

**Activity
14.1**

Name _____ Date _____ Hour _____

Unit Word Search

Student Materials

Pencil

Directions

Fill in the blank with the correct term from the word bank. Find each word within the word search.

- _____ 1. Gas often used with oxygen in the cutting of metal
- _____ 2. Personal Protective _____
- _____ 3. Characterized by a loud snap or pop when cutting
- _____ 4. Type of welding machine that acts as an electrical generator
- _____ 5. Also known as a rod or stick
- _____ 6. _____ current machines plug into normal 220V wiring
- _____ 7. Characterized by a shrill hissing sound; flame burning back into the torch body
- _____ 8. Slit in metal as a result of the cutting process
- _____ 9. The combination of oxygen and iron is called _____.
- _____ 10. Pattern used by welders such as circles or crescents
- _____ 11. Needs to assessed before cutting metal to make sure it is neutral
- _____ 12. A hot flame is produced when a combustible gas is combined with _____.
- _____ 13. Welding arc striking method similar to striking a match
- _____ 14. Travel speed, oxygen pressure, preheat, clearance
- _____ 15. Layer on top of a weld created as the weld cools
- _____ 16. Type of bead created by welding in a straight line

- _____ 17. Holds either oxygen or acetylene gas
- _____ 18. Provides a gas shield for the molten pool during the welding process
- _____ 19. Striking method where the electrode is touched to the base metal and quickly raised
- _____ 20. This part of the cutting attachment allows mixed gas and cutting oxygen to exit separately

Word Bank

acetylene
alternating
backfire
cylinder
direct

electrode
equipment
errors
flame
flashback

flux
kerf
oxidation
oxygen
scratching

slag
stringer
tapping
tip
weaving

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

Activity 14.2

Name _____ Date _____ Hour _____

Start, Run and Stop a Bead

Equipment and Supplies

Clean piece of metal 1/4 inch to 3/8 inch thick,
4 inches by 4 inches (the metal should be free
of rust, paint, oil, or any other substance)

Welding machine

Electrode holder and cable

Ground clamp and cable

Helmet

Leather gloves

E6011 electrodes, 1/8 inch

Welding booth or table

Safety glasses or goggles (OSHA approved)

Chipping hammer

Wire brush

Proper protective clothing, including leather shoes
or boots



Procedure

- _____ 1. Set the amperage on the welding machine according to your instructor's recommendations.
- _____ 2. Arrange the cables to reach the work area easily.
- _____ 3. Attach the ground clamp to the welding booth or table.
- _____ 4. Position and adjust the welding helmet for maximum comfort.
- _____ 5. Put on welding gloves.
- _____ 6. Position the piece of metal on a table or booth for comfort during welding. Right-handed welders should weld from left to right. The opposite is correct for left-handed welders.
- _____ 7. Place the bare end of the electrode in the electrode holder.
- _____ 8. Turn the welding machine on while holding the electrode holder in one hand.
- _____ 9. Call out, "Cover!"
- _____ 10. Lower the helmet and strike an arc 1 inch from the edge where the bead is to begin.
- _____ 11. When the arc burns brightly, move to the edge, maintaining the correct arc length, and begin forming a puddle.
- _____ 12. Weld across the metal in a straight line 2 inches.
- _____ 13. To stop the bead, lift the electrode quickly. Moving the electrode back through the puddle prevents cracks from forming in the puddle.
- _____ 14. Restart by calling, "Cover!" Then lower your helmet and striking an arc about 1 inch in front of the crater.

- _____ 15. When the arc burns brightly, move back through the crater and resume the bead.
- _____ 16. When the bead across the metal is complete, stop by moving the electrode back through the puddle and lifting up.
- _____ 17. Turn off the welding machine.
- _____ 18. Use a chipping hammer and wire brush to remove slag from the bead.
- _____ 19. Continue to practice running beads. Concentrate your practice on running straight beads all the way across the pad without stopping. Also, concentrate on keeping them parallel to each other.
- _____ 20. Turn off the welding machine.
- _____ 21. Clean your work area and return all equipment to its proper place.

