equipment related to AFNR tasks.
  - CS.03.04.03.b. Assess and demonstrate appropriate operation, storage, and maintenance techniques for AFNR tools and equipment.

Access the **SAE for All Educator Resources** site for additional teacher and student resources.

Lesson 3.2 Teacher Notes

Lesson 3.2 Food Safety

In preparation for teaching this lesson, review Concepts, Performance Objectives, Essential Questions, and Key Terms. Also, review all activity and project directions, expectations, and work students will complete.

First, students identify biological, chemical, and physical hazards in case studies. Next, they learn the location of necessary safety equipment and how to use the equipment properly. Students design signs detailing personal hygiene and Current Good Manufacturing Practices (CGMPs). Then, the class practices knife safety and makes salsa.

Activities, Projects, and Problems

Activity 3.2.1 Kitchen Investigators

Students explore biological, chemical, and physical hazards in foods.

Student Performance

Students individually review the three case studies in the procedure. For each case study, students identify potential hazards and list steps for prevention on the *Activity 3.2.1 Student Observations* sheet.

Results and Evaluation

Table 1 serves as a key for *Activity 3.2.1 Kitchen Investigators*.

Table 1. ***Identifying Hazards***

Part One: Food Science Class			
Potential source(s)	**Improper storage of food in the pantry.**		
Type of hazard	Biological	**Chemical**	Physical
Steps to prevent hazard	**Dispose of ingredients exposed to chemicals. Find proper and separate storage for chemicals.**		
Part Two. *Family BBQ*			
Potential source(s)	**Wire bristles from BBQ brush in food.**		
Type of hazard	Biological	Chemical	**Physical**
Steps to prevent hazard	**Switch to a non-wire brush. Clean the food-contact surface with water to remove physical hazards between use.**		
Part Three: Team Meal			
Potential source(s)	**The meatless sauce is not heated to proper temperatures.**		
Type of hazard	**Biological**	Chemical	Physical
Steps to prevent hazard	**Identify the proper temperature of foods. Check food with a food thermometer to ensure proper heating of food.**		

Project 3.2.2 Personal Safety Protocols

Students evaluate the Current Good Manufacturing Practices (CGMP) of handwashing using Glo-Germ™. Next, students develop CGMP signs for personal hygiene practices and display them across the food science laboratory.

Teacher Preparation

Print in Color
Print two color copies of the GloGerm™ Comparison Chart and post them around the room. Consider laminating for future use. Students use a colored comparison chart to estimate contamination levels.

Part One
Obtain a white bottle of Glo Germ™. The white gel is more student-friendly. The red gel offered by Glo Germ™ stains clothing easily. Shake the bottle of gel well before class.

Part Two
Obtain an example CGMP sign for students to analyze and use for an example. Schools can purchase handwashing signs online, but a free example will be available in your school kitchen. Ask permission to photocopy the handwashing sign above your school's handwashing sink.

Student Performance
Part One
Students work in groups of four to identify the best handwashing method. Students use the **Retail Food Protection: Employee Health and Personal Hygiene Handbook** to review CGMP guidelines for handwashing. They preview the remaining steps to develop a prediction for handwashing effectiveness. Students pump a nickel-sized amount of Glo Germ™ gel onto their hands and spread the gel over their hands and fingers. Each group member washes their hands using one of the following procedures:

- **Procedure 1 -** Rinse hands under cold water without rubbing them together. Dry your hands with a paper towel.
- **Procedure 2 -** Rinse hands under warm water without rubbing them together. Dry your hands with a paper towel.
- **Procedure 3 -** Wash hands with hand soap. Rinse hands under cold water while rubbing hands together. Dry your hands with a paper towel.
- **Procedure 4 -** Wash hands with hand soap. Rinse hands under warm water while rubbing them together. Dry your hands with a paper towel.

After testing, lower the lights for students to observe the Glo Germ™ with a UV light. Students compare their hands to the *Glo Germ™ Comparison Chart*, as summarized in Figure 1, to determine the contamination level. Lastly, students answer analysis questions regarding the effectiveness of handwashing techniques.

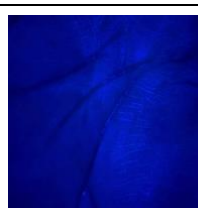
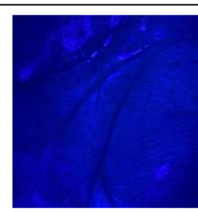
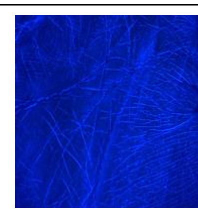
			
25%	**50%**	**75%**	**100%**

Figure 1. Comparison Chart

Part Two
First, students review an example handwashing sign. Discuss student answers to analysis questions regarding the sign. Next, assign student pairs a personal hygiene practice and create a CGMP sign. Table 2 lists example practices.

Table 2. *Personal Hygiene Practices*

• Eating and drinking	• Gloves	• Hair
• Personal clothing	• Illness	• Injury
• Jewelry	• Nails	• Protective clothing
• Transferring contaminants		

Students work in pairs to publish a sign explaining CGMPs for a personal hygiene practice from Table 4 that is assigned by the teacher. They display the signs on the wall around the food science laboratory. Encourage students to hang the signs at eye level and where appropriate. Each pair will have one minute to present the proper procedures for maintaining good hygiene for the assigned personal hygiene practice.

Results and Evaluation

Use **Project 3.2.2 Evaluation Rubric** to assess student work. Table 3 includes potential responses to analysis questions.

Table 3. ***Analysis Questions and Potential Responses***

Q1	Rank the procedures in Step 7 from best to worst handwashing procedures.	*Student predictions will vary dependent on prior knowledge.*
Q2	Which handwashing method(s) in Step 7 meets CGMP guidelines?	*Procedure four meets CGMP guidelines. The guidelines include warm water, hand soap, and rubbing hands underwater.*
Q3	Were your predictions from Step 4 correct?	*Answers will vary.*
Q4	Which method was the best? Why?	*Procedure four should produce the best results. This procedure includes warm water, hand soap, and rubbing hands underwater.*
Q5	How does the sign communicate CGMPs to food handlers?	*Answers vary depending on the sign selected. Responses may include graphics, bolded letters, multiple languages, and short descriptions.*

Activity 3.2.3 Knife Safety

Students apply knife safety practices to prepare salsa in the food science laboratory.

Teacher Preparation

1. Provide knives and a Mercer Rules tool to students.
   - Obtain a **Mercer® Cutlery 13-Piece Cutlery Set** from NASCO or a similar product.
   - The kit contains five knives: serrated, Chef's, boning, paring, and peeling. The kit also includes a food thermometer, sharpening steel, Mercer Rules tool, and knife guards.
2. Prepare produce. Each group of four students needs the following produce:
   - (3) Roma tomatoes
   - (½) Red onion – Cut onions before the class with a chef's knife
   - Jalapeno
   - Lime
   - Cilantro, 10g – One bunch of cilantro is 100 grams, including the stem. Split two to three bunches into smaller sections.
3. Consider student health. If the student(s) in the class cannot eat spice foods due to health issues, remove the cumin and substitute the jalapeno pepper with green bell pepper.

