Chapter 2

Safety in Welding

ANSWERS TO REVIEW QUESTIONS

1. What is the key to preventing accidents in a welding shop?
   Getting specific safety information about dangers on the job and using caution and common sense.
2. Who is ultimately responsible for the welder's safety?
   Each person must take personal responsibility for their own safety and the safety of others on the job.
3. Describe the three classifications of burns.
   1st degree—skin reddish in color, tender, and painful.
   2nd degree—blisters and possible breaks in the skin.
   3rd degree—surface of the skin and possibly the tissue below are white or charred.
4. What emergency steps should be taken to treat burns?
   1st—Put the burned area under cold water or cover with cold compresses. Then cover the area with sterile bandages or a clean cloth.
   2nd—Treat with cold water like a first degree burn but cover with a sterile bandage and seek medical attention.
   3rd—Apply cool compresses and seek medical attention immediately.
5. List the three types of light that may be present during welding.
   The three types of light include ultraviolet, infrared, and visible.
6. Which type of light is the most likely to cause burns? Why?
   Ultraviolet—because the burn it causes is not felt until sometime later.
7. What can be done on the job site to reduce the danger of reflected light?
   To reduce the danger from reflected light, the welding area, if possible, should be painted with a flat, dark-colored or black paint. Flat black will reduce the reflected light by absorbing more of it than any other color. When the welding is to be done

on a job site, in a large shop or other area that cannot be painted, weld curtains can be placed to absorb the welding light.

8. What is the name of the eye burn that can occur in a fraction of a second?

   Flash burn

9. In what two ways can ultraviolet light burn the eyes?

   The eye can be burned on the white or on the retina by ultraviolet light.

10. Why is it important to seek medical treatment for eye burns?

    Dead cells in the moist environment of the eyes will promote the growth of bacteria that cause infection if not properly treated.

11. What fabric(s) are the best choice to wear as general work clothing in a welding shop?

    The best choice is 100% wool, another good choice is 100% cotton.

12. Describe the ideal work shirt, pants, boots, and caps that should be worn in a welding shop**.**

    - **Shirts must have long sleeves to protect the arms, must have a high-buttoned collar to protect the neck, must be long enough to tuck into the pants to protect the waist, and must have flaps on the pockets to keep sparks out (or have no pockets).**
    - **Pants must have legs long enough to cover the tops of the boots and must be without cuffs that would catch sparks.**
    - **Boots must have high tops to keep out sparks, must have steel toes to prevent crushed toes, and must have smooth tops to prevent sparks from being trapped in seams.**
    - **Caps should be thick enough to prevent sparks from burning the top of a welder's head**

13. Why is it unsafe to carry butane lighters or matches in your pockets while welding?

    Lighters and matches can easily catch fire or explode if they are subjected to the heat and sparks of welding

14. What special protective items can be worn to provide extra protection for a welder's hands, arms, body, waist, legs, and feet?

    Leather capes, jackets, aprons, sleeves, gloves, caps, pants, knee pads, and spats.

15. Why must eye protection be worn at all times in the welding shop?

UV exposure can go undetected because it is happening with the symptoms not showing up until the next day.

16. What types of injuries can occur to the ears during welding?

The sound level is at times high enough to cause pain and some loss of hearing if the welder's ears are unprotected.

17. What types of protection are available to protect the ears during welding?

Earmuffs that cover the outer ear completely and earplugs that fit into the ear canal.

18. What types of information should be covered in a respirator training program?

- **proper use of respirators, including techniques for putting them on and removing them,**
- **schedules for cleaning, disinfecting, storing, inspecting, repairing, discarding, and performing other aspects of maintenance of the respiratory protection equipment,**
- **selection of the proper respirators for use in the workplace and any respiratory equipment limitations,**
- **procedures for testing the proper fitting of respirators,**
- **proper use of respirators in both routine and reasonably foreseeable emergency situations, and**
- **regular evaluation of the effectiveness of the program**

19. Name two types of respirators and describe how they work.

Answers will vary.

- **Air-purifying respirators have an air-purifying filter, cartridge, or canister that removes specific air contaminants by passing ambient air through the air-purifying element.**
- **Atmosphere-supplying respirators supply breathing air from a source independent of the ambient atmosphere; this includes both the supplied-air respirators (SARs) and self-contained breathing apparatus (SCBA) units.**
- **Demand respirators are atmosphere-supplying respirators that admit breathing air to the facepiece only when a negative pressure is created inside the facepiece**

by inhalation.