Product evaluation

Evaluator Note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of “3” or higher to demonstrate student mastery. (See the key below.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Grading Criteria				
Safety procedures followed	4	3	2	1
Correct electrode angles maintained	4	3	2	1
Correct arc length maintained	4	3	2	1
Correct speed of travel used	4	3	2	1
Uniform beads created	4	3	2	1
Equipment replaced	4	3	2	1
Work areas cleaned	4	3	2	1

Key

- 4 Skilled** Can perform the task with no additional assistance
- 3 Moderately Skilled** Has performed the task during the class period; limited additional assistance may be required
- 2 Limited Skill** Has performed the task during the training program; additional assistance is needed
- 1 Unskilled** Is familiar with the process, but is unable to perform the task

Activity 14.3

Name _____ Date _____ Hour _____

Oxyacetylene Equipment Set-up

Equipment and Supplies

Oxygen cylinder
Acetylene cylinder
Oxygen regulator
Acetylene regulator
Hoses
Wrench
Cylinder truck

Leak detection liquid or a small water container and
non-detergent hand soap
Clean paintbrush
Torch body with cutting attachment
Tip selection guide
Safety glasses or goggles



Procedure

Set up equipment:

- _____ 1. Inspect all equipment and connections for the presence of oil, grease, or damage. Do not use if oil, grease, or damage is present.
- _____ 2. Ensure that cylinders are securely fastened in a vertical position in the cylinder truck or in a permanent location. Remove steel safety caps from the cylinders, if present.
- _____ 3. Crack the valves of each cylinder by quickly opening and closing them to blow out dust.
- _____ 4. Connect the oxygen regulator to the oxygen cylinder. Tighten securely with a proper-sized wrench.
 - a. Turn the adjusting screw on the regulator counterclockwise until tension on the spring is released.
 - b. Stand to one side of the regulator as you slowly turn the oxygen cylinder valve wide open.
- _____ 5. Connect the acetylene regulator to the acetylene cylinder. Tighten securely with a proper-sized wrench.
 - a. Turn the adjusting screw on the acetylene regulator counterclockwise until tension on the spring is released.
 - b. Stand to one side of the regulator as you open the cylinder valve 1/2 to 3/4 turn.
- _____ 6. Connect the acetylene hose to the acetylene regulator. Tighten securely with a proper-sized wrench.
- _____ 7. Purge the hose by turning the regulator adjusting screw clockwise until the gas flows through the hose. Then quickly loosen the regulator adjusting screw.

- _____ 8. Connect the oxygen hose to the oxygen regulator. Tighten securely with a proper-sized wrench.
- _____ 9. Purge the oxygen hose using the same procedure.
- _____ 10. Connect the torch body to the oxygen and acetylene hoses, and close both valves on the torch body. Tighten securely with a proper-sized wrench.
- _____ 11. Attach the cutting attachment to the torch body.
NOTE: The tip size is determined by the thickness of the metal to be cut and the manufacturer's recommendations.
- _____ 12. Close the oxygen preheat valve on the cutting attachment.
- _____ 13. Turn the adjusting screw on the oxygen regulator clockwise until working pressure is reached.
- _____ 14. Turn the adjusting screw on the acetylene regulator clockwise until the correct working pressure is reached.
CAUTION: Acetylene is unstable at pressures greater than 15 psi. Do not exceed the recommended working pressure based on the tip size and the manufacturer's recommendations.

Test for leaks:

- _____ 15. Test all connections for leaks using leak detection liquid. If this is not available, test for leaks using soapsuds and water.
 - a. Mix a sliver of soap with a small amount of water in a clean container to create soapsuds.
 - b. Apply soapsuds with a clean paintbrush to all connections.
 - c. If any bubbles occur as a result of leaks, notify your instructor immediately.

Depressurize oxyacetylene equipment:

- _____ 16. Close the acetylene cylinder valve.
- _____ 17. Close the oxygen cylinder valve.
- _____ 18. Open the acetylene valve on the torch.
- _____ 19. Close the acetylene valve on the torch when the working pressure gauges reach zero.
- _____ 20. Release the adjusting screw on the acetylene regulator by turning counterclockwise.
- _____ 21. Open the oxygen preheat valve on the torch.

- _____ 22. Close the oxygen preheat valve on the torch when the working pressure gauge reaches zero.
- _____ 23. Release the adjusting screw on the oxygen regulator by turning counterclockwise.
- _____ 24. Close the oxygen valve on the torch.
- _____ 25. Place the torch and the hose on the hanger or brackets provided.
- _____ 26. Clean the work area and put away the equipment and materials.