Student Performance

Part One

Play the video **How to Master Basic Knife Skills–Knife Cuts 101**. Students watch the video, take notes using *Presentation Notes*, and answer analysis questions.

Part Two

The emphasis of this lab is the proper and safe use of a knife. Students use pairing knives, chef knives, serrated knives, and Mercer Rules tools to cut fruits and vegetables into sizes appropriate for salsa. Produce is prepared as shown in Table 4.

Table 4. ***Vegetable Preparations***

Produce	Knife	Final Product
(3) Tomatoes, Roma	Serrated knife	Diced (¼" x ¼" x ¼").
(½) Onion, red	Chef knife	Diced (⅛" x ⅛" x ⅛").
Pepper, jalapeno	Paring knife	Diced (⅛" x ⅛" x ⅛").
Lime	Chef knife	Cut into wedges
Cilantro	Chef knife	Minced, 10g

Part Three

Students mix the diced tomatoes, onions, jalapenos, and cilantro into a bowl. Next, they mass the salt, pepper, and cumin and add the seasonings to the salsa. Then, they add lime juice by squeezing the lime wedges over the salsa. Students then mix, cover, and refrigerate the salsa overnight. Provide tortilla chips and paper plates for students to eat salsa on the following day.

Results and Evaluation

Table 5 contains potential responses to analysis questions. Students should complete this activity with sound understanding and practice of knife safety.

Table 5. ***Analysis Questions and Potential Responses***

Q1	How does a food handler cut food without cutting a finger?	*The food handler keeps the knife's tip on the cutting surface and pivots the knife from the handle. Handlers rock a knife back and forth using only small motions. The non-knife hand holds the food with fingertips pointing downwards.*
Q2	How does a food handler use the Mercer Rules tool to increase uniformity?	*Mercer Rules has rulers and cutting guides. When dicing, the tool has guides appropriate for different dice cuts.*

Assessment

Lesson 3.2 Check for Understanding

Lesson 3.2 Check for Understanding is included for you to use as an assessment tool for this lesson. Use **Lesson 3.2 Check for Understanding Answer Key** for evaluation purposes.

Name____

Activity 3.2.1 Kitchen Investigators

Purpose

The focus of food science's early advancements was controlling contaminants in foods. Identifying and limiting contaminants were foundational to a safe food supply. Today, the food industry monitors facilities, employees, equipment, and ingredients to prevent food contaminants. How do contaminants enter the food supply?

Food safety begins with identifying biological, chemical, and physical hazards in a kitchen or food manufacturing plant. Microorganisms, such as bacteria or fungi, are the source of biological hazards. The growth of microorganisms in food can be harmful, leading to spoilage and foodborne illnesses. The food industry uses many cleaners and sanitizers to reduce biological hazards. Cleaners become chemical hazards with improper use or storage. Non-food objects embedded into foods classify as physical hazards. Imagine eating a chicken patty and biting into a bone. The first step to food safety is identifying potential hazards. Table 1 summarizes food contaminants and their impact.

Table 1. ***Food Contaminants***

	Biological Hazards	Chemical Hazards	Physical Hazards
Sources	• Bacteria • Parasites • Viruses • Fungi	• Cleaners • Sanitizers • Polishes • Machine lubricants • Pesticides	• Bones • Packaging • Food manufacturing • Food handler • Jewelry • Dirt
Impact on human health	• Diarrhea • Vomiting • Fever • Nausea • Abdominal cramps • Jaundice	Most illnesses occur within minutes. • Diarrhea • Vomiting	• Mild to fatal injuries • Cuts • Dental damage • Choking • Internal bleeding
Prevention	• Sanitation • Food handler hygiene • Handwashing and gloves • Keeping sick employees at home	• Store chemicals away from food preparation areas. Never store above food. • Use separate equipment for food preparation and equipment sanitation.	• Inspect food • Hairnets • Food handler hygiene • Clean preparation area • Inspect equipment for wear

A food handler is the first line to preventing contaminants from entering the food supply. Food handlers include food production, processing, distribution, foodservice, and retail sales employees. How do you identify biological, chemical, and physical hazards as a food handler?

Materials

Per student:

- *Agriscience Notebook*
- Pencil

Procedure

Work in pairs to read case studies in food safety. Identify the sources of each hazard and how to prevent the contamination.

1. Read *Case Study One – Food Science Class*.
2. Analyze the case study and record information in *Activity 3.2.1 Student Observations*.
    - List potential sources of contamination in Table 2.
    - Classify the hazard by circling biological, chemical, or physical in Table 2.
    - Identify two to three steps to prevent the hazard in the future. List the steps in Table 2.
3. Read *Case Study Two – Family BBQ*.
4. Repeat Step 2 to analyze *Case Study Two – Family BBQ*. Record information in Table 3.
5. Read *Case Study Three – Team Meal*.
6. Repeat Step 2 to analyze *Case Study Three – Team Meal*. Record information in Table 4.

Case Study One – Food Science Class
Your class made brownies yesterday for an upcoming fundraiser. Today your class packaged and ate the brownies. Afterward, everyone from “Kitchen C” became sick with symptoms including vomiting and diarrhea. The teacher asked students to help clean Kitchen C. Figure 1 shows Kitchen C’s pantry products.

Figure 1. Kitchen Pantry

Case Study Two – Family BBQ
The family reunion is at a local park. The event is a potluck, and your family oversees grilling hamburgers. Before the event starts, you clean the grill with the wire brush shown in Figure 2. Then, to prevent foodborne illness, you prepare each burger to an internal temperature of 74°C (165°F). When eating a burger, your cousin cuts their tongue.

Figure 2. BBQ Brush

Case Study Three – Team Meal
Your team is eating a family-style pasta meal the night before the big game. Two sauces were available to the team. Figures 3 and 4 list the recipe for each sauce. The next day, six teammates were home sick with diarrhea, vomiting, and fever. The coach noticed that those students ate the meatless option.

Meat Sauce	**Meatless Sauce**
Ingredients • Ground beef, 1.8kg • Pasta sauce, 6L • Oregano, 15g • Garlic powder, 15g **Instructions** 1. Mix the spices within the beef. 2. On a cutting board, roll the ground beef into small balls. 3. Cook the meatballs on a skillet to 68°C (155°F). 4. Add the pasta sauce and meatballs into a saucepan. Warm until 74°C (165°F).	**Ingredients** • Onions, 400g • Tomato paste, 340g • Tomato, 2kg • Brown sugar, 57g • Salt, 6g • Oregano, 10g **Instructions** 1. Chop the onions and tomatoes on a cutting board. 2. Sauté the onions in a saucepan until tender. 3. Add tomatoes, tomato paste, brown sugar, salt, and oregano to the saucepan. 4. Warm the pasta sauce until ready to serve.

