

- (e) • Ensure that the flexible cord is securely anchored
• Ensure that the cord grip is on the sheath of the flexible cord, not on the basic insulation.

(2 marks)

(f) $I = \frac{W}{V}$

(½ mark)

$$= \frac{1200}{230}$$

(½ mark)

$$= 5.22A$$

(1 mark)

(g) (i) 500V d.c

(1 mark)

(ii) 250V d.c.

(1 mark)

- (h) • Brown Red
• Light blue (or blue). Black

(2 marks)

(i) Any TWO of:

- Voltage applied.
- Current level .
- Contact duration.
- Skin dryness.
- Current path.

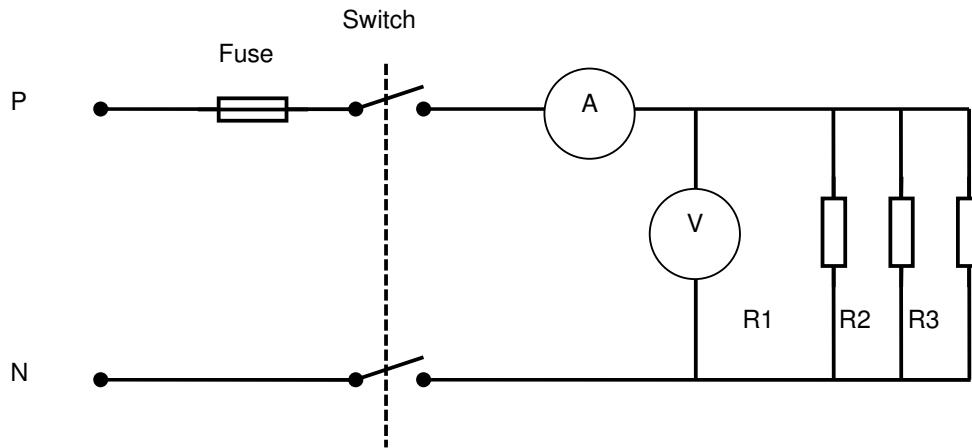
(2 marks)

(j) Any TWO of:

- The appliance is fixed wired and connected through a continuous flexible cord to a supply of electricity from a source isolated from earth with a voltage between conductors not exceeding 250 volts:
Ref: ER 77(3)(a)
- The appliance is supplied with electricity from a safety extra-low voltage source.
Ref: ER 77(3)(b)
- The appliance is double insulated and is supplied with electricity through a RCD
Ref: ER 77(3)(c)
- The appliance is supplied with electricity from a monitored earth circuit where the supply to the appliance is automatically disconnected in the event of the earth to the appliance being broken or disconnected:
Ref: ER 77(4)(b)
- The appliance is supplied with electricity from a source connected to earth in such a way that the voltage to earth will not exceed 55 volts a.c:
Ref: ER 77(4)(c)
- The appliance is supplied with electricity through a RCD
Ref: ER 77(4)(d)
- The appliance is supplied with electricity from a source isolated from earth with a voltage between conductors not exceeding 250 volts
Ref: ER 77(4)(e)
- The appliance is double insulated:
Ref: ER 77(4)(f)
(2 marks)

Question 2

(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)

$$(b) \frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \quad (1/2 \text{ mark})$$

$$\frac{1}{R_T} = \frac{1}{100} + \frac{1}{50} + \frac{1}{25} \quad (1/2 \text{ mark})$$

$$= \frac{7}{100} \quad (1/2 \text{ mark})$$

$$= 14.28\Omega \quad (1/2 \text{ mark})$$

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

$$= \frac{230}{14.28} \quad (1/2 \text{ mark})$$

$$= 16.11A$$

(1 mark)

(c) $P = V \times A$

(½ mark)

$= 230 \times 16.11$

(½ mark)

$= 3.703\text{kW or } 3703.3\text{W}$

(1 mark)

(d) Less

(1 mark)

Question 3

(a) Any ONE of:

- To protect the fixed wiring against excess current flow
- Safely interrupt and disconnect a faulty circuit

(2 marks)

(b) Any **THREE** of :

- It will safely interrupt short circuit currents of much higher values or higher rupturing capacity.
- It eliminates arcing because the fuse element is sealed.
- It is obtainable in a range of Utilisation category (fusing factors).
- Current rating is clearly marked.
- Reliable operation within prescribed limits.
- Good discrimination.
- Constant fusing characteristics.
- Faster operation/acting.
- Doesn't deteriorate over time.

(3 marks)

(c) Any TWO of:

- If correctly threaded, prevents fuse element from bulging out the side of the carrier and being accessible to touch.
or
If incorrectly threaded, contact could be made with the fuse element.
- If correctly threaded, under overload conditions the heat produced in the element is confined to the tunnel area.
or
If incorrectly threaded, the arc or molten metal may escape under overload conditions.
- If correctly threaded, under short-circuit conditions the arc and molten element is confined within the fuse carrier and base.
or
If incorrectly threaded, the arc or molten metal may escape under fault conditions.

