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| Course | Agricultural Science II |
| Unit | Agricultural Mechanics II |
| Subunit | Common Power Tools |
| Lesson | Safe Use and Maintenance of Power Tools for Woodworking |
| Estimated Time | Two 50-minute blocks |
| Student Outcome | |

Analyze the uses and safety procedures of common power tools used in woodworking.


Learning Objectives

1. Identify basic procedures for shop safety.
2. Identify common sources of power for woodworking tools.
3. Identify some safeguards for the use of power tools.
4. List the uses and safeguards for a portable drill.
5. List the uses and safeguards for a portable circular saw.
6. List the uses and safeguards for a reciprocating saw.
7. List the uses and safeguards for a band saw.
8. List the uses and safeguards for a table saw.
9. List the uses and safeguards for a shaper.
10. List the uses and safeguards for a jointer.

Grade Level Expectations

Resources, Supplies & Equipment, and Supplemental Information

Resources

1. PowerPoint Slides
 - ☐ PPt 1 – Basic Procedures for Shop Safety
 - ☐ PPt 2 – Portable Drill
 - ☐ PPt 3 – Circular Saw
 - ☐ PPt 4 – Reciprocating Saw
 - ☐ PPt 5 – Band Saw
 - ☐ PPt 6 – Table Saw
 - ☐ PPt 7 – Use of a Push Stick With a Table Saw
 - ☐ PPt 8 – Shaper
 - ☐ PPt 9 – Jointer
2. Activity Sheet
 -  AS 1 – Safety and Maintenance Procedures for Power Tools for Woodworking
3. *Agricultural Mechanics Unit for Agricultural Science II* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2002.
4. *Curriculum Enhancement for Agricultural Mechanics Unit for Agricultural Science II, "Unit I – Common Power Tools."* University of Missouri-Columbia: Instructional Materials Laboratory, 2004.

Supplemental Information

1. Internet Sites

- ❑ Cyr, D., and S. Johnson. "Power Tool Safety." National Ag Safety Database. Accessed October 1, 2007, from <http://www.cdc.gov/nasd/docs/d000901-d001000/d000903/d000903.html>.
- ❑ The Free Plan and Project List. Buildeazy. Accessed September 12, 2007, from http://www.buildeazy.com/fp_start.html.
- ❑ Hand and Power Tools. Occupational Safety and Health Administration. U. S. Department of Labor. Accessed September 12, 2007, from <http://www.osha.gov/SLTC/handpowertools/index.html>.
- ❑ My Woodworking Expert. Accessed September 12, 2007, from <http://www.mywoodworkingexpert.com/>.
- ❑ Recalls and Product Safety News. U. S. Consumer Product Safety Commission. Accessed September 12, 2007, from <http://www.cpsc.gov/cpscpub/prerel/prerel.html>.
- ❑ Woodworking Online. Accessed September 12, 2007, from <http://www.woodworkingonline.com/category/power-tools/>.

2. Print

- ❑ Burkybile, C., D. Johnson, J. Lee, and C. Shelhamer. *Agricultural Power and Technology*. Danville, IL: Interstate Publishers, 2005.
- ❑ Phipps, L., and G. Miller. *Introduction to Agricultural Mechanics*. Upper Saddle River, NJ: Prentice Hall Interstate, 2004.

3. Electronic Media

- ❑ The Power Tool Institute offers a line of free videos on safety that can be found at <http://www.powertoolinstitute.com/education.html>. Accessed September 12, 2007.
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Interest Approach


1. Have students discuss the advantages that power tools have over hand tools and the advantages or disadvantages that exist between portable power tools and stationary floor machines. Which tools are most likely to be used for certain jobs and why? What are the reasons for choosing specific tools for a particular job? For example, is it versatility or portability?
2. Have students discuss safety measures for use of power tools and why safety precautions are important. What could be the consequences of unsafe use of power tools?