Figure 3. Meat Sauce **Figure 4. Meatless Sauce**

Conclusion

1. Which food hazard do you believe is the hardest to prevent? Why?

2. Why are food handlers on the front line of food safety?

Name____

Activity 3.2.1 Student Observations

Table 2. ***Food Science Class***

Potential source(s)			
Type of hazard	Biological	Chemical	Physical
Steps to prevent hazard			

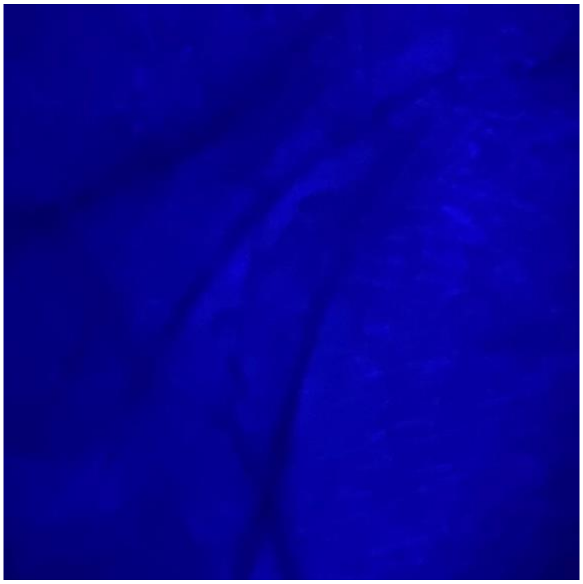
Table 3. ***Family BBQ***

Potential source(s)			
Type of hazard	Biological	Chemical	Physical
Steps to prevent hazard			

Table 4. ***Team Meal***

Potential source(s)			
Type of hazard	Biological	Chemical	Physical
Steps to prevent hazard			

GloGerm™ Comparison Chart



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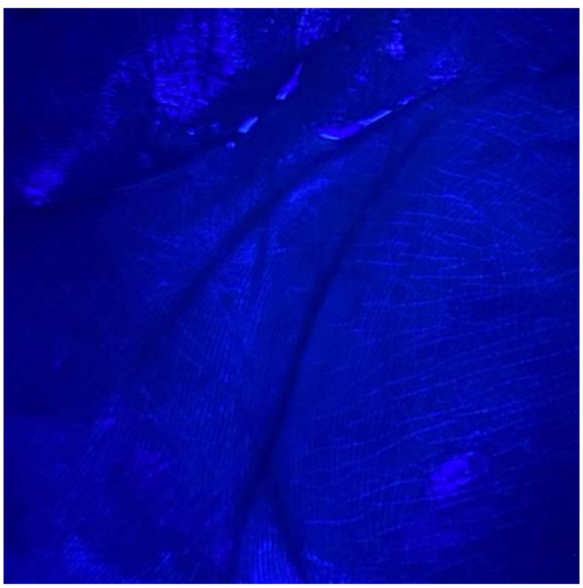

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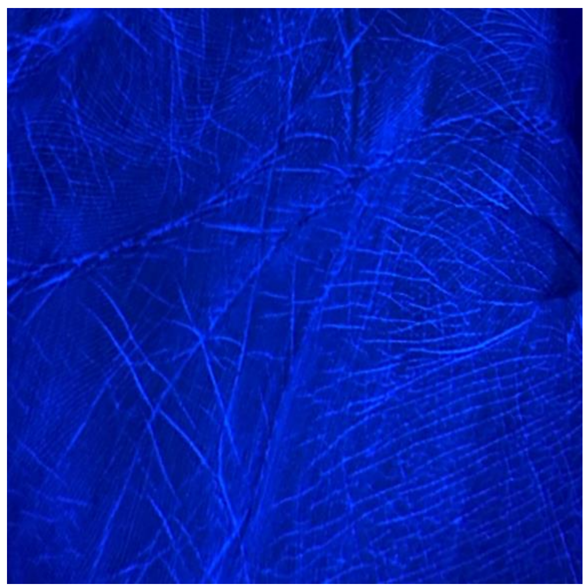

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Name____

Project 3.2.2 Personal Safety Protocols

Purpose

The safety guidelines you learned in previous lessons are important in a food science laboratory, but additional steps are needed to ensure food safety. Unlike other science laboratories, you will often eat in a food science laboratory; therefore, you must adhere to cleanliness guidelines to limit biological, chemical, and physical hazards.

Personal hygiene is an essential part of food safety. Hygiene includes the steps you take to keep yourself and your surroundings clean to maintain good health. Improper attire or poor hygiene of food handlers can lead to food contamination. Food contamination occurs when unwanted or unintended items find their way into a food product. When another food product contaminates a food, it is called cross-contamination. Cross-contamination is the most frequent cause of contamination. Food handlers limit cross-contamination by wearing gloves when handling ready-to-eat (RTE) foods, such as a sandwich. To prevent cross-contamination, food industry supervisors focus on food handler hygiene, illness, and behavior.

The FDA regulates *Current Good Manufacturing Practices* (CGMPs) in the food industry. CGMPs are minimum requirements food industry employees and supervisors follow. For example, a designated sink for handwashing is a CGMP requirement. Figure 1 shows a handwashing sink with soap, paper towels, a trashcan, and information on handwashing. The food industry uses CGMP signs to remind trained employees of proper hygiene. Washing your hands and cleaning the workspace is CGMP that you will follow in the food science laboratory. Every time you handle food, you should wash your hands and workspace.

Figure 1. Handwashing Sink

How does the food industry remind food handlers of CGMPs?

Materials

Per group of four students:

- Hand soap
- Sink
- UV light

Per pair of students:

- Device with internet access and a poster making program
- Printer

Per student:

- *Agriscience Notebook*
- Pencil
- *Project 3.2.2 Evaluation Rubric*

Per class:

- CGMP handwashing signs
- (2) *Glo-Germ™ Comparison Chart*
- Paper towels

Procedure

Use Glo-Germ™ to evaluate a handwashing CGMP. Next, create a CGMP sign to display in your laboratory space.

Part One – Proper Hand Washing

Work in a group of four to evaluate handwashing techniques.

1. Access the **Retail Food Protection: Employee Health and Personal Hygiene Handbook**. (https://www.fda.gov/food/retail-food-industryregulatory-assistance-training/retail-food-protection-employee-health-and-personal-hygiene-handbook)
2. Read *What handwashing steps do food employees need to follow?* on pages 14–15.
3. Record in Table 1 of *Project 3.2.2 Student Observations* the steps for proper handwashing.
4. Review Steps 6–12. Record a prediction for each handwashing procedure in Table 2.
5. Answer the *Handwashing Predication Questions*.

Handwashing

6. Put a nickel-size drop of Glo Germ™ on your hands and rub it all over your hands.
7. Assign each group member one of the following wash procedures. Record the names assigned to each procedure in your *Laboratory Notebook*.
    - **Procedure 1 -** Rinse hands under cold water without rubbing them together. Dry your hands with a paper towel.
    - **Procedure 2 -** Rinse hands under warm water without rubbing them together. Dry your hands with a paper towel.
    - **Procedure 3 -** Wash hands with hand soap. Rinse hands under cold water while rubbing hands together. Dry your hands with a paper towel.
    - **Procedure 4 -** Wash hands with hand soap. Rinse hands under warm water while rubbing them together. Dry your hands with a paper towel.
8. Wash hands for 20 seconds following your assigned procedure. Discard paper towels in the trash can after use.

Testing Hands

Wait until your teacher has lowered the classroom lights. When lowered, proceed to Step 9.

9. Use the UV light to observe the "dirt and bacteria" visible on each group member's hands.
10. Compare each group member's hands to the *Glo Germ™ Comparison Chart*, provided by your teacher. Record approximate contamination levels in Table 2.
11. Answer the *Handwashing Analysis Questions*.
12. Wash your hands thoroughly with soap and warm water to remove the remaining Glo-Germ™.

