

SGE Expanded Lesson Review

The following is a compiled listing of the concepts, performance objectives, standards alignment, and essential questions by lesson.

Lesson 1.1 Safe Setting

Concepts	Performance Objectives
<p><i>Students will know and understand</i></p> <ol style="list-style-type: none"> 1. Organization and record-keeping are important to success in agricultural mechanics. 2. Site-specific safety policies and procedures are in place for agricultural mechanic shops and labs. 3. Safety must be planned and systematic for effective identification and management in a laboratory or shop. 4. Personal protective equipment is the last line of defense against injury. 	<p><i>Students will learn concepts by doing</i></p> <ul style="list-style-type: none"> • Develop and keep an <i>Agriscience Notebook</i> to record and store information. (Activity 1.1.1) • Identify workplace hazards and the root cause of accidents. (Activity 1.1.2) • Develop a standard set of safety requirements for an agricultural mechanics shop. (Project 1.1.3) • Assess a shop to determine if safety standards are being met and make recommendations for improvements. (Project 1.1.4) • Identify types of PPE and their uses in the shop. (Activity 1.1.5)

National AFNR Career Cluster Content Standards Alignment

Career Ready Practices
<p>1. Act as a responsible and contributing citizen and employee.</p>
<ul style="list-style-type: none"> • CRP.01.01: Model personal responsibility in the workplace and community.
<ul style="list-style-type: none"> • 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.
<ul style="list-style-type: none"> • CRP.01.03: Identify and act upon opportunities for professional and civic service at work and in the community.
<p>2. Apply appropriate academic and technical skills.</p>
<ul style="list-style-type: none"> • CRP.02.01: Use strategic thinking to connect and apply academic learning, knowledge and skills to solve problems in the workplace and community.
<ul style="list-style-type: none"> • CRP.02.02: Use strategic thinking to connect and apply technical concepts to solve problems in the workplace and community.
<p>4. Communicate clearly, effectively and with reason.</p>
<ul style="list-style-type: none"> • CRP.04.02: Produce clear, reasoned and coherent written and visual communication in formal and informal settings.
<p>5. Consider the environmental, social and economic impacts of decisions.</p>
<ul style="list-style-type: none"> • CRP.05.01: Assess, identify and synthesize the information and resources needed to make decisions that positively impact the workplace and community.
<p>6. Demonstrate creativity and innovation.</p>
<ul style="list-style-type: none"> • 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.

8. Utilize critical thinking to make sense of problems and persevere in solving them.
<ul style="list-style-type: none"> • CRP.08.01: Apply reason and logic to evaluate workplace and community situations from multiple perspectives. • CRP.08.02: Investigate, prioritize and select solutions to solve problems 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.
<ul style="list-style-type: none"> • 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.
<ul style="list-style-type: none"> • 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)
2. Operate and maintain mechanical equipment related to AFNR power, structural, and technical systems.
<ul style="list-style-type: none"> • 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?
11. What is first aid?
12. What factors determine how you provide first aid to a victim?
13. What type of personal protective equipment should you wear in an agricultural work area?
14. How do you select the PPE required for operating a tool or machine?

Lesson 1.2 Equipment Safety

Concepts	Performance Objectives
<p><i>Students will know and understand</i></p> <p>1. Working in a mechanical shop requires diligence when following safety procedures and expectations.</p>	<p><i>Students will learn concepts by doing</i></p> <ul style="list-style-type: none"> • Identify near misses and complete an example near-miss report. (Activity 1.2.1)