- **Positive pressure respirators are respirators in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.**
- **Powered air-purifying respirators (PAPRs) are air-purifying respirators that use a blower to force the ambient air through air-purifying elements to the inlet covering,**
- **Self-contained breathing apparatuses (SCBAs) are atmosphere-supplying respirators for which the breathing air source is designed to be carried by the user.**
- **Supplied-air respirators (SARs), or airline respirators, are atmosphere-supplying respirators for which the source of breathing air is not designed to be carried by the user.**

20. List the materials that can give off dangerous fumes during welding and require forced ventilation**.**

Forced ventilation is always required when welding on metals that contain zinc, lead, beryllium, cadmium, mercury, copper, austenitic manganese, or other materials that give off dangerous fumes.

21. Why must metal that has been used before be cleaned prior to welding?

Any metal that has been painted or has any grease, oil, or chemicals on its surface must be thoroughly cleaned prior to welding because they can generate dangerous fumes.

22. Under what conditions can natural ventilation be used?

Areas that have 10,000 cubic feet (283 cubic meters) or more per welder, or that have ceilings 16 feet (4.9 meters) high or higher may not require forced ventilation unless fumes or smoke begin to collect.

23. Name two advantages of recycling scrap metal**.**

It is good for the environment and it can generate revenue for the shop.

24. When must forced ventilation be used?

Small shops or shops with large numbers of welders require forced ventilation. Forced ventilation is always required when welding on metals that contain zinc,

lead, beryllium, cadmium, mercury, copper, austenitic manganese, or other materials that give off dangerous fumes.

25. Who must be provided with safety data sheets (SDSs)?

    They must be provided to anyone using the product or anyone working in the area where the products are in use.

26. Describe an acceptable storage area for a cylinder of fuel gas.

    The storage areas must be separated by 20 ft (6.1 m) or by a wall 5-ft high (1.5 m) with at least a 30-minute (min) burn rating.

27. How must high-pressure gas cylinders be stored so they cannot be accidentally knocked over?

    Cylinders must be secured with a chain or other device.

28. What should be done with a leaking cylinder if the leak cannot be stopped?

    The cylinder should be moved to a vacant lot or an open area. The pressure should then be slowly released after posting a warning sign.

29. Why is it important for acetylene cylinders to not be stored horizontally?

    It takes time for the acetone inside the cylinder to flow away from the valve.

30. What is hot work?

    Welding is considered to be "hot work" by the National Association of Fire Prevention.

31. How far away should highly combustible materials be from any welding or cutting?

    Highly combustible materials should be 35 ft (10.7 m) or more away from any welding.

32. When is a fire watch needed?

    Anytime that welding will be near anything that might catch fire.

33. List the four types of fire extinguishers and the types of material for which they are used.

    - **Type A fire extinguishers are used for combustible solids (articles that burn), such as paper, wood, and cloth.**
    - **Type B fire extinguishers are used for combustible liquids, such as oil, gas, and paint thinner.**
    - **Type C fire extinguishers are used for electrical fires.**
    - **Type D fire extinguishers are used on fires involving combustible metals, such as**

zinc, magnesium, and titanium.

34. Why is it important to have a planned maintenance program for tools and equipment?
In order to catch potential problems before they result in lost time, injuries, or death.

35. Why is it important to keep a welding area clean?
Collections of steel, welding electrode stubs, wire, hoses, and cables are difficult to work around and easy to trip over.

36. What should you do if you have to leave a piece of hot metal unattended?
If a piece of hot metal is going to be left unattended, write the word hot on it before leaving.

37. Why must a mushroomed chisel or hammer be reground?
To avoid injuring your hand

38. What causes most electric shock in the welding industry?
Most electric shocks in the welding industry are a result of accidental contact with bare or poorly insulated conductors.

39. According to the Welding Safety Checklist in Figure 2-44, what are the factors necessary for a confined space hazard?
Metal enclosure, wetness, restricted entry, heavier than air gas, welder inside or on workpiece

40. What can happen if too much power is being carried by a cable?
It will overheat and break down the insulation rapidly.