Part Two – CGMP Sign

Review an example CGMP sign for handwashing. Answer the *CGMP Analysis Question*.

Work with a partner to develop a CGMP sign for a specific personal hygiene practice in Table 2. The sign should include information about maintaining proper hygiene by following the below parameters. Use the internet and class texts to research hygiene practices.

Table 2. *Personal Hygiene Practices*

• Eating and drinking	• Gloves	• Hair
• Personal clothing	• Illness	• Injury
• Jewelry	• Nails	• Protective clothing
• Transferring contaminants		

Parameters

- One page sign
- Title lists personal hygiene practice
- Guidelines for food handlers
- Graphics, pictures, or diagrams demonstrating hygiene practice
- Sufficient text size to read at a distance

Potential Resources

- **FDA Resources for You (Food)** – (https://www.fda.gov/food/resources-you-food)
- **Retail Food Protection: Employee Health and Personal Hygiene Handbook** – (https://www.fda.gov/food/retail-food-industryregulatory-assistance-training/retail-food-protection-employee-health-and-personal-hygiene-handbook)

Display your sign on the wall of the food science laboratory as a safety reminder for your classmates. Next, provide a one-minute overview of the correct hygiene practices related to your hygiene practice. Your teacher will evaluate the project using *Project 3.2.2 Evaluation Rubric*.

Conclusion

1. How does proper personal hygiene affect the safety of food?

2. Why does the food industry use CGMP signs?

3. Why do food producers encourage employees to maintain good personal hygiene?

Name____

Activity 3.2.2 Student Observations

Table 1. ***Proper Handwashing***

Proper Handwashing Procedures

Table 2. ***Handwashing Observations***

Handwashing Procedure	Prediction	Student	Contamination Level
Procedure 1			
Procedure 2			
Procedure 3			
Procedure 4			

Handwashing Predication Questions

Q1 Rank the procedures in Step 7 from best to worst handwashing procedures.

Q2 Which handwashing method(s) in Step 7 meets CGMP guidelines?

Handwashing Predication Questions

Q3 Were your predictions from Step 4 correct?

Q4 Which method was the best? Why?

CGMP Analysis Question.

Q5 How does the sign communicate CGMPs to food handlers?

Name____

Project 3.2.2 Evaluation Rubric

Areas with Room for Improvement	Criteria	Areas that Meet or Exceed Expectations
	Content Succinctly and clearly states the main points of hygiene. The sign details the assigned personal hygiene practice and suggested guidelines from the FDA.	
	Delivery Effectively explains the guidelines for food handlers while maintaining brevity.	
	Visual Appearance Organized and easy to read. Text is of sufficient size for a sign. The sign is colorful, has pictures, and displays good hygiene.	
	Participation Each student assists in developing the sign and participates in presenting the sign.	

Name____

Activity 3.2.3 Knife Safety

Purpose

Trying a new recipe in your home kitchen, you grab a knife from the knife block. Which knife do you use? Some of the knives have teeth, and others are smooth. Do you use the large one that looks like it came from a horror movie? Over the years, knives have taken on several forms to accomplish several uses. In the field-to-fork model, knife use ranges from harvesting grain to processing food to food preparation. Food handlers should become competent in using a knife safely and effectively.

The following knife safety guidelines help food handlers prevent injury.

- Use a plastic or wood cutting board to protect the blade.
- Use the correct knife for the task.
- Cut food away from your body.
- Keep knives sharp.
- Carry knives downwards and at your side, as shown in Figure 1.
- Do not attempt to catch a falling knife.
- Never leave a knife in a sink of water.
- Wear disposable gloves when cutting RTE food or processing meats.
- Wash knives after sharpening to keep metal shavings out of food.
- Store knives in a knife block or knife guards.

Figure 1. Carrying a Knife

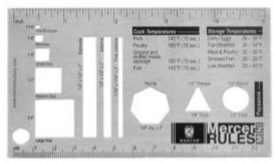

Figure 2. Mercer Rules Tool

Common knives in a kitchen or food processing line include a chef's knife, paring knife, serrated knife, boning knife, and peeler. Food handlers use knives to cut commodities into uniform sizes on a processing line. Chefs similarly use a Mercer Rules tool to increase the efficiency of cuts with preparing foods to specific sizes. Table 1 lists the size and shape of knives, along with their uses.

Table 1. *Knives*

Knife/Tool	Blade	Use
Chef's knife	8–10″ with a round tip	Chopping or dicing vegetables, fruits, and herbs
Paring knife	3–4″ with a sharp tip	Cut vegetables into smaller pieces or make precise cuts
Serrated knife	Serrated tip along the edge	Cutting or dicing foods with a hard exterior and soft interior (bread, tomato, cucumbers)
Boning	Long flexible blade with a sharp tip	Sharp tip pierces into meat easier, making it safer when cutting through ligaments and connective tissue
Potato peeler	Blade with an interior slot	Removes layers of flesh from vegetables and fruits

How do food handlers use knives safely?

Materials

Per class:

- Cumin
- Disposable gloves
- (3) Electronic balance
- Pepper

Per student:

- *Agriscience Notebook*
- Hairnet
- Lab coat
- Pencil

- Salt

Per group of four students:

- Cilantro, 10g
- Cutting board
- Knife, chef
- Knife, paring
- Knife, serrated
- Lime
- Mercer Rules tool
- (½) Onion, red
- Pepper, jalapeno
- Spatula, silicone
- (3) Tomato, Roma
- Weighing dish

Procedure

Watch the video, *How to Master Basic Knife Skills–Knife Cuts 101*. Next, make salsa while practicing knife safety.

Part One – Knife Safety and Identification

Watch **How to Master Basic Knife Skills** (https://www.youtube.com/watch?v=VJNA4vrdWec) and record key information using *Presentation Notes*. Answer the *Knife Safety Analysis Questions* on the *Activity 3.2.3 Student Observation* page.

Part Two – Knife Practice

Wash your hands, cover your hair, and put on disposable gloves. In groups of four, prepare fruits and vegetables for fresh salsa. Rinse all produce in the sink with warm water. Use the Mercer Rules tool to prepare fruits and vegetables to the proper size. Use a plastic or wood cutting board and the appropriate knives for completing the cuts detailed in Table 2. When done with a knife, place it at the edge of the sink until you are ready to clean it.

Table 2. ***Vegetable Preparations***

Produce	Knife	Steps
(3) Tomatoes, Roma	Serrated knife	1. Slice the tomatoes into halves. 2. Dice the tomato into ¼” cubes (¼” x ¼” x ¼”).
(½) Onion, red	Chef knife	1. Peel the outside layer of the onion. 2. Chop the onion into rings. 3. Dice the onion into ⅛” cubes (⅛” x ⅛” x ⅛”).
Pepper, jalapeno	Paring knife	1. Cut the pepper into quarters lengthwise and remove the seeds. 2. Dice the pepper into ⅛” cubes (⅛” x ⅛” x ⅛”).
Lime	Chef knife	1. Cut the lime into halves. 2. Cut the halves into wedges.
Cilantro	Chef knife	1. Mass 10g of cilantro using an electronic balance and weighing dish. 2. Mince the cilantro.