<p>2. Agricultural employees need to work efficiently and communicate effectively in the workplace.</p> <p>3. Safety Data Sheets (SDS) contain important information on the proper use and cleaning of materials.</p> <p>4. Guarding and shielding agricultural equipment prevent injury to an operator.</p> <p>5. Engine operators use safe practices to protect themselves and those around them.</p> <p>6. Technicians use digital service procedure manuals to diagnose and repair equipment.</p>	<ul style="list-style-type: none"> • Describe and identify employability skills that industry employers expect of employees. (Activity 1.2.2) • Use SDS forms to determine the proper use and cleanup of chemicals used in the course. (Activity 1.2.3) • Identify the safety hazards found in the internal motions of equipment. (Project 1.2.4) • Complete a <i>Tool Operation Template and Equipment Safety Checklist</i> for a small engine. (Activity 1.2.5) • Safely operate an engine. (Activity 1.2.5) • Locate key information using a digital service manual. (Activity 1.2.6)
---	--

National AFNR Career Cluster Content Standards Alignment

Career Ready Practices
1. Act as a responsible and contributing citizen and employee.
<ul style="list-style-type: none"> • CRP.01.01: Model personal responsibility in the workplace and community. • 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.
Power, Structural and Technical (AG-PST)
2. Operate and maintain mechanical equipment related to AFNR power, structural, and technical systems.
<ul style="list-style-type: none"> • AG-PST 2.3: Operate machinery and equipment while observing all safety precautions.

Essential Questions

1. What is a near miss?
2. What are proper safety procedures when working in a shop?
3. What interpersonal skills do technicians need?
4. Where is the risk of injury greatest when working on equipment?
5. How is equipment designed to reduce the risk of injury?
6. What guidelines are you expected to follow when working in a shop?
7. What safe practices for operating equipment?
8. How do you select PPE to wear when operating a machine?
9. How do you safely operate a small engine?
10. What are Safety Data Sheets?
11. How are Safety Data Sheets used in a shop setting?
12. How are reference numbers used in illustrated parts manuals?
13. What are the advantages of a digital service manual?
14. What is a repair manual?
15. Where can a consumer or technician find safety information for a small gas engine?

Lesson 2.1 Engine Operation

Concepts	Performance Objectives
<p><i>Students will know and understand</i></p> <ol style="list-style-type: none"> Four-stroke cycle engines systematically process energy inputs and produce energy outputs. A small engine consists of a series of systems converting energy from one form to another in a controlled manner. Technicians use diagnostic tools to solve mechanical problems caused by improper design or product failure. 	<p><i>Students will learn concepts by doing</i></p> <ul style="list-style-type: none"> Develop a storyboard to identify inputs, processes, and outputs in a four-stroke cycle small engine. (Activity 2.1.1) Use the flow chart with the leakdown tester to identify the current stroke of an engine. (Activity 2.1.3) Define small engine systems and record the inputs and outputs of each system. (Activity 2.1.2) Record the energies transferred throughout the systems in an engine. (Activity 2.1.2) Measure the thermal energy transferred in an engine. (Activity 2.1.4) Test an engine's electrical and compression system to ensure proper working order. (Activity 2.1.4) Identify diagnostic tests for finding an ignition or compression problem in an engine. (Activity 2.1.4)

National AFNR Career Cluster Content Standards Alignment

Career Ready Practices
<p>1. Act as a responsible and contributing citizen and employee.</p>
<ul style="list-style-type: none"> CRP.01.01: Model personal responsibility in the workplace and community.
<p>2. Apply appropriate academic and technical skills.</p>
<ul style="list-style-type: none"> CRP.02.02: Use strategic thinking to connect and apply technical concepts to solve problems in the workplace and community.
Power, Structural and Technical (AG-PST)
<p>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.</p>
<ul style="list-style-type: none"> AG-PST 1.2: Use hand and power tools commonly required in power, structural, and technical systems
<p>3. Service and repair mechanical equipment and power systems used in AFNR power, structural and technical systems.</p>
<ul style="list-style-type: none"> AG-PST 3.1: Service and repair the components of internal combustion engines using procedures for troubleshooting and evaluating performance.

