

(d) In respect of electricity supplied by either a single-phase MEN system or a multiple-phase MEN system, a nominal voltage of 230 volts a.c. between phase and neutral

ER 2
(2 marks)

(e) Any **TWO** of:

- High electrical resistance or dielectric strength.
- Good flexibility.
- Non absorbent.
- Withstand mechanical stress.
- Withstand corrosive environments
- Withstand the ambient temperature.
- Withstand heat from the circuit conductors.
- Abrasion resistance.

(2 marks)

(f) • Safe Working Practices that are appropriate to the type of work being undertaken.
• Testing to ensure safety before, during and after the completion of work.

ER 26
(2 marks)

(g) $W = \frac{V^2}{R}$

(1/2 mark)

$$= \frac{230 \times 230}{32}$$

(1/2 mark)

$$= 1653W$$

(1 mark)

(h) 415V is the maximum nominal circuit voltage of the circuit.
AC 46 is the category of duty (i.e. 46,000A prospective short-circuit current).

(2 marks)

(i) There is no voltage between either of the secondary terminals and earth.

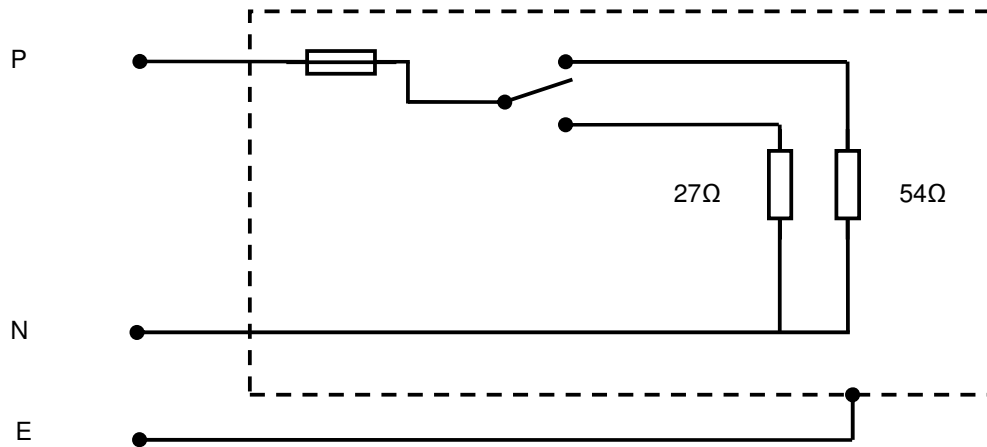
(2 marks)

(j) 1 ohm.

(2 marks)

Question 2

(a)



- Correct polarity (1½ marks)
- The fuse is in the phase and protects all the heater components. (½ mark)
- The selector switch and resistors are connected so two different load settings can be achieved. (2 marks)
- Fully correct diagram (2 marks)

(b) $W = \frac{V^2}{R}$ (½ mark)

$= \frac{230 \times 230}{27}$ (½ mark)

$= 1959.26W$ (1 mark)

(c) $I = \frac{V}{R}$ (½ mark)

$= \frac{230}{54}$ (½ mark)

$= 4.26A$ (1 mark)

Question 3

(a) (i) (A) Three.

(1 mark)

Brown	Red	Phase
Blue/light blue	Black	Neutral
Green/Yellow	Green	Earth

(3 marks)

(ii) (A) Two.

(1 mark)

(B)

Brown	Red	Phase
Blue/light blue	Black	Neutral

(2 marks)

(b) Any THREE of:

- Length of cord
- Cross-sectional area
- Number of cores
- Type of insulation or sheath
- Correct conductor colours

(3 marks)

Question 4

(a) The neutral and phase currents are balanced.

(1 mark)

(b) • There is an imbalance between the phase and neutral currents.

(1 mark)

• A magnetic field is induced into the iron core

(1 mark)

• The induced magnetic field induces a current in the sensing coil

(1 mark)

• The tripping coil is energised and the RCD contacts open

(1 mark)

(c) RCD

• To ensure the tripping mechanism has not become stuck or "frozen"

or

• To ensure it works correctly (rapidly)

or

PRCD

• To ensure the tripping mechanism has not become stuck or "frozen"

or

• To ensure PRCD does not reset to the "on" position after supply is re-established.