Part Three – Salsa

Prepare the fruits and vegetables to make fresh salsa.

1. Add the following ingredients together into a medium-sized plastic or glass bowl.
    - Diced tomatoes
    - Diced onion
    - Diced jalapeno
    - Minced cilantro
3. Mass the following seasonings. Add each seasoning to the bowl of salsa.
    - Salt, 1.5g
    - Pepper, 0.5g
    - Cumin, 0.5g
4. Squeeze the juice from the four lime wedges over the salsa.
5. Mix the salsa with a silicone spatula.
6. Cover the bowl of salsa with a lid or plastic wrap. Refrigerate overnight.
7. Clean up as instructed by your teacher. Use caution when cleaning knives, following the procedures below.
    - Place knives by the edge of your sink. Never leave a knife in a sink of water.
    - Wash each knife separately with warm soap and water.
    - Carry knives downwards and at your side, as shown in Figure 1.
    - Store knives in their original knife block or knife guards.

Conclusion

1. How can knives present physical hazards to food?

2. How should a knife be carried in a kitchen?

3. How are knives washed?

Name____

Activity 3.2.3 Student Observations

Knife Safety Analysis Questions

Q1 How does a food handler cut food without cutting a finger?

Q2 How does a food handler use the Mercer Rules tool to increase uniformity?

Lesson 3.2 Glossary

A

Accident – An undesirable or unfortunate happening that occurs unintentionally and usually results in harm, injury, damage, or loss; casualty; mishap.

B

Biological hazard – A hazard in food that can cause illness from microbial growth, such as bacteria, viruses, or mold.

Boning knife – A type of kitchen knife with a sharp point and narrow blade used in removing bones of poultry and meat products.

C

Chef's knife – A large, general-purpose knife, usually eight to ten inches long.

Chemical hazard – A hazard in food that can cause illness from chemical poisonings, such as improperly stored food service chemicals or traces of chemicals on equipment.

Current Good Manufacturing Practices (CGMPs) – General practices recommended by the Food and Drug Administration (FDA) to ensure product safety and quality.

E

Emergency – A sudden, urgent, usually unexpected occurrence or occasion requiring immediate action.

M

Mercer Rules tool – A reference tool for culinary professionals for uniform cuts in food processing.

P

Pairing knife – A small knife for peeling or slicing fruits or vegetables.

Physical hazard – A hazard in food that can cause illness due to physical objects such as a feather left in a chicken carcass or a metal shaving from food processing equipment in a candy bar.

Potato peeler – A special knife for peeling the skin from potatoes or other vegetables.

R

Ready to eat (RTE) – Food ready to eat by the consumer without cooking or baking.

S

Safety – Freedom from accidents.

Serrated knife – A sharp-edge blade with saw-like teeth that enable cutting without damaging delicate or soft textures.

Name____

Lesson 3.2 Check for Understanding

1. List an example of each type of food hazard: biological, chemical, and physical.

2. When should food handlers wash their hands?

3. Part of knife safety is using the proper knife for each cut. You are cutting a cucumber with a hard exterior and a soft interior. Which knife is best for slicing the cucumber?
   a) Boning knife
   b) Chef's knife
   c) Paring knife
   d) Serrated knife

Name____

Lesson 3.2 Check for Understanding Answer Key

1. List an example of each type of food hazard: biological, chemical, and physical.

Biological – Yeast, mold, *E. Coli,* microorganisms
Chemical – Cleaner, sanitizer
Physical – Bone, feather, metal shavings

2. When should food handlers wash their hands?

Food handlers wash their hands when arriving at work, after lunch, and after using the restroom. Other examples include touching their face after breaks or preventing cross-contamination.

3. Part of knife safety is using the proper knife for each cut. You are cutting a cucumber with a hard exterior and a soft interior. Which knife is best for slicing the cucumber?

   a) Boning knife
   b) Chef's knife
   c) Paring knife
   d) Serrated knife

Lesson 3.2 Materials

Unit 3 – Lesson 3.2 Food Safety

APP	Qty/ 20	Qty/ 30	Unit	Item Specifications	Vendor
3.2.2	5	8	Each	Hand soap	Local
	5	8	Each	Sink	Local
	5	8	Each	UV light	Ward's
	2	3	Each	CGMP handwashing signs – See Teacher Notes	Local
	1	1	Bottle	Glo-Germ™ gel (white)	Lab-Aids or Ward's
	1	2	Roll	Paper towel	Local
	1	1	Each	Printer	Local
	2	2	Each	*Glo Germ™ Comparison Chart*	Printed
	1	1	Roll	Painter's tape	Local
3.2.3	2	3	Bunches	Cilantro	Local
	5	8	Each	Cutting board	Local
	5	8	Each	Knife, chef	Local
	5	8	Each	Knife, paring	Local
	5	8	Each	Knife, serrated	Local
	5	8	Each	Lime	Local
	5	8	Each	Mercer Rules tool	Local
	5	8	Each	Spatula, silicone	Local
	3	4	Each	Onion, red	Local
	5	8	Each	Pepper, jalapeno	Local
	15	24	Each	Tomato, Roma	Local
	5	8	Each	Weighing dish	Ward's
	3	4	grams	Cumin	Lab-Aids
	3	3	Each	Electronic balance	Ward's
	3	4	grams	Pepper	Local
	8	12	grams	Salt	Local
	20	30	Pairs	Disposable gloves, assorted sizes	Local or Ward's
	20	30	Each	Hairnet	Local
	20	30	Each	Lab coat	Ward's

Lesson 4.1 Safety in your SAE

Preface

Laboratory and Shop Safety (LSS) has exposed students to safety skills and practices found throughout classrooms and the agriculture industry. Now is the time for students to reflect on what they have learned and how they can use the safety information now and in the future. Supervised Agricultural Experiences (SAEs) are introduced in this lesson so that students can connect safety practices and skills to their future foundational or current immersion-level projects.

As the LSS course ends, students apply the skills and practices they learned to one of the two remaining course projects. The foundational SAE project is for students who do not have an SAE project. The foundational project allows for SAE exploration and looking at a future SAE project with safety skills and practices in mind. The immersion project is for students with a current SAE project. The immersion project has students examine their current SAE project for safety skills and practices that are in place or that can add to their project. In both projects, students examine safety skills and practices completed throughout the course and tie those to the SAE Workplace Safety standards.

Concepts	Performance Objectives
Students will know and understand	*Students will learn concepts by doing*
1. Agricultural employees follow workplace health, safety, and environmental procedures to comply with regulatory and safety standards.	• Describe and identify safety skills and practices applied at the workplace. (4.1.1) (4.1.2)

National AFNR Common Career Technical Core Standards Alignment

Career Ready Practices
1. Act as a responsible and contributing citizen and employee.
• CRP.01.01: Model personal responsibility in the workplace and community.
6. Demonstrate creativity and innovation.
• CRP.06.02: Assess a variety of workplace and community situations to identify ways to add value and improve the efficiency of processes and procedures.
10. Plan education and career path aligned to personal goals.
• CRP.10.04: Identify, prepare, update, and improve the tools and skills necessary to pursue a chosen career path.
Agriculture, Food, and Natural Resources Career Cluster
3. Examine and summarize importance of health, safety, and environmental management systems in AFNR organizations.
• AG 3.1: Examine health risks associated with a particular skill to better form personnel safety guidelines.
• AG 3.2: Develop response plans to handle emergencies.
• AG 3.3: Identify hazards and acquire first aid skills to promote environmental safety.
• AG 3.4: Examine required regulations to maintain/improve safety, health, and environmental management systems and sustainable business practices.
• AG 3.5: Enact procedures that demonstrate the importance of safety, health, and environmental responsibilities in the workplace.
• AG 3.6: Demonstrate methods to correct common hazards.
• AG.3.7: Demonstrate application of personal and group health and safety practices.
•

Essential Questions

1. What is a SAE project?

2. What is a foundational SAE Project?
3. What is an immersion SAE Project?
4. What safety skills and practices relate to your SAE project?