Essential Questions

- What are the inputs and outputs of a combustion engine?
- How are systems in a machine connected?
- What are the five events of a small gas engine?
- How is energy converted in a small engine?
- What types of systems are in an engine?
- How do mechanical systems transfer energy?
- What tools can a technician use to troubleshoot a small engine?

Lesson 2.2 Disassembly Required

Concepts	Performance Objectives
<p><i>Students will know and understand</i></p> <ol style="list-style-type: none"> 1. Machine disassembly requires a systematic process that is sequential and organized. 2. A small engine carburetor has a series of parts used to increase fuel efficiency. 3. Governor controls and electrical systems in an engine are used to manage the fuel input and energy output. 4. Tolerances and specifications guide how small engine components are assembled together to function effectively. 5. Engine components are designed for a specific application or function. 6. Machine disassembly requires a systematic process that is sequential and organized. 	<p><i>Students will learn concepts by doing</i></p> <ul style="list-style-type: none"> • Document and organize the disassembly of a small engine. (Activity 2.2.1, Activity 2.2.4, Activity 2.2.5, Activity 2.2.6) • Construct a prototype of a carburetor (Activity 2.2.2) • Improve a prototype of a carburetor to produce the optimum air-fuel ratio. (Project 2.2.3) • Diagram how the governor adjusts small engine speed. (Activity 2.2.4) • Draw a schematic of the electrical system in a small engine. (Activity 2.2.4) • Measure and adjust valve clearances for a small engine. (Activity 2.2.5) • Identify types of metals found in an engine and the purpose of each. (Activity 2.2.6) • Diagram and calculate the gear ratios and speeds in a small engine. (Activity 2.2.6) • Document and organize the disassembly of a small engine. (Activity 2.2.1, Activity 2.2.4, Activity 2.2.5, Activity 2.2.6)

National AFNR Career Cluster Content Standards Alignment

Power, Structural and Technical (AG-PST)
<p>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.</p>
<ul style="list-style-type: none"> • AG-PST 1.2: Use hand and power tools commonly required in power, structural, and technical systems
<ul style="list-style-type: none"> • AG-PST 1.4: Design or modify equipment, structures, or biological systems to improve performance of an AFNR enterprise or business unit.
<p>3. Service and repair mechanical equipment and power systems used in AFNR power, structural and technical systems.</p>
<ul style="list-style-type: none"> • AG-PST 3.1: Service and repair the components of internal combustion engines using procedures for troubleshooting and evaluating performance.
<ul style="list-style-type: none"> • AG-PST 3.5: Execute the safe and proper use of construction/fabrication hand tools in the workplace.
<ul style="list-style-type: none"> • AG-PST 3.6: Service electrical systems by troubleshooting from schematics.

Essential Questions

1. What is the process for reverse engineering a machine?
2. How should you organize parts when removing them from an engine?
3. How will you document steps when taking apart an engine?
4. How do the components of a carburetor work?

5. How are mechanical and electrical controls used in an engine?
6. Why do technicians adjust mechanical controls?
7. How can mechanical controls be used for safety purposes?
8. What is a machine specification or tolerance?
9. Why do machines need to be assembled with precision?
10. How is clearance measured between two machine parts?
11. Why are machine components made of different materials?
12. Why are components marked or stamped?
13. How do gears control the operation of machine systems?

Lesson 2.3 Machine Assembly

Concepts	Performance Objectives
<p><i>Students will know and understand</i></p> <ol style="list-style-type: none"> 1. A fastener's strength and size vary based on its purpose. 2. Technicians use tools to make precise measurements. 3. Technicians use part specifications to ensure mechanical components fit together and work properly. 4. Lubrication and bearings reduce wear on an engine. 5. Proper assembly prevents malfunctions in a small engine. 6. Technicians monitor and adjust engines for power and speed. 	<p><i>Students will learn concepts by doing</i></p> <ul style="list-style-type: none"> • Identify bolt size, type, and grade. (Activity 2.3.1) • Use a micrometer to make precise measurements. (Activity 2.3.2) • Locate part standard and reject sizes in a repair manual. (Activity 2.3.3) • Measure the wear on a crankshaft and find the specification for replacement. (Activity 2.3.4) • Identify wear points in an engine. (Activity 2.3.4) • Describe the systems in place to reduce wear. (Activity 2.3.4) • Reassemble a small engine using correct torque and sequencing of bolts, spacing of valves, and spacing of armature. (Activity 2.3.4, Activity 2.3.5) • Set the governed speed of a small engine. (Activity 2.3.6)