Communicate the Learning Objectives


1. Identify basic procedures for shop safety.
2. Identify common sources of power for woodworking tools.
3. Identify some safeguards for the use of power tools.
4. List the uses and safeguards for a portable drill.
5. List the uses and safeguards for a portable circular saw.
6. List the uses and safeguards for a reciprocating saw.
7. List the uses and safeguards for a band saw.
8. List the uses and safeguards for a table saw.
9. List the uses and safeguards for a shaper.
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| Instructor Directions | Content Outline |
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| <p>Objective 1</p> <p><i>A number of basic safety procedures apply to almost any work situation. These basic safety procedures appeared in Agricultural Mechanics Unit for Agricultural Science I and can be reviewed here. Refer to PPT 1. Specific safety procedures for different types of tools are discussed in this lesson's sections on individual tools.</i></p> <p><input type="checkbox"/> PPT 1 – Basic Procedures for Shop Safety</p> | <p>Identify basic procedures for shop safety.</p> <p>Adhere to instructions from the following sources:</p> <ol style="list-style-type: none">1. Labels and warnings on containers and tools2. The manufacturer's recommendations for use and maintenance of specific power tools3. Signs posted in the work area4. Directions given by the instructor <p>Wear safety glasses in the shop at all times.</p> <p>Wear protective gear such as gloves, earplugs, and safety shoes if appropriate.</p> <p>Do not wear loose-fitting clothing that could get caught in a moving part.</p> <p>Secure long hair to avoid getting it caught.</p> |



| Instructor Directions | Content Outline |
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| | <p>Keep work areas clean and free of clutter.</p> <p>Inspect each tool before using it to make sure it is working properly.</p> <p>Tell the instructor about any damaged tool.</p> <p>Do not use a tool that does not function properly.</p> <p>Return each tool to its proper place of storage.</p> |
| <p>Objective 2</p> <p><i>Electricity and compressed air are common power sources for woodworking tools. In addition to the general safety precautions listed above, there are safety considerations specific to electric and air-driven (pneumatic) tools. These are discussed below.</i></p> | <p>Identify common sources of power for woodworking tools.</p> <ol style="list-style-type: none"> 1. Electricity, including battery packs 2. Compressed air (pneumatic tools) |
| <p>Objective 3</p> | <p>Identify some safeguards for the use of power tools.</p> <p>Safety precautions for electric tools and battery-powered tools</p> <ol style="list-style-type: none"> 1. Always unplug a tool or disconnect it from its battery before inspecting it and making adjustments. 2. Only use a tool that is double insulated or has a grounded plug. 3. Always plug a tool into a power source with a ground-fault circuit interrupter (GFCI or GFI), which will shut off the electricity if a short occurs. If GFCIs are not installed, portable GFCIs can be plugged into grounded outlets. 4. Do not stand on wet ground or a wet surface while operating an electric tool. 5. Make sure stationary power tools are securely anchored to the floor. 6. Make sure all guards and shields are in place and vents are free of debris before operating an electric tool. 7. Do not bend the power cord sharply or use the cord to pull the plug from the outlet or carry the tool. Such |

| Instructor Directions | Content Outline |
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| | <p>actions could break the cord, and a broken cord is an electrical hazard.</p> <ol style="list-style-type: none"> 8. Use only the battery specified by the manufacturer for the tool being used. 9. Use only the type of recharger designed for the batteries being used. 10. Always store battery packs safely so that no metal can come in contact with the terminals. This can short-circuit the battery and cause sparks, fire, or burns. <p>Safety precautions for pneumatic tools</p> <ol style="list-style-type: none"> 1. Disconnect pneumatic tools for all inspections and adjustments. 2. Do not join or separate quick-disconnect couplings on high-pressure lines when bystanders are nearby. 3. Do not use compressed air for cleanup if the air pressure is 30 lb per sq in. (psi) or greater. 4. Do not point an air stream at anyone. High-pressure air can drive dust into the eyes, damage eardrums, and cause other types of injury. 5. Inspect couplings and air lines regularly for evidence of wear or damage. 6. Make sure air tanks and air lines are free of moisture and appropriate filters are in place. 7. Follow the manufacturer's recommendations for hose size and maximum air pressure. 8. Oil pneumatic tools regularly according to manufacturer recommendations. |
| <p>Objective 4</p> <p><i>Refer to PPT 2 or display the actual tool when explaining the main parts and features. Discuss safety and maintenance considerations.</i></p> <p> PPT 2 – Portable Drill</p> | <p>List the uses and safeguards for a portable drill.</p> <p>Main parts</p> <ol style="list-style-type: none"> 1. On/off switch 2. Power cord 3. Handle 4. Chuck 5. Chuck key <p>Uses</p> <ol style="list-style-type: none"> 1. Drilling and boring 2. Driving and removing screws 3. Sanding 4. Polishing |