Key Terms

Foundational SAE	**Immersion SAE**	**Supervised Agricultural Experience (SAE)**

Day-to-Day Plans
Time: 3 days

*Refer to the Teacher Resources section for specific information on teaching this lesson, in particular **Lesson 4.1 Teacher Notes**, **Lesson 4.1 Glossary**, **Lesson 4.1 Materials**, and other support documents.*

Day 1:

- Present the **Concepts and Performance Objectives**, **Essential Questions**, and **Key Terms** to provide a lesson overview.
- Provide students with a copy of **Project 4.1.1 Your Foundational SAE** and **Project 4.1.1 Evaluation Rubric**.
- Students start *Project 4.1.1, Your Foundational SAE, individually.*

or

- Provide students with a copy of **Project 4.1.2 Your Immersion SAE** and **Project 4.1.2 Evaluation Rubric**.
- Students start *Project 4.1.2, Your Immersion SAE, individually.*

Day 2:

- Students continue working on *Project 4.1.1, Your Foundational SAE, individually.*

or

- Students continue working on *Project 4.1.2, Your Immersion SAE, individually.*

Day 3:

- Students complete *Project 4.1.1 Your Foundational SAE individually*
- Assess the project using *Project 4.1.1 Evaluation Rubric*.

or

- Students complete *Project 4.1.2 Your Immersion SAE individually.*
- Assess the project using *Project 4.1.2 Evaluation Rubric*.

Instructional Resources

Student Support Documents

Lesson 4.1 Glossary

Project 4.1.1 Your Foundational SAE

Project 4.1.2 Your Immersion SAE

Teacher Resources

Lesson 4.1 Safety in your SAE **(PDF)**

Lesson 4.1 Teacher Notes

Lesson 4.1 Materials

Answer Keys and Assessment Rubrics

Project 4.1.1 Evaluation Rubric

Project 4.1.2 Evaluation Rubric

Reference Sources

Herren, R. V., & Donahue, R. L. (2000). *Delmar's agriscience dictionary with searchable CD-ROM*. Albany, NY: Delmar.

The Council, National FFA Organization, & FFA Foundation. (2019, October 4). *SAE for all*. SAE For All. **https://saeforall.org/**

SAE for All

Foundational SAE

All students in an agricultural education program are expected to have a Foundational SAE. Students completing Activities and Projects from this course will meet the Foundational SAE qualification for the *Intermediate (Grades 9-10) level*. *Project 4.1.1 Your Foundational* SAE will be a compilation of evidence that the student meets the safety requirements for a Foundational SAE.

SAE Workplace Safety Standards

- Activity 4.1.1 Your Foundational SAE
    - CS.03.01.01.b. Execute health, safety, and environmental procedures to comply with regulatory and safety standards.
    - CS.03.04.01.b. Analyze and demonstrate adherence to protective equipment requirements when using various AFNR tools and equipment.
    - CS.03.04.03.b. Assess and demonstrate appropriate operation, storage, and maintenance techniques for AFNR tools and equipment.
- Activity 4.1.2 Your Immersion SAE
    - CS.03.01.01.b. Execute health, safety, and environmental procedures to comply with regulatory and safety standards.
    - CS.03.04.02.b. Complete the setup and adjustment for tools and equipment related to AFNR tasks.
    - CS.03.04.01.b. Analyze and demonstrate adherence to protective equipment requirements when using various AFNR tools and equipment.
    - CS.03.04.03.b. Assess and demonstrate appropriate operation, storage, and maintenance techniques for AFNR tools and equipment.

Access the **SAE for All Educator Resources** site for additional teacher and student resources.

Lesson 4.1 Teacher Notes

Lesson 4.1 Safety in your SAE

In preparation for teaching this lesson, review Concepts, Performance Objectives, Essential Questions, and Key Terms, along with the PowerPoint® presentations. Also, review all activity, project, and problem directions, expectations, and work students complete.

As the course ends, students will compile what they have learned into one of two culminating projects, tying safety skills and practices to their SAE project. The foundational SAE project is for students who do not currently have an SAE. Students identify safety skills and practices for a potential SAE project. The second project is for students who have an SAE project. Students apply safety skills and practices to their projects.

Activities, Projects, and Problems

Project 4.1.1 Your Foundational SAE

This foundational project allows students to explore potential SAE projects and then connect one potential project to *Laboratory and Shop Safety (LSS)* skills and practices.

Teacher Preparation
Be prepared to assist students in locating potential Immersion SAE Projects on the ***AgExplorer*** *(https://AgExplorerFFA.org/)*. Print the hard copy documents listed below, or have digital copies prepared ahead of time in your learning management system. Include blank copies of the safety forms, tags, templates, or materials used in *LSS*. The forms required include the following.

- *1.1.4 – Near Miss Report*
- *2.1.2 – Safety Standards Template*
- *2.2.2 – Tool Operation Checklist*
- *2.2.3 – Lockout Tagout*

Students may require assistance brainstorming ideas for their SAE project, allowing them to complete the safety documents.

Student Performance
Part One
Students utilize the *Ag Explorer* survey to help them select potential SAE projects. Students select a minimum of three potential Immersion SAE Projects, select the SAE Immersion type, and then choose one of those projects to write a one-sentence description of that project.

Part Two
Students examine their selected Immersion SAE project, complete four safety documents, and list SAE safety hazards, including two fire hazards and potential near misses from throughout the course related to their selected Immersion SAE Project.

Results and Evaluation
Students submit the completed SAE safety documents, materials, and tables on the student worksheet to their teacher. This project serves as a formative assessment for Lesson 4.1. There is no *Check for Understanding*.

Project 4.1.2 Your Immersion SAE

This immersion project allows students to review their SAE project to the skills and practices covered in the *Laboratory and Shop Safety (LSS).*

Teacher Preparation
Be prepared to assist students in determining their Immersion SAE type on the ***AgExplorer*** *(https://AgExplorerFFA.org/)*. Print the hard copy documents listed below, or have digital copies prepared ahead of time in your learning management system. Include blank copies of the safety forms, tags, templates, or materials used in *LSS*. The forms required include the following.

- *1.1.4 – Near Miss Report*
- *1.2.3 – Fire Extinguisher Safety Checklist*
- *2.1.2 – Safety Standards Template*
- *2.2.1 – Tool Safety Checklist*
- *2.2.2 – Tool Operation Checklist*
- *2.2.3 – Lockout Tagout*
- *3.2.2 – Personal Safety Protocols*

Student Performance
Part One
Students provide a name, immersion type, and short description of their Immersion SAE Project in Table 1.