National AFNR Career Cluster Content 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.
2. Apply appropriate academic and technical skills.
• CRP.02.02: Use strategic thinking to connect and apply technical concepts to solve problems in the workplace and community.
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 2.2: Perform service routines to maintain power units and equipment.
- AG-PST 2.3: Operate machinery and equipment while observing all safety precautions.

3. Service and repair mechanical equipment and power systems used in AFNR power, structural and technical systems.

- AG-PST 3.1: Service and repair the components of internal combustion engines using procedures for troubleshooting and evaluating performance.

Essential Questions

1. How are bolts sized?
2. What is the difference between coarse and fine-threaded bolts?
3. What are bolt gauges?
4. Why are engine components manufactured with precision?
5. How can you determine if a part does not fit within the correct specification?
6. How are engines designed to lubricate and cool moving parts?
7. What types of bearings are in machines?
8. What are the features of antifriction and friction bearings?
9. Why do bearings and journals wear out?
10. Why are machines assembled in a specific order?
11. How does assembly sequence affect machine function?
12. Why is torque considered when fastening engine components?
13. How do you set the speed of an engine?
14. How are governor systems adjusted on an engine?

Lesson 3.1 Engine Diagnostics

Concepts	Performance Objectives
<i>Students will know and understand</i> 1. Technicians use service manuals to determine engine maintenance and repair costs. 2. Technicians follow a standard diagnostic procedure to inspect a problem, make repairs, and verify operation.	<i>Students will learn concepts by doing</i> <ul style="list-style-type: none">• Use an electronic service manual to find and identify part numbers and costs. (Activity 3.1.1)• Create a service plan for a small engine. (Problem 3.1.4)• Identify the parts of the six-step diagnostic process during a guest technician presentation. (Activity 3.1.2)• Use the diagnostic process to identify faults in a small engine. (Problem 3.1.4)
3. Technicians utilize written reports, such as <i>Work/Repair Orders</i> , to communicate services provided to a customer.	<ul style="list-style-type: none">• Write a <i>Work/Repair Order</i> using technical writing. (Project 3.1.3)

National AFNR Career Cluster Content Standards Alignment

Career Ready Practices
2. Apply appropriate academic and technical skills.
• CRP.02.02: Use strategic thinking to connect and apply technical concepts to solve problems in the workplace and community.
4. Communicate clearly, effectively and with reason.
• CRP.04.02: Produce clear, reasoned and coherent written and visual communication in formal and informal settings.
Power, Structural and Technical (AG-PST)
2. Operate and maintain mechanical equipment related to AFNR power, structural, and technical systems.
• AG-PST 2.2: Perform service routines to maintain power units and equipment.
3. Service and repair mechanical equipment and power systems used in AFNR power, structural and technical systems.
• AG-PST 3.1: Service and repair the components of internal combustion engines using procedures for troubleshooting and evaluating performance.

Essential Questions

1. What is the process for identifying and ordering new parts for an engine or machine?
2. Why do machine parts have identification numbers?
3. What is the role of a service technician?
4. How do technicians diagnose failures in agricultural equipment?
5. Why is the work/repair order critical to a technician's job?
6. How does a technician communicate services to a customer?
7. How does a service manual help a technician find the cause, correct the problem, and confirm the repair?
8. How are troubleshooting and failure analysis similar?