41. Why must equipment be turned off and unplugged before working on the electrical terminals?
To prevent electrocution

42. According to Table 2-2 what gauge wire size would be needed for a power tool that has a nameplate amperage of 9 and a cord length of 100 feet?
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43. What is a GFCI?
A ground-fault circuit interpreter (GFCI) A ground-fault circuit interrupter

44. List five safety tips for safe extension cord use.
Answers will vary.

- **Always connect the cord of a portable electric power tool into the extension cord before the extension cord is connected to the outlet.**
- **Always unplug the extension cord from the receptacle before unplugging the cord of the portable power tool from the extension cord.**
- **Extension cords should be long enough to make connections without being pulled taut, creating unnecessary strain or wear, but should not be excessively long.**
- **Be sure that the extension cord does not come in contact with sharp objects or hot surfaces. The cords should not be allowed to kink, nor should they be dipped in or splattered with oil, grease, or chemicals.**
- **Before using a cord, inspect it for loose or exposed wires and damaged insulation. If a cord is damaged, replace it. This also applies to the tool's power cord.**
- **Extension cords should be checked frequently while in use to detect unusual heating. Any cable that feels more than slightly warm to a bare hand placed outside the insulation should be checked immediately for overloading.**
- **See that the extension cord is positioned so that no one trips or stumbles over it.**
- **To prevent the accidental separation of a tool cord from an extension cord during operation, make a knot or use a cord connector.**
- **Extension cords that go through dirt and mud must be cleaned before storing.**

45. List 10 safety rules for the safe use of portable electric tools.

Answers will vary.

Following are a few safety precautions that should be observed:

- **Know the tool. Learn the tool's applications and limitations as well as its specific potential hazards by reading the manufacturer's literature.**
- **Ground the portable power tool unless it is double insulated. If the tool is equipped with a three-prong plug, it must be plugged into a three-hole electrical receptacle. Never remove the third prong.**
- **Do not expose the power tool to water or rain. Do not use a power tool in wet locations.**

- **Keep the work area well lighted. Avoid chemical or corrosive environments.**
- **Because electric tools spark, portable electric tools should never be started or operated in the presence of propane, natural gas, gasoline, paint thinner, acetylene, or other flammable vapors that could cause a fire or explosion.**
- **Do not force a cutting tool to cut faster. It will do the job better and more safely if operated at the cutting rate for which it was designed.**
- **Use the right tool for the job. Never use a tool for any purpose other than that for which it was designed.**
- **Wear eye protectors. Safety glasses or goggles will protect the eyes while you operate power tools.**
- **Wear a face or dust mask if the operation creates dust.**
- **Take care of the power cord. Never carry a tool by its cord or yank it to disconnect it from the receptacle.**

46. Why is important to not weld when everything is wet?

Electrical resistance is lowered in the presence of water or moisture, so welders must take special precautions when working under damp or wet conditions.

47. List two types of grinders used by welders.

Pedestal grinder and portable grinder

48. How close to the grinding stone face should the tool rest be adjusted?

When the stone wears down, keep the tool rest adjusted to within 1/16 in. (2 mm).

49. Name metal cutting machines used in the welding shop and their advantages.

Many types of mechanical metal cutting machines are used in the welding shop—for example, shears, punches, cut-off machines, and band saws. Their advantages over thermal cutting include little or no post-cutting cleanup, the wide variety of metals that can be cut, and the fact that the metal is not heated.

50. Describe how a person should safely lift a heavy object.

When you are lifting a heavy object, the weight of the object should be distributed evenly between both hands, and your legs should be used to lift, not your back.

51. List the things that should be inspected on a ladder.

Look for loose or damaged steps, rungs, rails, braces, and safety feet. Check to see that all hardware is tight including hinges, locks, nuts, bolts, screws, and rivets.

Wooden ladders must be checked for cracks, rot, or wood decay.

52. List and explain five ladder use safety rules.

Answers will vary.

- **Follow all recommended practices for safe use and storage.**
- **Do not exceed the manufacturer's recommended maximum weight limit for the ladder.**
- **Before setting up a ladder, make certain that it will be erected on a level, solid surface.**
- **Never use a ladder in a wet or muddy area where water or mud will be tracked up the ladder's steps or rungs. Only climb or descend ladders with clean, dry shoes.**
- **Tie the ladder securely in place.**
- **Climb and descend the ladder cautiously.**
- **Do not carry tools and supplies in your hand as you climb or descend a ladder**
- **Use a rope to raise or lower the items once you are safely in place.**
- **Never use ladders around live electrical wires.**
- **Never use a ladder that is too short for the job so you have to reach or stand on the top step.**
- **Wear well-fitted shoes or boots.**