Part Two
Students review their Immersion SAE Project, complete seven safety forms, and identify hazards and needed fire extinguisher classes related to their SAE. Table 2 from the student worksheet is completed with instructions related to the student's project.

Results and Evaluation
Students submit the completed SAE safety documents, materials, and tables on the student worksheet to their teacher. This project serves as a formative assessment for Lesson 4.1. There is no *Check for Understanding*.

Name____

Project 4.1.1 Your Foundational SAE

Purpose

The activities and projects in the *CASE Laboratory and Shop Safety* (LSS) meet the Workplace Safety or Employability Skills for a Foundational SAE. A supervised agricultural experience (SAE) is a student-led agricultural project that interests you. The possibility of doing what you like is an SAE's most exciting and scary part. While you have control, your agriculture teacher will help; however, they can ensure your success. You have already learned safety skills to apply to your SAE project. In addition to those skills, you will need resources. As an advisor, your agriculture teacher can help you find the resources you need.

This activity aligns your safety coursework with the Foundational SAE requirements. As you have learned, safety is always a concern when doing any task. Before starting an SAE, it is crucial to consider safety concerns and steps required to ensure your safety and that of others. You have experienced safety activities that apply to many SAEs. These safety practices are easily transferable to the agriculture industry.

What safety skills have you learned that you can apply to an SAE?

Materials

Per student:

- *Agriscience notebook*
- Black permanent marker
- Device with Internet access
- Pencil
- *Project 4.1.1 Evaluation Rubric*
- Scissors
- Transparent tape
- Word processing software
- *Lockout Tagout (2.2.3)*
- *Near Miss Report (1.1.4)*
- *Safety Standards Template (2.1.2)*
- *Tool Operation Template (2.2.2)*

Procedure

Reflect on your experiences in the class and explore future SAE projects that can lead to a career in the agriculture industry.

Part One – SAE Exploration

1. Go to the ***AgExplorer*** (**https://agexplorerffa.org/**).
2. Select **MyCareer Quiz** at the top menu bar.
3. Select the answer that best describes you from each of the four options, then advance to the next question by selecting **Next Question**.
4. Once you have answered question 16, select **Review Results** at the bottom of the page.
5. Select at least three projects from the suggested SAE results and record the names in Table 1.
6. From the projects listed in Table 1, select the one that interests you the most and circle it.
7. Write the name of the SAE project circled in the ***SAE project name*** box.
8. Select and circle the ***SAE Immersion type*** of your project in Table 1.

9. Write a short description of the SAE project in the space provided on the student worksheet; if needed, use the *AgExplorer* to assist you.

Part Two – Safety Applications

You have used many forms during this *Laboratory and Shop Safety* course to demonstrate deliberate steps in documenting safety measures. For this project, you will complete forms you have previously used but will now assess safety for your SAE project. Complete the forms on your selected Immersion SAE Project. To complete this project, you are encouraged to use the Internet and the skills you have gained from completing activities in this course.

Complete the safety documents below for your selected Immersion SAE Project.

1. Gather the documents and materials listed in the *Materials* section.

Documents

- *Lockout Tagout (2.2.3)Tagout Blanks*
    - *Tagout Blanks,* scissors, tape, permanent marker
- *Near Miss Report (1.1.4) Report*
- *Safety Standards Template (2.1.2) Template*
- *Tool Operation Template (2.2.2) Template*

2. List ten potential safety hazards for your SAE in Table 2. Include at least two fire hazards.
3. What class(es) of fire extinguishers do you need for your SAE? Check the appropriate boxes in Table 2.
4. Select a piece of equipment related to your SAE and complete a *Tagout Form* for that equipment.
5. Using the piece of equipment selected in Step Five, complete a *Tool Operation Template*.
6. What are six near misses that could occur with your SAE project? List in Table 2.
    - Complete a *Near Miss Report* on one of the topics.
7. Complete a *Safety Standards Template* from *Activity 2.1.2* for one of the following topics.
    - Compressed gas and air
    - Electrical
    - Exit routes and emergency action plans
    - Materials handling and storage (Including SDS sheets, safety cabinets, or containers)
    - Medical first aid and recordkeeping (including first aid kits and emergency wash stations)
    - Personal protective equipment (PPE)
    - Space requirements
    - Ventilation
    - Walking – working surfaces and work environment
8. Once you have completed the above steps, place the materials in the following order:
    - Project 4.1.1 Your Foundational SAE
    - Lockout Tagout documents
    - Near Miss Report documents
    - Safety Standards documents
    - Tool Operation documents
9. Review the criteria found in the *Project 4.1.1 Evaluation Rubric* to ensure you have completed all components.
10. Submit the completed safety documents, materials, and student worksheet as directed by your teacher.

Conclusion

1. How will demonstrated safety practices assist you in your SAE and prepare you for your future?

Project 4.1.1 Student Worksheet

Table 1. *SAE Selection*

Potential Immersion SAE Projects					
1.			2.		
3.			4.		
Immersion SAE Project					
SAE project name					
Type of Immersion SAE (circle one)	Placement/Internship	Ownership/Entrepreneurship	Research	School-Based Enterprise	Service Learning
Short SAE description					

Table 2. *SAE Safety*

SAE Safety Hazards (Include two fire hazards)	
1.	2.
3.	4.
5.	6.
7.	8.
9.	10.
Potential SAE Near Misses	
1. 2. 3.	4. 5. 6.

Name____

Project 4.1.1 Evaluation Rubric

Areas with Room for Improvement	Criteria	Areas that Meet or Exceed Expectations
	SAE Exploration Three potential SAE projects are listed with a one-sentence description of a selected SAE project.	
	Student Worksheet The student worksheet is complete and is related to their selected SAE project. Safety hazards and near misses are realistic safety hazards for their selected SAE project. The student provides safety.	
	Safety Forms Completion The student completes the *Near Miss Report, Safety Standards Template, Tool Operation Checklist, Lockout Tagout,* and *Personal Safety Protocols* safety documents related to their SAE.	
	Document Organization Documents are organized in the following order. • *Project 4.1.1 Your Foundational SAE* • *Lockout Tagout* documents • *Near Miss Report* documents • *Safety Standards* documents • *Tool Operation* documents	

Name____

Project 4.1.2 Your Immersion SAE

Purpose

The activities and projects in the CASE Laboratory and Shop Safety (LSS) course meet the Workplace Safety or Employability Skills for an Immersion SAE. You have gained transferrable skills between your work in this course and your SAE project.

As you have learned, safety is always a concern when doing any task. Before starting an SAE, it is crucial to consider safety concerns and steps required to ensure your safety and that of others. You have experienced safety activities that apply to many SAEs. These safety practices are easily transferable from the classroom to the agriculture industry. Having gained experience in your SAE, you are uniquely qualified to review your SAE work under the safety lens.

What safety skills have you learned that you can apply to your Immersion SAE project?