(d) Any THREE of:

- Current rating.
- Voltage rating.
- Category of duty (Rupturing Capacity).
- Utilisation category (fusing factor)

(3 marks)

Question 4

(a) Table F1 of AS/NZS 3760

Function	International	Superseded
Earth	Green	Green
Neutral	Blue (or light blue)	Black
Active	Brown	Red

(6 marks)

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

(1 mark)

- (ii)
- Maximises terminal or connection contact.
 - Minimises the risk of shock.
 - Minimises the risk of short-circuit..

(3 marks)

Section 2 - Plumbers Only

Question 5

(a) The isolation method has to show:

- Identification of the correct MCB. (1 mark)
- Prove-test-prove to ensure circuit is isolated. (2 marks)
- No live terminals exposed (1 mark)
- Steps taken to prevent reconnection
 - Danger tag for personal protection
 - Locking off isolator or disconnecting conductors from load side of isolator. (2 marks)

(b) Any TWO of:

- There would be exposed live terminals in the fuse base.
- The circuit can be easily relivened by inserting a fuse carrier in the fuse.
- Don't need a tool to reliven. (2 marks)

(c) Any TWO of:

- If covers are left off basic insulation will be exposed.
- If covers are left off live terminals will be exposed.
- If covers are left off moving parts will be exposed.
- If covers are unsecured access can be gained to live terminals.
- If covers are unsecured access can be gained to basic insulation.
- If covers are unsecured access can be gained to moving parts. (2 marks)

Question 6

(a) Any **FOUR** of – from AS/NZS 3760:2001:

- Check for obvious damage or defects in the accessories or plugs.
- Check that flexible cords are effectively anchored to equipment and plugs.
- Check that the inner cores of flexible supply cords are not exposed or twisted;
- Check that the external sheaths are not cut, abraded, twisted, or damaged to such an extent that the insulation of the inner cores is visible
- Check that unprotected conductors or insulation tape are not in evidence.
- Check that any controls are in good working order i.e. they are secure, aligned and appropriately identified.
- Check that covers, guards and the like are secured in the manner intended by the manufacturer or supplier.
- Check that safety facilities and devices are in good working order.
- Check that ventilation inlets and exhausts are unobstructed.

AS/NZS 3760: 2.3.2
(4 marks)

Or

Any **FOUR** of – from AS/NZS 3760:2003:

- Check for obvious damage or defects in the accessories or plugs.
- Check for discolouration that may indicate exposure to heat, chemicals and moisture.
- Check that flexible cords are effectively anchored to equipment and plugs.
- Check that the inner cores of flexible supply cords are not exposed or twisted;
- Check that the external sheaths are not cut, abraded, twisted, or damaged to such an extent that the insulation of the inner cores is visible
- Check that unprotected conductors or banding insulation tape are not in evidence.
- Check that any operating controls are in good working order i.e. they are secure, aligned and appropriately identified.
- Check that covers, guards and the like are secured in the manner intended by the manufacturer or supplier.
- Check that ventilation inlets and exhausts are unobstructed.
- The pins of insulated pin plugs should be inspected for damage to the insulation of the pins.

AS/NZS 3760: 2.3.2
(4 marks)

(b) 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 Megohm
or
• Not less than 10,000 ohms
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)

Question 7

- (a) (i) • To ensure that the resistance to earth from protectively earthed parts is low enough to permit adequate fault current to flow to earth.
Ref: AS/NZS3760: Foreword
- or
- To ensure that the resistance of the protective earthing conductor is not greater than 1 ohm.
(1 mark)
- (ii) • To ensure the integrity of the insulation between live mains parts and exposed or external metal parts.
Ref: AS/NZS3760: Foreword
- or
- To ensure that the insulation resistance:
- between active and neutral and between neutral and earth
- between active and earth
- is not less than 10,000 ohms.
(2 marks)
- (iii) • Ensure phase, neutral and earth conductors are terminated at the correct terminals
(1 mark)
- Ensure switch and thermostat are in the phase conductor.
(1 mark)
- (b) • Use a meter that can accurately read values of 1 ohm or less.
(1 mark)
- Touch the leads together and adjust for zero.
(1 mark)
- Test between the earth pin of the plug and the frame of the appliance.
(1 mark)
- To obtain an accurate reading choose a point that will provide a good connection to earth i.e. free from paint, corrosion etc.
(1 mark)
- Maximum acceptable value 1 ohm.
(1 mark)

