1. What is the purpose of a protective device? *Open the circuit before damage to conductors or equipment.*

2. What are the two most common types of protective devices? *Circuit breakers and fuses.*

3. What is an overload? *Moderate increase in current beyond the normal rated current value.*

4. What is the octopus effect? *Too much current connected to a circuit.*

5. What are some causes of overloads? *Too much equipment connected to a circuit, undersized equipment, and worn or seized bearing.*

6. What is the difference between an overload and an overcurrent? *Overcurrents happen over a very short time period.*

7. What is a short circuit and what are the two types? *A current hundreds of times larger than normal. Insulation failure or accidental contact with a foreign object.*

8. What is a ground fault? *Short circuit to ground.*

9. What are the two main types of ground fault circuit interrupters? *One that protects human life and one that protects against fire.*

10. What determines the amount of current that will flow if a transformer has a line-to-line fault? *Impedance of the transformer.*

11. What is the formula for the maximum fault current in a transformer? *Fault = Rated Current x Percent Impedance.*

12. What are two effects of a short circuit? *Mechanical forces and thermal energy.*
13. What is a HRC fuse and what is it used for? 200,000A interrupting capacity. Many industrial applications.

14. What are the standard fuse ratings? Which table in the CEC lists standard fuses?
   15,20,25,30,40,50,60,100,200,300,400,600,800,1000, 1200,1600. Table 13

15. What is different about a protective device installed on a motor circuit? Can be larger than the rating of the conductors.

16. What is interrupting capacity? Maximum current that can be safely interrupted without damage to the device.

17. What is the interrupting capacity of a HRC fuse? 200,000A

18. What is fuse coordination? Designing fuses so the ones closest to the problem will blow first.

19. What is the difference between a “D” and a “P” type fuse? “D” type are time delay and heat sensitive. “P” type are just heat sensitive.

20. What does the term “inverse time-current characteristic” mean? As the magnitude of current increases, the time to open decreases.

21. Other than overloads what can cause a fuse to blow? High ambient temperature, vibration, dirty connection.

22. What is the maximum voltage for a plug fuse? 125V between conductors or 150V to ground.

23. What is the maximum current for a plug fuse? 30A

24. What are the different types of cartridge fuses? Ferrule, knife, and bolt-on.

25. How is the arc quenched in a large cartridge fuse? Arc-quenching powder.
26. What is a renewable fuse? One where the fuse link can be changed and the body used over again.

27. Do the middle restrictive sections of a fuse link melt first? Yes

28. Which type of fuse has a spring-loaded connector inside? Time delay.

29. What is the current interrupting capacity of most standard fuses? 10,000 A

30. What is used as an arc-quenching material in HRC fuses? Silica sand.

31. How are HRC fuses made non-interchangeable? Different physical sizes.

32. What is the main difference between HRCI and HRCII fuses? HRCI gives protection from short-circuits and overloads. HRCII gives only short-circuit protection.

33. What are the different classes of HRC fuses? R, J, T, L, CA, CB, and CC.

34. Which class of HRC fuse has the smallest physical size? “T” class.

35. Which type of HRC fuse is the fastest acting? “T” class

36. What is current limiting ability for fuses? Will open a circuit before the fault current reaches its maximum value.

37. What is the definition of a circuit breaker? An electro-mechanical device designed to open a current-carrying circuit under both overload and short circuit conditions without injury to the device.

38. What are the four main types of circuit breakers? Thermal, magnetic, thermal-magnetic, and solid state.

39. What is the function of a circuit breaker? Protect connected apparatus against overloads and short-circuits.
40. What is an arc chute? A parallel arc chamber where an arc is broken down into smaller segments.

41. Should circuit breakers be switched on and off quickly to prevent arching? No, they have a spring loaded mechanism that works independent of how fast the handle is moved.

42. What are the two types of trip elements in circuit breakers and how do they work? Magnetic element in series with the load. As the strength of the magnet increases with an increase in current, the field becomes strong enough to pull the metal trip plunger. Thermal element is made from two different materials with different expansion characteristics. This causes it to bend and trip a spring loaded mechanism.

43. What is an instantaneous trip circuit interrupter and how is it identified? Magnetic only and typically has an adjustable trip element in the front.

44. What is a solid-state breaker and how does it work? Uses a current transformer and solid-state circuitry.

45. What amount of fault current will a ground-fault breaker detect? 5mA or greater.

46. How does a GFI breaker operate? It measures the outgoing current and compares it to the return current. If there is any difference (5mA) it will trip.