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| | <p>5. Powering hole saws</p> <p>Additional features</p> <ol style="list-style-type: none"> 1. Available in different sizes 2. Size of drill determined by the chuck capacity (e.g., a 1/4-in. drill holds a drill bit with a shank no larger than 1/4 in.) 3. Single or variable speed 4. Reversible <p>Safety considerations</p> <ol style="list-style-type: none"> 1. Choose the correct bit for the job. For example, do not use a square-shank bit in an electric drill. 2. Make sure the bit is tightly seated in the chuck, securing it by turning the chuck key in each hole. Remove the chuck key before starting the drill. 3. Make sure the work is held securely in place. Use a clamp or vise to hold small work. 4. Hold the drill perpendicular to the work to avoid binding the bit. 5. Remove the bit from the drill when work is completed. <p>Maintenance considerations</p> <ol style="list-style-type: none"> 1. Follow the manufacturer's instructions for regular lubrication of parts. 2. Sharpen or replace dulled bits. |
| <p>Objective 5</p> <p><i>Refer to PPt 3 or display the actual tool when explaining the main parts and features. Discuss safety and maintenance considerations.</i></p> <p> PPt 3 – Circular Saw</p> | <p>List the uses and safeguards for a portable circular saw.</p> <p>Main parts</p> <ol style="list-style-type: none"> 1. On/off switch 2. Power cord 3. Angle scale 4. Base 5. Angle adjustment lock 6. Handle 7. Blade guard 8. Blade <p>Uses</p> <ol style="list-style-type: none"> 1. Rip cuts 2. Crosscuts |

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| | <ol style="list-style-type: none"> 3. Bevel cuts 4. Mitering <p>Additional features</p> <ol style="list-style-type: none"> 1. Available in different sizes 2. Size of portable circular saw determined by the diameter of largest blade it will hold 3. Different types of blades for different kinds of cuts 4. Angle scale used to set the depth of the blade's cut 5. Upward rotation of the blade produces splintering on the topside of piece. Cut with the better side of the work face down. <p>Safety considerations</p> <ol style="list-style-type: none"> 1. Choose the correct blade for the job. 2. Make sure base and angle adjustments are correct and snug. 3. Back the saw slightly away from the work before turning it on. The saw should be at full speed before beginning the cut. 4. Cut only in a straight line to avoid binding the blade. 5. Wait until the blade stops moving before setting the saw down. <p>Maintenance considerations</p> <ol style="list-style-type: none"> 1. Make sure the blade guard moves freely and covers the blade completely when the saw is not in use. Small pieces of wood can become wedged in the guard and prevent it from closing over the blade. 2. Clean, sharpen, or replace dulled or gummy blades. |
| <p>Objective 6</p> <p><i>Refer to PPt 4 or display the actual tool when explaining the main parts and features. Discuss safety and maintenance considerations.</i></p> <p> PPt 4 – Reciprocating Saw</p> | <p>List the uses and safeguards for a reciprocating saw.</p> <p>Main parts</p> <ol style="list-style-type: none"> 1. On/off switch 2. Power cord 3. Handle 4. Shoe 5. Blade <p>Uses</p> <ol style="list-style-type: none"> 1. Relief cuts 2. Irregular cuts |