Product evaluation

Evaluator Note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of “3” or higher to demonstrate student mastery. (See the key below.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Grading Criteria

Safety procedures followed	4	3	2	1
Regulators attached properly	4	3	2	1
Hoses attached properly	4	3	2	1
Torch attached properly	4	3	2	1
Valves opened and closed properly	4	3	2	1
Equipment replaced	4	3	2	1
Work areas cleaned	4	3	2	1

Key

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Activity 14.4

Name _____ Date _____ Hour _____

Adjusting Torch Flames

Equipment and Supplies

Oxy-gas torch with cutting attachment

Flint lighter

Wrench

Leather gloves

Shaded cutting goggles or shaded face shield

Safety glasses or goggles

Coveralls or protective clothing, including leather shoes or boots

Tip selection guide



Procedure

Turn on equipment:

- _____ 1. Check all cylinder, regulator, and torch valves to make sure that they are off.
- _____ 2. Open the acetylene cylinder valve 1/2 to 3/4 of a turn.
CAUTION: Never open acetylene cylinder valve more than 1 1/2 turns.
- _____ 3. Open the acetylene valve on the torch approximately 1/8 to 1/4 turn, depending on the type of equipment.
- _____ 4. Turn the adjusting screw on the acetylene regulator clockwise until the desired pressure is reached.
NOTE: Oxygen and acetylene pressures and tip size depend upon the thickness of the metal to be cut. Use the pressures and tip size recommended by the manufacturer.
- _____ 5. Close the acetylene valve on the torch.
- _____ 7. Open the oxygen torch valve all the way.
- _____ 9. Turn the adjusting screw on the oxygen regulator clockwise until the desired pressure is reached.
- _____ 10. Close the oxygen preheat valve on the cutting attachment.

Light the torch:

- _____ 11. Open the acetylene valve on the torch 1/4 turn.
- _____ 12. Light the torch with a flint lighter, and adjust the acetylene valve on the torch until the smoke on the flame clears.
NOTE: The correct position of the flint lighter does not obstruct the flow of gas from the cutting tip.

Adjust cutting torch to a neutral flame:

- _____ 13. Open the oxygen preheat valve slowly and adjust to a neutral flame.
- _____ 14. Depress oxygen cutting lever and check to see that a neutral flame is present.
NOTE: If necessary, adjust the oxygen preheat valve with the oxygen cutting lever depressed until a neutral flame is secured.

Turn off equipment:

- _____ 15. Close the acetylene valve on the torch.
- _____ 16. Close the oxygen preheat valve.
- _____ 17. Close the acetylene cylinder valve.
- _____ 18. Close the oxygen cylinder valve.
- _____ 19. Open the acetylene valve on the torch.
- _____ 20. Close the acetylene valve on the torch when the working pressure gauge reaches zero.
- _____ 21. Release the adjusting screw on the acetylene regulator by turning counter-clockwise.
- _____ 22. Open the oxygen preheat valve on the torch.
- _____ 23. Close the oxygen preheat valve on the torch when the working pressure gauge reaches zero.
- _____ 24. Release the adjusting screw on the oxygen regulator by turning counterclockwise.
- _____ 25. Close the oxygen valve on the torch.

_____ 26. Place the torch and hose on the hanger or brackets provided.

_____ 27. Clean the work area, and put away the equipment and materials.

Product evaluation

Evaluator Note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of “3” or higher to demonstrate student mastery. (See the key below.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Grading Criteria				
Safety procedures followed	4	3	2	1
Torch lit properly	4	3	2	1
Torch turned off correctly	4	3	2	1
Equipment replaced	4	3	2	1
Work areas cleaned	4	3	2	1

Key

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Activity 14.5

Name _____ Date _____ Hour _____

Making 90° Cuts

Equipment and Supplies

Oxy-gas torch with cutting attachment

Tip selection guide

Mild steel plate, 1/4 inch to 1/2 inch thick, at least 4 inches wide and 8 inches long

Soapstone with a sharp point or edge

Straightedge

Leather gloves

Shaded cutting goggles or shaded face shield

Safety glasses or goggles

Pliers

Coveralls or protective clothing, including leather shoes or boots

Flint lighter

Welding or cutting table

Slag box

Can of water



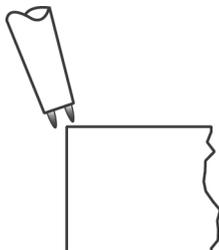
Procedure

Turn on equipment:

