

(e) Any TWO of:

- By the words "double insulation".
- By the international symbol for double insulated equipment – a square within a square.
- By the words "Class II".

(2 marks)

(f) To disconnect a large fault current safely.

(2 marks)

(g) Any TWO of:

- An isolating transformer
- An RCD affording personal protection
- Monitored earth unit.

(2 marks)

(h) Any TWO of

- The wiring is wrongly installed.
- The wrong isolating switch has been operated.
- The isolating switch is damaged or faulty
- The appliance is supplied from two sources.

(2 marks)

(i) A thermostat switch has contacts that open or close when a pre-set temperature is reached.

(2 marks)

(j) Any TWO of:

- Voltage applied.
- Current level .
- Contact duration.
- Skin dryness/dampness
- Current path.
- Physical condition

(2 marks)

Question 2

(a) (i) 1 ohm.

(1 mark)

(ii) Any TWO of:

- It establishes low resistance path of no greater than 1 ohm.
- It ensures that the appliance frame is held at 0 V and no shock hazard exists.
- It ensures that the protection will operate.

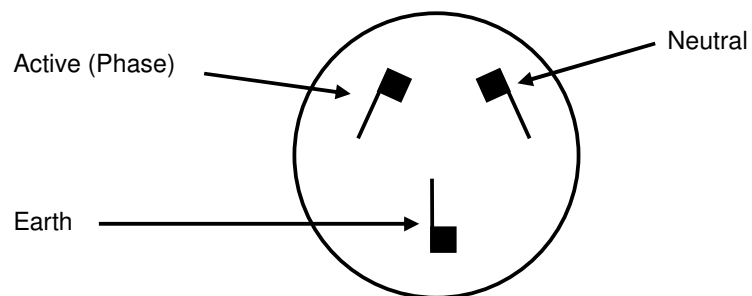
(2 marks)

(b) So that the earth pin:

- Is first to make contact when inserted,
- And the last to break contact when the plug is withdrawn,

(2 marks)

(c)



(3 marks)

(d) A nominal voltage of 230 volts a.c. between phase and neutral.

ER 2
(2 marks)

Question 3

- (a)
- Some current is diverted to earth (1 mark)
 - This causes an imbalance between phase and neutral currents (1 mark)
 - Which is detected by the sensing coil (1 mark)
 - Which trips and disconnects the supply to the load (1 mark)

(b) RCD

Any ONE of:

- To ensure the trip mechanism operates.
- To ensure the RCD can detect a current imbalance and trip the RCD

PRCD

Any ONE of:

- To ensure the trip mechanism operates.
- To ensure the RCD can detect a current imbalance and trip the RCD
- To ensure PRCD does not remain in the "on" position after loss of supply.

(1 mark)

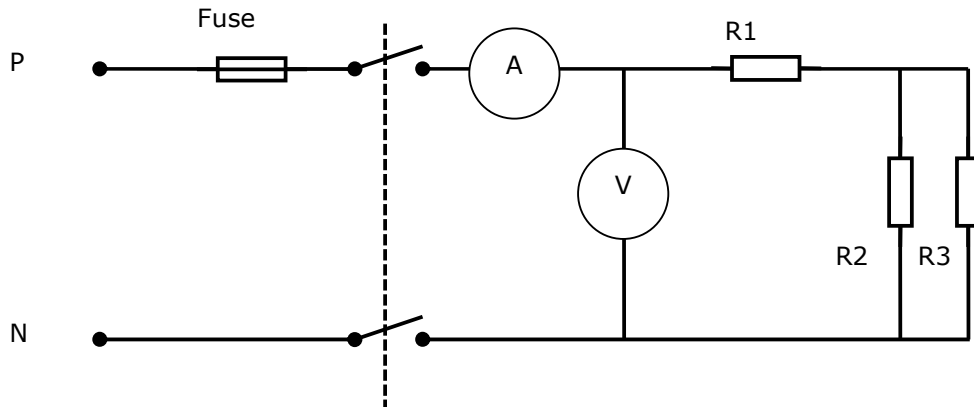
- (c)
- A breakdown in insulation
 - Results in a leakage current to earth
 - RCD will operate rapidly
 - Minimising shock level.
- (4 marks)

- (d) 30 mA
- (1 mark)

Fuse

Question 4

(a)



- Correct polarity (1/2 mark)
- Correctly connected fuse (1/2 mark)
- Correctly connected switch (1/2 mark)
- Correctly connected voltmeter (1/2 mark)
- Correctly connected ammeter (1/2 mark)
- Correctly connected resistors. (1/2 mark)

$$(b) \frac{1}{R_p} = \frac{1}{R_2} + \frac{1}{R_3} \quad (1/2 \text{ mark})$$

$$\frac{1}{R_p} = \frac{1}{50} + \frac{1}{75} \quad (1/2 \text{ mark})$$

$$= \frac{5}{150} \quad (1/2 \text{ mark})$$

$$R_p = 30\Omega \quad (1/2 \text{ mark})$$

$$R_t = 100 + 30 = 130 \Omega \quad (1 \text{ mark})$$

$$I = \frac{V}{R} \quad (1/2 \text{ mark})$$

$$= \frac{230}{130}$$

$$= 1.77\text{A}$$

(½ mark)

(1 mark)

(c) $W = V \times A$

(½ mark)

$$= 230 \times 1.77$$

(½ mark)

$$= 407.1\text{W}$$

(1 mark)

Question 5

(a) (i) Just enough to terminate the bare wire securely in the connection or termination.