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| | <ol style="list-style-type: none"> 3. Crosscuts 4. Pocket cuts <p>Additional features</p> <ol style="list-style-type: none"> 1. Heavy duty yet compact in size, making it useful for work in a close area where it would be difficult to operate a circular saw 2. Because of maneuverability, particularly useful for making irregular and pocket cuts 3. Different kinds of blades for cutting different types of materials, such as wood, metal, plastic, and plaster 4. Shoe adjusts for cutting at different depths <p>Safety considerations</p> <ol style="list-style-type: none"> 1. Choose the correct blade for the cut. 2. Choose the appropriate speed for the cut. Dense materials are cut at a slower speed and soft materials are cut at a higher speed. 3. Make sure the saw is operating at full speed before beginning the cut. 4. Hold the shoe against the work at all times. <p>Maintenance considerations</p> <ol style="list-style-type: none"> 1. Follow the manufacturer's recommendations for regular service. 2. Clean, sharpen, or replace blades as needed. |
| <p>Objective 7</p> <p><i>Refer to PPt 5 or display the actual tool when explaining the main parts and features. Discuss safety and maintenance considerations.</i></p> <p> PPt 5 – Band Saw</p> | <p>List the uses and safeguards for a band saw.</p> <p>Main parts</p> <ol style="list-style-type: none"> 1. On/off switch 2. Upper and lower wheels and wheel guards 3. Table 4. Blade 5. Upper and lower blade guides 6. Arm <p>Uses</p> <ol style="list-style-type: none"> 1. Straight cuts 2. Irregular cuts 3. Curved cuts 4. Bevel cuts |

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| | <p>Additional features</p> <ol style="list-style-type: none"> 1. Size of band saw determined by the diameter of its wheels (e.g., a 14-in. band saw has 14-in. wheels) 2. Thin blade forms a loop over the two wheels and through the two blade guides 3. Upper and lower blade guides for holding blade on wheels 4. Different types of blades for different cuts <p>Safety considerations</p> <ol style="list-style-type: none"> 1. Choose the correct blade for the cut and material. 2. Make sure the blade is held tightly in the saw and the guide is within 1/8 in. of the piece. The teeth should point downward. 3. Plan the cut so the work and the waste piece of wood can be controlled. Make sure the board cannot strike the arm of the saw. 4. Turn off the saw immediately if the blade breaks or “clicks” during cutting. A clicking noise could indicate that the blade is cracked. 5. Turn off the saw before backing out of a cut. <p>Maintenance considerations</p> <ol style="list-style-type: none"> 1. Maintain proper blade tension. 2. Maintain proper tracking of the blade. The blade should stay at the center of the wheels. 3. Repair or replace broken blades. |
| <p>Objective 8</p> <p><i>Refer to PPTs 6 and 7 or display the actual tool when explaining the main parts and features. Discuss safety and maintenance considerations.</i></p> <p> PPT 6 – Table Saw</p> <p> PPT 7 – Use of a Push Stick With a Table Saw</p> | <p>List the uses and safeguards for a table saw.</p> <p>Main parts</p> <ol style="list-style-type: none"> 1. On/off switch 2. Blade-height adjustment wheel 3. Rip fence 4. Miter groove 5. Blade 6. Blade guard 7. Table 8. Blade-angle adjustment wheel <p>Uses</p> <ol style="list-style-type: none"> 1. Rip cuts 2. Crosscuts |

