Chapter 1 Review Questions Answer Key

1. What are the three Rs of robotics?

   A: Robots Require Respect

2. What are the three conditions that can stop a robot?

   A: The program/driven action is finished, an alarm condition, and a mechanical failure.

3. What are the safe zone, the cautionary zone, and the danger zone as they relate to a robotic system?

   A: The safe zone is where a person can pass near the system safely without having to worry about making contact with the system. The cautionary zone is the area where one is close to the robot, but still outside of the work envelope or reach of the system. The danger zone is the area that the robot can reach, or the work envelope, and is where all the robot's tasks take place.

4. What is a common way to keep people out of a robot's danger zone?

   A: One of the popular methods to achieve this is to place metallic fencing around the robot, creating a cage that keeps people out of the danger zone while providing one or two entrances to the danger zone. These entrances have sensors in place and when opened, the robot either stops automatic operations or in some other way renders itself safe for humans

5. Which organization made it a requirement that whenever you enter a robot's work envelope you must take the teach pendant with you? What is one of the main benefits of having the teach pendant?

A: OSHA. The system has an E-stop on it to shut down the robot if needed. Might also talk about the control over the robot that the teach pendant offers.

6. What are some of the tasks for which proximity switches are used?

   A: We use them to sense when parts are present, when machinery is in position, to track items on conveyor lines, and many other applications. When it comes to safety, we tend to use the proximity switch where we want to ensure that something is in a specific position before an operation takes place.

7. Which purposes do pressure sensors serve in relation to robotic safety?

   A: These devices prevent the operator form entering the danger zone and closing the cage behind them, creating a condition where the robot could run in automatic and thus expose the operator to risk of injury or death.

8. What is the difference between a safety interlock and a presence sensor?

   A: A safety interlock has to be made for the system to run in automatic and could be reset with a person in the danger zone. A presence sensor detects anytime a person is in the danger zone and prevents automatic operation.

9. Describe what happens when a person is shocked.

   A: In cases where a person gets an electric shock or becomes a part of the circuit, the electricity enters their body at the point of contact with the electrical system, passes through the body, and then exits at a grounded point or another point somehow connected to the earth.

10. What are the three factors that determine the severity of a shock?

    A: The amount of current that passes through the body, the path the electricity takes through the body, and the duration of the shock

11. What is the formula for Ohm's Law?

    A: $I = E/R$ or $E = I \times R$ or $R = E/I$

12. What is ventricular fibrillation and at which amperage passing through the body does it become a high possibility?

    A: If the shock increases to 0.100 to 0.200 amps there is a high possibility of ventricular fibrillation, a condition where the heart quivers instead of actually pumping blood.

13. In terms of industrial robotic systems, what are the common ranges for voltage and amperage?

    A: Many industrial robotic systems use voltages from 220V to 480V and have amperages ranging from 30A to 100A.

14. What are the steps of LOTO?

The following checklist gives you a step-by-step procedure for the LOTO process:

- Notify affected individuals you are about to shut the machine down. This includes operators, employees nearby, and management.
- Stop the machine cycle, if necessary.
- Turn off or remove all external power supplies and lock them in the off position using lockout devices and a lock with your name on it.
- Place appropriate information tags on the equipment, such as "Do Not Run, Under Maintenance."
- Verify a zero-energy state. Make sure to account for capacitors, compressed springs, items that could fall, stored fluid pressures, or other potential energy sources.

- Perform repairs.
- Once finished, remove all tools and any blocking devices or other items you added to the machine for safety reasons.
- Once everything is clear, each person working on the robot removes his or her own lock and the last person can return power to the equipment.

15. What are the general rules for dealing with emergencies?

    A: General Rule #1: Remain calm.

    General Rule #2: Assess the situation.

    General Rule #3: Perform to the level of your training.

    General Rule #4: After it is over, talk it out.

16. How would you stop serious bleeding?

    A: Take a clean bandage, cloth, or gauze and apply firm pressure directly to the wound.

17. How would you treat a minor burn?

    A: When dealing with burns that do not have open wounds such as first-degree and minor second-degree burns, you will want to submerge the area in cool water for 10 to 15 minutes or until the pain subsides and then wrap with a dry, nonstick, sterile bandage. Do not pop blisters should they appear and seek medical help if the area burnt is a sensitive area or pain persists.

18. How would you treat a severe burn?

    A: For burns that have open wounds such as severe second-degree, third-degree, or fourth-degree burns ***DO NOT*** place these wounds in water and do not try to

remove any clothing that may be stuck in these burns. Cover with a cool, moist, sterile, nonstick bandage or cloth and seek immediate medical help.

19. What would you do for a broken bone?

    A: In the case of a broken bone, immobilize the limb as best you can with a splint device from your first aid kit. If you do not have a splint, you can use rigid materials such as wood, rolled up magazines, or anything rigid placed on either side of the broken bone and held there by a cloth wrap of some kind.

20. When a person is being electrocuted, what is the first thing you must do?

    A: If the person is still being shocked you will need to either cut the power to the circuit or use a nonconductive item like a wooden broom handle or dry rope to get the person out of contact with the circuit.