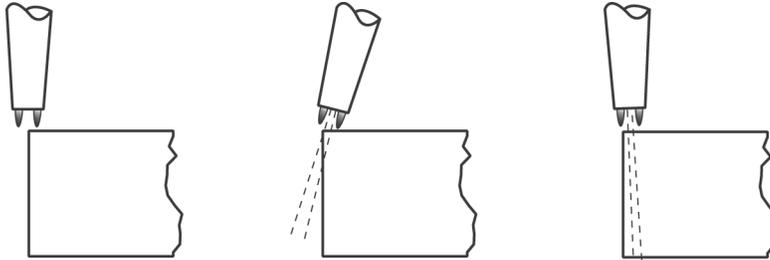
- _____ 1. Using a soapstone and straightedge, mark three parallel lines 2 inches apart on the plate to be cut.
- _____ 2. Turn on the oxyacetylene rig and adjust the working pressures until the desired pressure is reached.
NOTE: Working pressures depend on the tip size and thickness of the metal to be cut. Use the pressures and tip size recommended by the manufacturer.
- _____ 3. Place the plate to be cut over the slag box.
- _____ 4. Light the torch.
- _____ 5. Adjust to neutral flame.
- _____ 6. Place hoses behind you and assume a comfortable position.

Make a 90-Degree Cut:

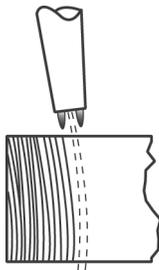
- _____ 7. Hold the preheat flame with the tip of the inner cone 1/16 to 1/8 inch above the top of the plate at the right edge until a red spot appears.



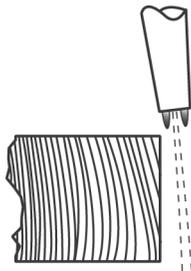
- _____ 8. Depress the oxygen cutting lever and move from the right to the left across the plate.
NOTE: Left-handed operators move from left to right.



- _____ 9. While cutting, hold the tip perpendicular to the work and at a very slight angle in the direction of travel. Keep the inner cone 1/16 to 1/8 inch above the work.



- _____ 10. Cut all the way across the steel. Release the oxygen cutting lever when the cut is complete.



- _____ 11. Continue making 90-degree cuts until you have developed a good technique. Cool the work between each cut, or the cutting flame will require adjustment between each cut.

Restart a Cut:

- _____ 12. Stop and restart a cut.
a. Release the oxygen cutting lever after you have made a cut partway along the piece of steel.
b. Preheat only the point where cutting action was stopped.
c. Slowly depress the oxygen cutting lever and continue the cut.
d. Repeat this procedure until you have developed proper skill.
- _____ 13. Turn off the flame.

- _____ 14. Cool the metal by picking it up with pliers and placing it in a can of water.
- _____ 15. Show your work to your instructor for approval and grading.
- _____ 16. After the instructor’s approval, depressurize the oxyacetylene equipment.
- _____ 17. Clean the work area and put away the equipment and materials.

Product evaluation

Evaluator Note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of “3” or higher to demonstrate student mastery. (See the key below.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Grading Criteria				
Safety procedures followed	4	3	2	1
90-degree cut completed	4	3	2	1
Cut restarted	4	3	2	1
Equipment replaced	4	3	2	1
Work areas cleaned	4	3	2	1

Key

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Activity 14.6

Name _____ Date _____ Hour _____

Cutting Errors

Student Materials

Pencil

Directions

Look at each picture and read the description to determine the cutting error that occurred. Write the error(s) on the line provided.