(1 mark)

(d) (i) 300ms or 0.3 seconds

(1 mark)

(ii) 40ms or 0.04 seconds

(1 mark)

(e) PRCDs are voltage dependent to ensure that, when supply is lost:

• Portable or hand-held appliances do not automatically restart when supply is restored.

(1 mark)

• The PRCD has to be manually reset to establish the supply.

(1 mark)

Question 5

- (a) It is the maximum current that a flexible cord is designed to carry safely without overheating. (2 marks)
- (b) • The cord will overheat and cause a fire risk. (1 mark)
• The insulation deteriorates and breaks down (1 mark)
- (c) Any FOUR of:
- Number of cores required
 - Mechanical strength
 - Operating environment
 - Flexibility needed
 - Application temperature at point of entry to appliance
 - Colour coding
 - Voltage rating
 - Current rating
 - Length
 - Cross-sectional area
- (4 marks)
- (d) • Minimise the risk of shock.
• Minimise the risk of short-circuit. (2 marks)

Question 6

- (a) • Protective earthing conductor test (½ mark)
- Any ONE of:
 - * Any meter that can accurately read values of less than 1Ω.
 - * An ohmmeter that is of Class 5 accuracy or better (½ mark)
 - 1Ω (½ mark)
 - Maximum (½ mark)
AS/NZS 3760: 2001: 2.3.3.1
AS/NZS 3760: 2003: 2.3.3.1
- Insulation resistance test (½ mark)
- Insulation resistance tester (½ mark)
 - 500 V d.c. (1 mark)
 - 1 MΩ (½ mark)
 - Minimum (½ mark)
AS/NZS 3760: 2001: 2.3.3.2
AS/NZS 3760: 2003: 2.3.3.2, Table 2
- (b) • Not less than 1 MΩ (½ mark)
- AS/NZS 3760: 2001: 2.3.3.3 or Appendix C3
Or
AS/NZS 3760: 2003: 2.3.3.3 (½ mark)
- (c) • To ensure that the control switch switches the active conductor.
• The active pin on the plug is connected to the active terminal in the appliance
• The neutral pin on the plug is connected to the neutral terminal in the appliance
• The earth pin on the plug is connected to the frame of the appliance. (4 marks)

Question 7

(a) The description must include:

- Use of an ohmmeter
or
A meter that can accurately read values of 1 ohm or less. (1 mark)
- Testing between the earth pin of the plug and the frame of the appliance. (1 mark)
- A test result of 1 ohm maximum. (1 mark)

(b) The description has to include:

- Use an insulation tester. (1 mark)
- A test voltage of 500V d.c. (1 mark)
- Bridging the phase and neutral (1 mark)
- Testing between the phase & neutral and the frame of the appliance. (1 mark)
- A test result of 1 M Ω minimum. (1 mark)

(c) The output voltage of the multimeter is insufficient to stress the insulation (1 mark)

- And detect any weaknesses (1 mark)

Question 8

- (a) • The motor will operate normally (1 mark)
- The neutral would be switched (1 mark)
- The motor circuitry would be live when the isolating switch is in the "off" position. (1 mark)
- (b) The RCCB will trip as the PEC would carry the return current. (1 mark)
- (c) (1) The motor will not operate (1 mark)
- (2) - The MCB would not operate (1 mark)
- The frame of the motor will be live with the isolator in the "off" position (1 mark)
- The motor framework will be alive at 230V to earth (1 mark)
- (3) The MCB would trip only if there was a fortuitous connection between the frame of the motor and earth. (3 marks)

Note the answer is either (1) and (2) or (1) and (3)

- (d) Any TWO of:
- Earth continuity test
 - Polarity test
 - Insulation resistance test between the phase conductor and the motor frame.
- (2 marks)

Question 9

- (a) (i)
 - That the test instrument functions correctly.
 - That the circuit to be worked on has been correctly isolated and is safe to work on. (2 marks)
- (ii)
 - Check that test instrument works correctly on a known live source. (1 mark)
 - Test for isolation (between all conductors) on the circuit being isolated. (1 mark)
 - Check again that test instrument works correctly on a known live source. (1 mark)
- (b) (i) To ensure an isolated circuit remains isolated until the person who attached the tag changes the status of the circuit. (1 mark)
- (ii)
 - Their name
 - The company (or department) they work for.
 - The date
 - The time (2 marks)
- (iii) In any situation where you need to ensure that the isolated equipment (or circuit) that you are working on remains isolated (2 marks)