Materials

Per student:

- *Agriscience notebook*
- Black permanent marker
- Device with Internet access
- Pencil
- *Project 4.1.2 Evaluation Rubric*
- Scissors
- Transparent Tape
- Word processing software
- *Fire Extinguisher Checklist (1.2.3)*
- *Lockout Tagout (2.2.3)*
- *Near Miss Report (1.1.4)*
- *Personal Safety Protocols (3.2.2)*
- *Safety Standards Template (2.1.2)*
- *Tool Operation Template (2.2.2)*
- *Tool Safety Checklist (2.2.1)*

Procedure

Complete the appropriate forms related to your SAE project to assist you in meeting Workplace Safety or Employability skills.

Part One – What's your SAE?

1. Write the name of your SAE project in the ***SAE project name*** box in Table 1 of the *Activity 4.1.2 Student Worksheet.*
2. Use the **AgExplorer** (https://agexplorerffa.org) to help select the correct immersion type for your SAE project.
3. Select and circle the ***SAE Immersion type*** of your project in Table 1.
4. Write a short description of your SAE project in the space provided on the student worksheet in Table 1.

Part Two – Using What You've Done

You have used many forms during this Laboratory and Shop Safety course to demonstrate deliberate steps in documenting safety measures. For this project, you will use forms you have previously used to assess safety for your SAE project. Follow the steps below to complete the safety forms for your SAE Project. To complete this project, you are encouraged to use information from your Immersion SAE Project and the skills you have gained from completing activities in this course.

1. In Table 2 of the student worksheet, list ten safety hazards you have witnessed or could potentially happen with your SAE. Include at least two fire hazards.
2. What class(es) of fire extinguishers do you have for your SAE? Check the appropriate boxes in Table 2.
3. Complete the *Fire Extinguisher Safety Checklist* from *Activity 1.2.3* for your SAE Project.
4. Select a piece of equipment you have used for your SAE and complete a *Tagout Form* for that equipment.
5. Using the piece of equipment selected in Step Five, complete a *Tool Operation Template*.
6. Complete a *Tool Safety Checklist* from *Activity 2.2.1 Safe to Use* to inspect the tool you selected at the in Steps 5 and 6.
7. What are six near misses you have witnessed or could potentially occur with your SAE project? List in Table 2.
    - Complete a *Near Miss Report* on one of those topics.
8. Complete a *Safety Standards Template* for one of the following topics in *Activity 2.1.2*.
    - Compressed gas and air
    - Electrical
    - Exit routes and emergency action plans
    - Materials handling and storage (Including SDS sheets, safety cabinets, or containers)
    - Medical first aid and recordkeeping (including first aid kits and emergency wash stations)
    - Personal protective equipment (PPE)
    - Space requirements
    - Ventilation
    - Walking – working surfaces and work environment
9. Once you have completed the above steps, place the materials in the following order.
    - Project 4.1.2 Your Immersion SAE
    - Fire Extinguisher Checklist
    - Lockout Tagout documents
    - Near Miss Report documents
    - Safety Standards documents
    - Tool Operation documents
    - Tool Safety Checklist
    - Personal Safety Protocols, documents, if appropriate
10. Review the criteria found in the *Project 4.1.2 Evaluation Rubric* to ensure you have completed all components.
11. Submit the completed safety documents, materials, and student worksheet as directed by your teacher.

Conclusion

1. How will the safety practices and skills gained assist you in your SAE and future career?

4.1.2 Student Worksheet

Table 1. ***SAE Information***

Immersion SAE Project					
SAE project name					
Type of Immersion SAE (circle one)	Placement/Internship	Ownership/Entrepreneurship	Research	School-Based Enterprise	Service Learning
Short SAE description					

Table 2. ***SAE Safety***

SAE Safety Hazards (Include two fire hazards)									
1.					2.				
3.					4.				
5.					6.				
7.					8.				
9.					10.				
Fire Extinguisher Classes									
A	☐	B	☐	C	☐	D	☐	K	☐
Potential SAE Near Misses									
1. 2. 3.					4. 5. 6.				

Name____

Project 4.1.2 Evaluation Rubric

Areas with Room for Improvement	Criteria	Areas that Meet or Exceed Expectations
	SAE Information Student provides name, SAE immersion type, and short description of their SAE project.	
	Student Worksheet The student worksheet is complete and is related to their selected SAE project. Safety hazards and near misses are realistic safety hazards for their selected SAE project. The student provides safety.	
	Worksite Safety Forms Completion The student completes the *Fire Extinguisher Checklist, Near Miss Report, Safety Standards Template, Tool Operation Checklist, Tool Safety Checklist, Lockout Tagout,* and *Personal Safety Protocols* safety documents on site of their SAE.	
	Meets Requirements Student follows workplace safety, health, and environmental procedures while complying with regulatory and safety standards.	
	Document Organization Documents are organized in the following order. • *Project 4.1.2 Your Immersion SAE,* • *Fire Extinguisher Checklist,* • *Lockout Tagout* documents, • *Near Miss Report* documents, • *Safety Standards* documents, • *Tool Operation* documents, • *Tool Safety Checklist,* • *Personal Safety Protocols,* documents, if appropriate.	

CASE Safety Module SAE for All Foundational Checksheet

By completing the *CASE Safety Module*, you have finished the *Workplace Safety* component of a **Foundational SAE** (https://saeforall.org/foundational-sae/). Complete the remaining *Foundational SAE Components* to complete a Foundational SAE.

Use the checksheet below to gather the documents proving your accomplishment. Then submit the checksheet and documentation to your instructor as evidence of your achievement.

Foundational SAE Components	Hands-on Performance Objective	Documentation
Career Exploration and Planning	• •	• •
Workplace Safety	• Prepare an emergency first aid booklet. • Develop a standard set of safety requirements for an agricultural shop.	• *Activity 1.2.5 Plan of Action* • First aid booklet • *Project 2.1.2 Setting the Standard* • *Safety Standard Template*
Employability Skills for College and Career Readiness	• •	• •
Personal Financial Management	• •	• •
Agricultural Literacy	• •	• •
Authentic Experience	• •	• •

Lesson 4.1 Glossary

F

Foundational SAE – Conducted by all students in the agricultural education program consisting of Career Exploration and Planning, Employability Skills for College and Career Readiness, Personal Financial Management and Planning, Workplace Safety, and Agricultural Literacy.

I

Immersion SAE – Allow students to build upon their foundational SAE activities by gaining real-world, hands-on experience within their chosen career path. The five types of immersion SAEs include: Placement/Internship, Ownership/Entrepreneurship, Research: Experimental, Analysis, or Invention, School-Based Enterprise, and Service Learning.

S

Supervised Agricultural Education (SAE) – A student-led, instructor-supervised, work-based learning experience that results in measurable outcomes within a predefined, agreed upon set of Agriculture, Food, and Natural Resources (AFNR) Technical Standards and Career Ready Practices aligned to a career plan of study.

Lesson 4.1 Materials

Unit 4 – Lesson 4.1 Safety and Measurement

APP	Qty/ 20	Qty/ 30	Unit	Item Specifications	Vendor
4.1.1	20	30	Each	Device with Internet access	Local
	5	7	Each	Permanent marker, black	Local
	5	7	Each	Scissors	Local
	1	1	Each	Tape, transparent	Local
	20	30	Each	Word processing software	Local
4.1.2	20	30	Each	Device with Internet access	Local
	5	7	Each	Permanent marker, black	Local
	5	7	Each	Scissors	Local
	1	1	Each	Tape, transparent	Local
	20	30	Each	Word processing software	Local