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| | <ol style="list-style-type: none"> 3. Mitering 4. Bevel cuts 5. Joint making <p>Additional features</p> <ol style="list-style-type: none"> 1. Similar to a portable circular saw but in a stationary setup 2. Size of table saw determined by the diameter of the largest blade it will hold 3. Different kinds of blades, such as rip and crosscut blades, for different kinds of cuts 4. Tilting arbor or tilting table allows saw to make angle cuts 5. Rip fence used for straight rip cuts <p>Safety considerations</p> <ol style="list-style-type: none"> 1. Choose the correct blade for the cut. 2. Adjust the angle and height of the blade to accommodate the cut. The teeth should point in the direction of the blade's rotation. 3. Stand to the side of the blade and do not reach across the table. 4. Keep hands at least 6 in. from the blade. 5. Use a push stick to guide smaller stock. <p>Maintenance considerations</p> <ol style="list-style-type: none"> 1. Check the blade to be sure it is not warped. 2. Remove any accumulation of sawdust. A collection of sawdust could cause the motor to overheat. 3. Use silicone or powdered graphite, not oil, to keep screw threads working freely. With oil, screw threads could become gummed up with sawdust. 4. Remove rust on unpainted parts with oiled steel wool. Remove excess oil after cleaning with steel wool and coat the area with paste wax. |
| <p>Objective 9</p> <p><i>Refer to Ppt 8 or display the actual tool when explaining the main parts and features. Discuss safety and maintenance considerations.</i></p> | <p>List the uses and safeguards for a shaper.</p> <p>Main parts</p> <ol style="list-style-type: none"> 1. On/off switch 2. Spindle-height adjustment wheel 3. Miter gauge groove 4. Spindle |

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| <p>☐ PPt 8 – Shaper</p> | <ol style="list-style-type: none"> 5. Cutter 6. Cutter guard 7. Fence <p>Uses</p> <ol style="list-style-type: none"> 1. Cutting decorative edges 2. Cutting moldings 3. Cutting joints <p>Additional features</p> <ol style="list-style-type: none"> 1. Size of a shaper determined by the diameter of the spindle 2. Cutters available in a variety of shapes and sizes for making different patterns 3. Fence adjustable, used as a guide for straight cuts <p>Safety considerations</p> <ol style="list-style-type: none"> 1. Check all adjustments and locking nuts before using the machine. 2. Check the rotation of the cutter. Work must always be fed into the cutter opposite the direction of rotation. 3. Make sure the piece has no warps or cracks that could cause material to be thrown. 4. Always use proper guards and clamps. 5. Use a holder or a push stick when the piece less than 1 ft in length. <p>Maintenance considerations</p> <ol style="list-style-type: none"> 1. Follow the manufacturer's recommendations for proper lubrication. Oil is generally a good lubricant for locations not exposed to sawdust. Silicone can be used in areas where sawdust collects. 2. Inspect belts and follow the manufacturer's specifications for proper tension. |
| <p>Objective 10</p> <p><i>Refer to PPt 9 or display the actual tool when explaining the main parts and features. Discuss safety and maintenance considerations. Have students complete AS 1 to answer</i></p> | <p>List the uses and safeguards for a jointer.</p> <p>Main parts</p> <ol style="list-style-type: none"> 1. On/off switch 2. Table adjustment levers or wheels 3. Infeed table 4. Tilting fence 5. Cutterhead |

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| <p><i>questions about safety and maintenance procedures in the shop.</i></p> <p>☐ PPt 9 – Jointer</p> <p>📄 AS 1 – Safety and Maintenance Procedures for Power Tools for Woodworking</p> | <ol style="list-style-type: none"> 6. Cutter guard 7. Outfeed table <p>Uses</p> <ol style="list-style-type: none"> 1. Planing edges 2. Planing surfaces 3. Cutting bevels and chamfers <p>Additional features</p> <ol style="list-style-type: none"> 1. Does similar work to the hand plane 2. Infeed table, fence, and outfeed table are adjustable 3. Main adjustable parts: infeed table, tilting fence, and outfeed table 4. Length of cutterhead blades determines the size of the jointer and the maximum width of the board it will cut <p>Safety considerations</p> <ol style="list-style-type: none"> 1. Make the correct adjustments for the infeed and outfeed tables and tilting fence. Do not exceed recommended maximum cuts. 2. Make sure the outfeed table is set at the same height as the cutter edges at the highest point of their rotation to avoid tapering or biting stock. 3. Perform cuts on stock that is at least 1 ft in length. 4. Only plane surfaces that are at least 3/8 in. thick. 5. Cut with the grain of the wood. 6. Make sure stock is free of knots and splits. 7. Keep hands at least 6 in. from the cutterhead. 8. Use a push stick and feather board when necessary. <p>Maintenance considerations</p> <ol style="list-style-type: none"> 1. Make sure knives are sharp. Dull knives can cause kickback. 2. Follow the manufacturer's recommendations for lubricating the machine. Some disassembly may be needed to reach all parts that require lubrication. 3. Replace sealed bearings if they are worn. |