(1 mark)

- (ii) • Minimise the risk of shock.
• Minimise the risk of short-circuit and earth faults.

(2 marks)

(b) (i) (A) Three.

(1 mark)

(B)

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

(3 marks)

(ii) (A) Two.

(1 mark)

(B)

Polarity	Colour	Alternate
Phase	Brown	Red
Neutral	Blue/light blue	Black

(2 marks)

Question 6

- (a) (i) • Visual inspection (1 mark)
- All equipment shall be visually inspected and physically checked in accordance with Clause 2.3.2 AS/NZS 3760:2001: 2.3.1
- or
- An external inspection of the equipment and connecting facilities (e.g., supply flexible cord) AS/NZS 3760:2001: 2.3.1(a) (1 mark)

(ii) Test No.1

- (1) Protective earthing conductor (earth continuity) test AS/NZS 3760: 2001: 2.3.3.1 AS/NZS 3760: 2003: 2.3.3.1 (1 mark)
- (2) Meter that can accurately read values of 1 ohm or less (1 mark)
- (3) Maximum 1 ohm AS/NZS 3760: 2001: 2.3.3.1 AS/NZS 3760: 2003: 2.3.3.1 (1 mark)

Test No.2

- (1) Insulation resistance test. AS/NZS 3760: 2001: 2.3.3.2 (1 mark)
- (2) Insulation resistance tester AS/NZS 3760: 2001: 2.3.3.2 AS/NZS 3760: 2001: 2.3.3.2(b) (1 mark)
- (3) Not less than 1 Mohm AS/NZS 3760: 2001: 2.3.3.2(a) AS/NZS 3760: 2003: Table 2 (1 mark)
- or
- (1) Insulation resistance test. AS/NZS 3760: 2001: 2.3.3.2 AS/NZS 3760: 2003: 2.3.3.2 (1 mark)
- (2) Leakage current tester AS/NZS 3760:2001: 2.3.3.2 (1 mark)
- (3) Not greater than 5mA

AS/NZS 3760: 2001: 2.3.3.2(a)
AS/NZS 3760: 2003: Table 1
(1 mark)

(b) (1) Withdrawn from service immediately, have a label attached to it warning against further use; and
(1 mark)

(2) Sent for repair, disposal or destruction by an authorized repair agent or service personnel.
(1 mark)

AS/NZS 3760: 2001: 2.4.1

Question 7

- Carry out the protective earthing conductor test first. (1 mark)
To ensure that the protective earthing conductor resistance is low (or 1 ohm or below) so no false insulation resistance test reading is obtained. (2 marks)
- Protective earthing conductor test
 - Use an ohmmeter or other instrument that can read values of less than 1 ohm (1 mark)
 - Test between the earth pin of the plug and the frame of the appliance (1 mark)
 - The acceptable test result is 1 ohm - maximum. (1 mark)
- Insulation resistance test
 - Use an insulation resistance tester (1 mark)
 - A test voltage of 500v d.c. (1 mark)
 - Test between phase/neutral and earth (1 mark)
 - The acceptable test result is 1 M Ω , minimum (1 mark)

Question 8

- (a) (i) To ensure the highest standard of safety for electrical workers and others. (2 marks)
- (ii)
- Each tradesperson applies own tag. (1 mark)
 - Only that tradesperson can remove their own tag. (1 mark)
 - A supervisor may remove a tag if special circumstances warrant it and it is safe to do so. (1 mark)
- (b) (i)
- To ensure that the test instrument is operating correctly. (1 mark)
 - To ensure that the correct circuit has been isolated before it is worked on. (1 mark)
- (ii)
- First - prove the meter is operating correctly on a known live circuit. (1 mark)
 - Then - test that the isolated circuit shows no voltage present. (1 mark)
 - Then - again prove the meter is operating correctly on a known live circuit. (1 mark)

Question 9

- (a) (i) • The motor will operate normally (1 mark)
• The motor circuitry could be live whilst switched off (1 mark)
- (ii) Any ONE of:
- The motor will operate normally (½ mark)
 - The protective earthing conductor is the wrong colour – potential hazard. (½ mark)
- (iii) • The motor will not operate (1 mark)
• Its framework will be alive at 230V to earth
An immediate and serious shock hazard exists.
OR
Could operate the protective device (2 marks)
- (iv) Any ONE of:
- Earth continuity test
 - Polarity test (1 mark)
- (b) Any THREE of:
- The wiring is damaged, faulty or wrongly installed.
 - The wrong isolating switch has been operated.
 - The isolating switch is damaged or faulty
 - The appliance is supplied from two sources, e.g., main and control supplies. (3 marks)