Chapter Two Review Questions Answer Key

1. What are the three R's of robotics?
   A: Robots Require Respect

2. What are the three conditions that stop a robot?
   A: The program/driven action is finished, an alarm condition, mechanical failure.

3. What is the safe zone, cautionary zone, and danger zone as it relates 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 the robot can reach or the work envelop and where all the robot's tasks take place.

4. What is a common way we 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 stops automatic operations or in some other way renders itself safe for humans

5. Who made it a requirement that anytime you enter a robot's work envelope you take the teach pendant with you and 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 we use Proximity switches for?
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 prox switch where we want to insure that something is in a specific position before an operation takes place.

7. What do we use pressure sensors for when it comes 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: Saftey interlock has to be made for the system to run in automatic and could be reset with a person in the danger zone while 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 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 x R or R = E/I

12. What is ventricular fibrillation and at what amperage passing through the body does this 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. When it comes to 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 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.

15. How do we stop serious bleeding?

    A: To do this we take a clean bandage, cloth, or gauze and apply firm pressure directly to the wound.

16. How do we treat minor burns?

    A: When dealing with burns that do not have open wounds such as first-degree and minor second-degree, 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.

17. How do we treat severe burns?

A: For burns that have open wounds such as severe second-degree, third-degree, or fourth-degree ***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.

18. What do we do for broken bones?

A: In the case of broken bones, 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.

19. 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 circuit or use a nonconductive item like a wooden broom handle or dry rope to get the person out of contact with the circuit.

Chapter Two Activities Manual

Answer Section

MULTIPLE CHOICE

1.	ANS:	C	PTS:	1
2.	ANS:	B	PTS:	1
3.	ANS:	C	PTS:	1
4.	ANS:	D	PTS:	1
5.	ANS:	C	PTS:	1
6.	ANS:	A	PTS:	1
7.	ANS:	C	PTS:	1
8.	ANS:	D	PTS:	1
9.	ANS:	D	PTS:	1
10.	ANS:	A	PTS:	1
11.	ANS:	C	PTS:	1
12.	ANS:	B	PTS:	1
13.	ANS:	D	PTS:	1
14.	ANS:	D	PTS:	1
15.	ANS:	A	PTS:	1
16.	ANS:	A	PTS:	1
17.	ANS:	B	PTS:	1
18.	ANS:	D	PTS:	1
19.	ANS:	C	PTS:	1
20.	ANS:	B	PTS:	1
21.	ANS:	A	PTS:	1
22.	ANS:	C	PTS:	1
23.	ANS:	D	PTS:	1
24.	ANS:	D	PTS:	1
25.	ANS:	D	PTS:	1
26.	ANS:	D	PTS:	1

NUMERIC RESPONSE

27. ANS: 100V PTS: 1
28. ANS: 2.4A PTS: 1
29. ANS: 60Ω PTS: 1
30. ANS: 480V PTS: 1
31. ANS: 8Ω PTS: 1
32. ANS: 14.19A PTS: 1

MATCHING

33. ANS: C PTS: 1
34. ANS: E PTS: 1
35. ANS: G PTS: 1
36. ANS: A PTS: 1
37. ANS: D PTS: 1
38. ANS: F PTS: 1
39. ANS: B PTS: 1
40. ANS: D PTS: 1
41. ANS: G PTS: 1
42. ANS: B PTS: 1
43. ANS: E PTS: 1
44. ANS: C PTS: 1
45. ANS: H PTS: 1
46. ANS: F PTS: 1
47. ANS: A PTS: 1
48. ANS: Z PTS: 1
49. ANS: T PTS: 1
50. ANS: C PTS: 1
51. ANS: J PTS: 1
52. ANS: Q PTS: 1
53. ANS: A PTS: 1
54. ANS: I PTS: 1

55. ANS: O PTS: 1
56. ANS: N PTS: 1
57. ANS: G PTS: 1
58. ANS: P PTS: 1
59. ANS: R PTS: 1
60. ANS: S PTS: 1
61. ANS: D PTS: 1
62. ANS: W PTS: 1
63. ANS: L PTS: 1
64. ANS: X PTS: 1
65. ANS: B PTS: 1
66. ANS: V PTS: 1
67. ANS: K PTS: 1
68. ANS: H PTS: 1
69. ANS: M PTS: 1
70. ANS: E PTS: 1
71. ANS: F PTS: 1
72. ANS: Y PTS: 1
73. ANS: U PTS: 1

SHORT ANSWER

74. ANS: The program is waiting for a sensor or other system to initiate the next command or program.

PTS: 2

75. ANS: Alarms related to such things as safety sensors, e-stops, load on the motors, vision systems, and other devices that give the robot information about the world around it and what is going on with its internal systems.

PTS: 2

76. ANS: Motors fail, bolts break, air hoses rupture, wiring shorts out, connections work loose, etc., any of these conditions could cause a robot to stop, or in a worst case scenario, perform their tasks erratically or unpredictably.
PTS: 2

77. ANS: We use this to create cages around the robot with one or two monitored entrances that restricts entry to the danger zone and thereby protects people.
PTS: 2

78. ANS: Occupational Safety and Health Administration
PTS: 2

79. ANS: To insure that you have access to an E-stop.
PTS: 2

80. ANS: Their main purpose is to keep us safe and only rarely do they improve the operation of the equipment.
PTS: 2

81. ANS: We weld these into metallic frames, usually angle iron pieces, which make up the panels of the robot cage. This creates a robust guarding system that is easy to see through, but strong enough to resist thrown parts, robot impacts, and people falling into or leaning on it.
PTS: 2

82. ANS: a camera-based system mounted on the ceiling above the robot that detects when people pass into the danger zone, triggering the robot to respond accordingly.
PTS: 2

83. ANS: Limit switch makes contact with the part, a proximity switch does not.
PTS: 2

84. ANS: German physicist Georg Simon Ohm (1787-1854)
PTS: 2

85. ANS: 1/3 second
PTS: 2

86. ANS: often a severe electrical shock will stop the heart or cause ventricular fibrillation.
PTS: 2

87. ANS: For minor impact injuries, you may want to apply an ice pack and monitor for continued swelling, discomfort that does not fade, or other signs of serious injury.
PTS: 2

ESSAY

88. ANS: Evaluate according to the rubric.
PTS: 12

Research Question

89. ANS: Evaluate according to rubric.
PTS: 12

Suggested Lab

PTS: instructor assigned
ANS: Evaluate according to chart below or per instructor preference

GRADING SECTION – INSTRUCTOR USE ONLY

Did the students perform the lab safely?	Yes ___	No ___	Points ___
Did the students complete the lab?	Yes ___	No ___	Points ___
Did the students complete the paperwork?	Yes ___	No ___	Points ___
_____ _____	Yes ___	No ___	Points ___
_____ _____	Yes ___	No ___	Points ___
_____ _____	Yes ___	No ___	Points ___
_____ _____	Yes ___	No ___	Points ___
_____ _____	Yes ___	No ___	Points ___
_____ _____	Yes ___	No ___	Points ___
_____ _____	Yes ___	No ___	Points ___
_____ _____	Yes ___	No ___	Points ___

Total points possible ___ Total points earned ___

Instructor's Notes: