



# Candidate Handbook answers

## Progress check 9.1, p. 441

1. Why keep a fault report after a fault has been diagnosed and repaired?  
**There may be a pattern, or a recurring fault. Such a fault can be cured more quickly if there is a record of a previous diagnosis and corrective action.**
2. What are the three fault codes used in a Periodic Test Condition Report?  
**C1 – danger present – this should be rectified immediately.**  
**C2 – potentially dangerous – this should be rectified urgently.**  
**C3 – improvement recommended – the problem needs to be rectified but it is not urgent.**
3. Give two implications of recorded information regarding a fault.  
**Choose from the following.**  
**Danger – the reported fault raises the possibility that there is danger to those using the installation if the fault is not diagnosed and repaired.**  
**Isolation – the faulty equipment, component or circuit will need to be isolated if repair cannot be carried out immediately.**  
**Actions required – a decision needs to be made on what action to take: can the fault diagnosis take place immediately, can repair be effected, is the equipment or system under warranty?**  
**Recommendation – sometimes it is not immediate action that is needed, but a recommendation for a solution to the problem. This can then be considered by the customer.**

## Activity 9.1, p. 446

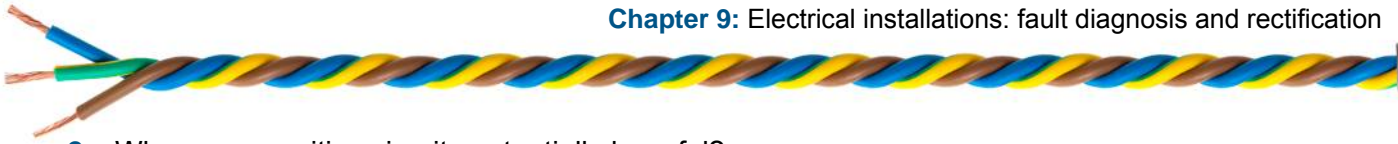
You are called to a large office area to attend to a lighting fault affecting one of the office area circuits. The office is filled with desks and IT equipment. The distribution board is not labelled. The lighting circuit no longer works when the switch is operated. You are met by the office manager. What discussion would you have with her before you start work?

**Example answer:**

- **How long has the lighting circuit been faulty?**
- **Exactly what happened?**
- **Were there any signs that it was going to happen – flickering, etc?**
- **Has it happened before?**
- **Has any work been carried out in the office recently?**
- **Arrange for the area to be cleared so you can work safely on the lights.**
- **Arrange a time for the power to be shut down – you may have to agree to working out of hours.**

## Progress check 9.2, p. 446

1. What is a functional earth?  
**It is an earth conductor designed to carry current during a normal operation, used mainly for computing equipment.**



2. Why are capacitive circuits potentially harmful?

**Capacitors discharge current into a circuit when the power supply is switched off.**

3. What precautions can be taken against electronic discharge when working with electronic circuits and components?

**Wear an ESD wrist band.**

### Activity 9.2, p. 449

As you prepare to find the fault in a three-phase circuit in a factory, you study the Condition Report from the last periodic inspection and test of the premises. In Section K of the report you notice the code 'C2'. What does this alert you to?

**A fault was found during the periodic inspection and test. The code warns that it needed urgent attention.**

### Working practice 9.1, p. 451

Jim's friend, Carl, rang him late on a Sunday evening. Carl knew Jim was an electrician and could help. Carl had been decorating one of his bedrooms and had taken down the light fitting to paint the ceiling. He said that he was sure he reconnected the light correctly, but when he switched it back on there was a loud bang, a flash and the circuit breaker operated. When Jim asked him to think carefully about how he reconnected the light he said that he connected all the brown wires together and then all the blue wires together. As soon as Jim heard this, he knew what Carl had done.

What was his mistake?

**The light was probably wired using the loop-in method. This means that the blue core from the switch to the light is the switch-wire and NOT a neutral. Connecting it to the other neutrals in the light created a short circuit between line and neutral.**

### Progress check 9.3, p. 451

1. List three questions you would ask a customer when gathering information about an electrical fault.

**Choose from the following.**

- What is the problem?
  - When did it happen?
  - What actually happened?
  - Did you see anything unusual such as a flash?
  - Did you smell burning?
  - Does a particular item of electrical equipment cause the protective device to operate?
  - Has this happened before?
2. What useful information can be gathered from maintenance and test records?  
**Information about any previous faults or problems which might have a bearing on the current one**
  3. Which protective device will only operate if there is an earth fault?

**RCD**

## Activity 9.3, p. 452

You are testing a newly installed ring final circuit, which has been wired in singles. The end-to-end test results are:

L to L =  $0.06 \Omega$

N-to-N =  $0.06 \Omega$

E-to-E =  $0.06 \Omega$

You move on to the  $r_1 + r_n$  test and  $r_1 + r_2$  tests. The results for most of the 13 A sockets are acceptable. However, one socket gives the following readings:

$r_1 + r_n = 0.03 \Omega$

$r_1 + r_2 = \text{open circuit}$

What is wrong with this 13 A socket?

**The line and neutral connection are reversed. Because they are securely connected into the terminals, they show up as normal in the end-to-end test. Because they are in the L and N terminals (though the wrong way round) they give a good reading in the  $r_1 + r_n$  test. However, when tested between the L terminal and earth, the mistake is shown up because there is no circuit between L and E.**

## Progress check 9.4, p. 455

1. Which test instrument is used to carry out a continuity test?

**Low reading ohmmeter**

2. How could you safely use an insulation resistance tester to find an earth fault in a circuit containing sensitive equipment?

**Test between line and neutral and earth only (with the line and neutral connected together). Do not carry out a line-to-neutral test.**

3. What is the maximum length for the tip of a test probe on a test instrument?  
**4 mm**

## Activity 9.4, p. 457

An area of a farm is illuminated by a halogen floodlight, operated by a waterproof metal switch. The light is supplied from a 6 A circuit breaker via an RCD. Someone has reported receiving a mild electric shock from the switch, although it still works. The switch is old and looks a little corroded.

What is going on?

**The switch is old so it may no longer be waterproof. Some moisture is getting in, enough to cause current to flow to the metal casing, but not enough to operate a circuit breaker or fuse. However, there is an RCD and this should have operated. Its failure to do so may be due to:**

- a faulty RCD
- a faulty shock protection system – CPC, earth conductors.



### Progress check 9.5, p. 457

1. State two faults that cause a high resistance joint or termination.

**Choose from the following.**

- Loose connections
- Stranded cables terminated with strands cut away (sometimes done to make it easier to fit into a terminal) – this is bad and unsafe practice because it reduces the cross-sectional area of the cable and this means that it can carry less current
- Damaged conductor
- Damaged winding or heating element

2. What is overcurrent?

**A current that is more than the rated value of a conductor**

3. What could cause a power failure in part of a circuit?

**Broken conductor, broken connection, loose connection, local fuse blown**

### Progress check 9.6, p. 459

1. State two faults that can occur at a terminal.

**Conductor snaps off, conductor too loose**

2. What action should be taken if screw-it connectors are found?

**They should be replaced with a junction box or connector blocks.**

3. State one fault that can occur in a mineral-insulated cable termination.

**Choose from twisted conductors, loose gland, dampness in the insulating powder**

### Progress check 9.7, p. 462

1. What is a throughput test?

**Locating the point in a circuit or system by taking voltage readings at various points**

2. Describe the half-split method for fault finding. Break a circuit into sections.

**Carry out the appropriate test on each section until the faulty part of the circuit is located.**

3. Describe the long lead method for measuring the continuity of a conductor.

- a. Connect one of the instrument (a low reading ohmmeter) leads to one end of the faulty conductor.
- b. Connect the other instrument lead to a fly lead.
- c. The test instrument should either be nulled with the fly lead in place, or the resistance of the fly lead taken so it can be subtracted from the final reading.
- d. The fly lead is connected to the other end of the faulty conductor.
- e. A continuity test is taken using a low reading ohmmeter.
- f. A high reading will indicate a loss of continuity.

Progress check 9.8, p. 465

1. What are the three main types of fault rectification?  
**Effect a repair, replace a part and rewire**
2. Why carry out a full inspection and test after diagnosing and repairing a fault?  
**Further faults may have been caused by the fault diagnosis and repair process.**
3. State two issues to be considered before carrying out fault rectification.  
**Choose from the following.**
  - **Is it cost-effective?**
  - **Is the repair a specialist job?**
  - **Is it safe to carry out a repair?**
  - **Is the equipment or installation still under guarantee or warranty?**
  - **Are there contractual issues?**
  - **Are replacement parts available or is the equipment or its components obsolete?**
  - **Will the repair work have to be undertaken out of working hours?**

Knowledge check, p. 466

1. Which safety procedure document must be completed and authorised if the electrician has to work in a hazardous area?  
**b Permit to work**
2. Which of the following does *not* pose an electric hazard when the supply is switched off?  
**c Functional earth**
3. The first three steps of the fault diagnosis process are:  
**b identify symptoms, gather information and analyse the evidence**
4. Information about an item of electrical equipment or a system such as a heating or alarm system can be found in:  
**a manufacturer's instructions**
5. The test instrument used to investigate a short circuit is a(n):  
**d insulation resistance tester**
6. The protective device that operates in the event of an open circuit is:  
**b none**
7. The faulty operation of an RCD is called:  
**c nuisance-tripping**
8. A voltage value is read using a:  
**b voltmeter**
9. An ammeter must be connected in:  
**b series with the circuit**
10. Trying to establish the cause of a fault by putting in new components and switching equipment or a system back on is called:  
**d substitution**