1. **Bad gouging at bottom of cut**

Error _____



2. **Adhering slag at bottom edge**

Error _____



3. **Top edge melted over, vertical drag lines**

Error _____



4. Top edge is dished with irregular drag lines

Error _____



5. Drag line irregularities

Error _____



6. Pronounced break in the drag line with irregular cut edge and excess slag

Error _____



7. Vertical drag lines, irregular bottom edge

Error _____



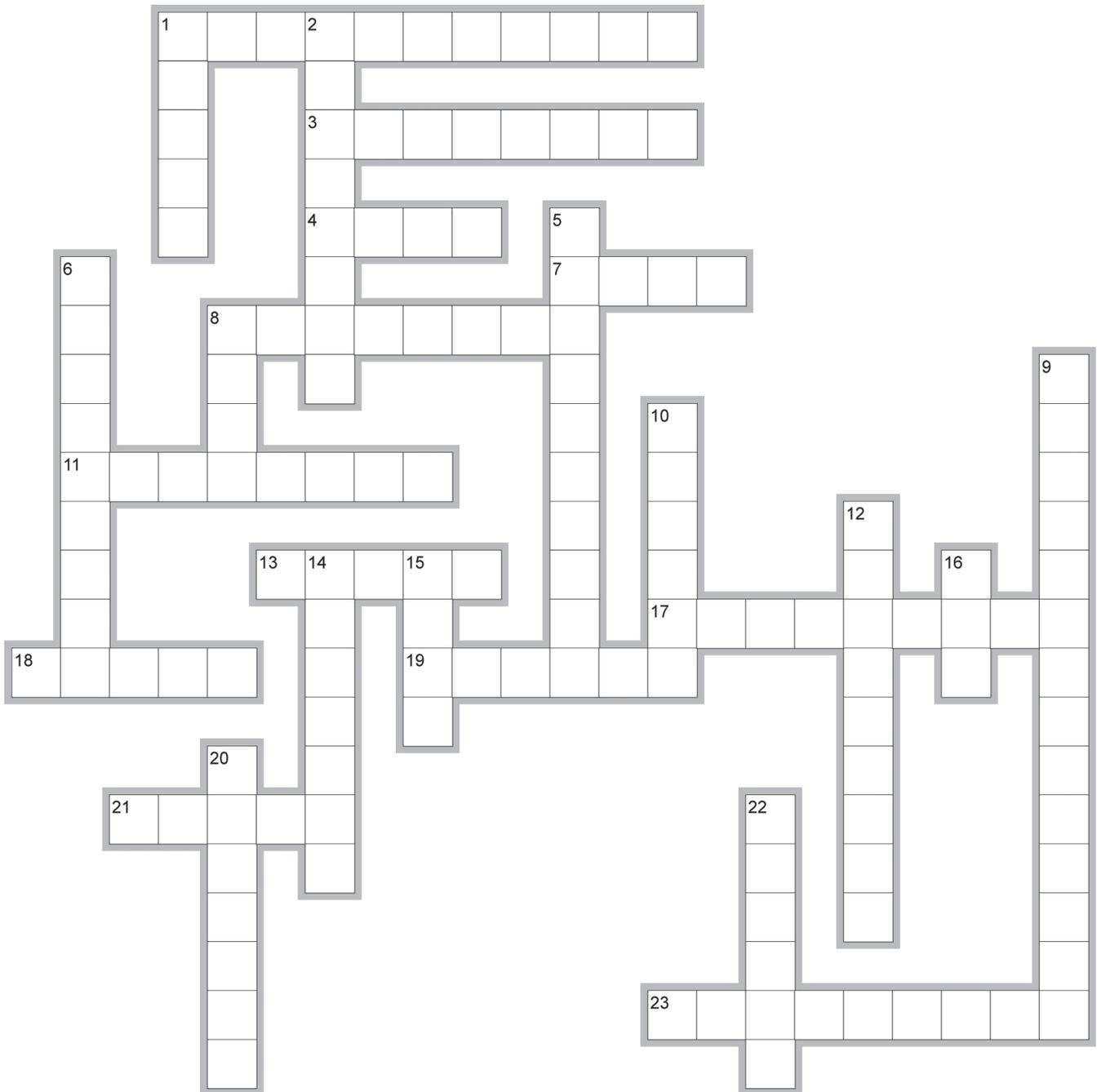
8. Bad gouges at restarting point

Error _____

**Activity
14.7**

Name _____ Date _____ Hour _____

Unit Review Crossword



EclipseCrossword.com

Across

1. Oxyacetylene flame with too much acetylene
3. Type of hammer used to knock away slag
4. Provides a shielding gas
7. How electrodes are identified
8. Straight line welding bead
11. Method of inert gas welding that yields a high quality weld
13. Shielded metal arc welding is also known as this type of welding
17. Burning and rust are examples of this
18. Allows oxygen to travel through the oxygen tube on a cutting attachment
19. Colorless, odorless, tasteless gas
21. Oxygen hoses attached to a cylinder are colored ____ .
23. Cutting error dealing with the distance of the tip from the metal

Down

1. Used to keep cylinders upright and stable
2. Torch flame burns back into the tip
5. Method for striking an arc similar to striking a match
6. Metal welding rod coated with flux
8. Layer of burned flux and impurities
9. Cutting error resulting in irregular drag lines
10. Arc welding uses an electric current to bond metal by ____ .
12. Flame burns back into the cutting torch body
14. Method for striking an arc
15. The welding machine should be allowed to do this before turning off
16. This machine uses a combination of electricity and inert shielding gas with a consumable wire
20. One of the most useful agricultural mechanics skills
22. Clamp that grips the electrode