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| <p>Application:</p> <p> AS 1 – Safety and Maintenance Procedures for Power Tools for Woodworking</p> | <p>Answers to AS 1 Answers will vary.</p> <p>Other activities</p> <ol style="list-style-type: none"> 1. Accompany or follow the lesson with instructor demonstrations of each tool students will be using and procedures they will be expected to perform. Discuss any specific safety features relevant to the tools and machines in the shop that were not covered in the lesson outline above, and supplement the lesson with discussion of any equipment not covered. Begin or end demonstrations by having students review major parts of the tool and basic use and safety considerations. |
| <p>Closure/Summary</p> | <p>Power tools can shorten the time it takes to complete woodworking jobs, but they must be used safely to prevent injuries. Using these tools safely requires choosing the right tool for the job, knowing how the tool works, and making the correct tool adjustments. Safe use also requires regular maintenance to be sure the tool is working properly.</p> |
| <p>Evaluation: Quiz</p> | <p>Answers:</p> <ol style="list-style-type: none"> 1. b 2. d 3. b 4. a 5. c 6. d 7. d 8. b 9. d 10. Students should provide five of the following: <ol style="list-style-type: none"> a. Follow instructions from labels and warnings on containers and tools, from the manufacturer's recommendations for use and maintenance, on signs posted in the work area, and from directions given by the instructor. |

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| | <ul style="list-style-type: none"> b. Wear safety glasses in the shop at all times. c. Wear protective gear such as gloves, earplugs, and safety shoes if appropriate. d. Do not wear loose-fitting clothing that could get caught in a moving part. e. Secure long hair to avoid getting it caught. f. Keep work areas clean and free of clutter. g. Inspect each tool before using it to make sure it is working properly. h. Tell the instructor about any damaged tool. i. Do not use a tool that does not function properly. j. Return each tool to its proper place of storage. <p>11. Students should provide three of the following:</p> <ul style="list-style-type: none"> a. Unplug a tool or disconnect it from its battery before inspecting it and making adjustments. b. Use tools that are double insulated or that have grounded plugs. c. Always plug a tool into a power source with a ground-fault circuit interrupter (GFCI or GFI), which will shut off power if a short occurs. If a GFCI is not installed in an outlet, a portable GFCI can be plugged into a grounded outlet. d. Do not stand on wet ground or a wet surface while operating an electric tool. e. Make sure stationary power tools are anchored to the floor. f. Make sure all guards and shields are in place and vents are clear of debris. g. Do not bend the cord sharply or use the cord to pull it from an outlet or carry the tool. These actions could break a power cord and a broken power cord is an electrical hazard. h. Use only the battery specified by the manufacturer for the tool being used. i. Use only the recharger designed for the batteries being used. j. Always store battery packs safely so that no metal can come in contact with the terminals. This can short-circuit the battery and cause sparks, fire, or burns. |

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| | <p>12. Students should provide three of the following:</p> <ul style="list-style-type: none"> a. Disconnect pneumatic tools for all inspections and adjustments. b. Do not join or separate quick-disconnect couplings on high-pressure lines when bystanders are nearby. c. Do not use compressed air for cleanup if the pressure is 30 lb per sq in. (psi) or greater. d. Do not point an air stream at anyone. High-pressure air can drive dust into the eyes, damage eardrums, and cause other types of injury. e. Inspect couplings and air lines regularly for evidence of wear and damage. f. Make sure tanks and air lines are free of moisture and air filters are in place. g. Follow the manufacturer's recommendations for hose size and maximum air pressure. h. Oil pneumatic tools regularly according to the manufacturer's recommendations. |