Question 8

- (a) • Check the test instrument on a known live source. This proves that the meter is working correctly. (2 marks)
- Test for isolation (between all conductors) on the circuit being isolated. (1 mark)
 - Re-check the test instrument on the known live source. This ensures that it is working correctly. (2 marks)
- (b) (i) To ensure the highest standard of safety for electrical workers and others. (1 mark)
- (ii) • Danger tag system. (1 mark)
- 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)
- or
- Out of service tag system. (1 mark)
 - When no person is working on a machine or circuit which is out of service to be worked on. (1 mark)
 - Where restoration of power could cause damage or may injure personnel. (1 mark)
 - Used when equipment which is available for use is seen to be faulty. The tag is attached and the matter reported to the Supervisor. (1 mark)

Question 9

(a) $I = \frac{P}{V}$ (½ mark)
 $= \frac{3000}{230}$ (½ mark)
 $= 13.04A$ (1 mark)

The switch is not adequate for the 3kW element. (1 mark)

- (b)
- Earth continuity resistance. AS/NZS 3760: 2.3.3.1
 - Insulation resistance. AS/NZS 3760: 2.3.3.2
 - Visual inspection AS/NZS 3760: 2.3.2 (3 marks)

- (c) Any FOUR of:
- Switch not damaged or burnt.
 - The flexible conduit is anchored at both ends and not damaged.
 - Conduit wire is in good condition and preferably high temp type.
 - Covers in place with no basic insulation or live terminals exposed to contact.
 - Cable terminations are tight.
 - Protective earthing conductor (earth continuity conductor) is connected to both the case and element frame.
- (4 marks)

or any FOUR from AS/NZS 3760: 2001: 2.3.2

- Check for obvious damage or defects in the accessories, connectors, plugs or extension outlet sockets.
- Check that flexible cords are effectively anchored to equipment
- Check that the inner cores of flexible supply cords are not exposed or twisted;
- Check that the external sheaths are not cut, abraded, twisted, or damaged to such an extent that the insulation of the inner cores is visible
- Check that unprotected conductors or insulation tape are not in evidence.
- Check that any controls are in good working order i.e. they are secure, aligned and appropriately identified.
- Check that covers, guards and the like are secured in the manner intended by the manufacturer or supplier.
- Check that safety facilities and devices are in good working order.
- Check that ventilation inlets and exhausts are unobstructed.

or

Any **FOUR** of – from AS/NZS 3760:2003:

- Check for obvious damage or defects in the accessories, connectors, plugs or extension outlet sockets; and for discolouration that may indicate exposure to heat, chemicals and moisture.
- Check that flexible cords are effectively anchored to equipment
- Check that the inner cores of flexible supply cords are not exposed or twisted;
- Check that the external sheaths are not cut, abraded, twisted, or damaged to such an extent that the insulation of the inner cores is visible
- Check that unprotected conductors or banding insulation tape are not in evidence.
- Check that any operating controls are in good working order i.e. they are secure, aligned and appropriately identified.
- Check that covers, guards and the like are secured in the manner intended by the manufacturer or supplier.
- Check that ventilation inlets and exhausts are unobstructed.

Section 3 – Gasfitters Only

Question 10

(a) Any **FOUR** of – from AS/NZS 3760:2001:

- Check for obvious damage or defects in the accessories or plugs.
- Check that flexible cords are effectively anchored to equipment and plugs.
- Check that the inner cores of flexible supply cords are not exposed or twisted;
- Check that the external sheaths are not cut, abraded, twisted, or damaged to such an extent that the insulation of the inner cores is visible
- Check that unprotected conductors or insulation tape are not in evidence.
- Check that any controls are in good working order i.e. they are secure, aligned and appropriately identified.
- Check that covers, guards and the like are secured in the manner intended by the manufacturer or supplier.
- Check that safety facilities and devices are in good working order.
- Check that ventilation inlets and exhausts are unobstructed.

AS/NZS 3760: 2.3.2

(4 marks)

Or

Any **FOUR** of – from AS/NZS 3760:2003:

- Check for obvious damage or defects in the accessories or plugs.
- Check for discolouration that may indicate exposure to heat, chemicals and moisture.
- Check that flexible cords are effectively anchored to equipment and plugs.
- Check that the inner cores of flexible supply cords are not exposed or twisted;
- Check that the external sheaths are not cut, abraded, twisted, or damaged to such an extent that the insulation of the inner cores is visible
- Check that unprotected conductors or banding insulation tape are not in evidence.
- Check that any operating controls are in good working order i.e. they are secure, aligned and appropriately identified.
- Check that covers, guards and the like are secured in the manner intended by the manufacturer or supplier.
- Check that ventilation inlets and exhausts are unobstructed.
- The pins of insulated pin plugs should be inspected for damage to the insulation of the pins.

AS/NZS 3760: 2.3.2

(4 marks)

(b) 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 Megohm
or
• Not less than 10,000 ohms
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)

Question 11

- (a) (i) • To ensure that the resistance to earth from protectively earthed parts is low enough to permit adequate fault current to flow to earth.
Ref: AS/NZS3760: Foreword
- or
- To ensure that the resistance of the protective earthing conductor is not greater than 1 ohm.
(1 mark)
- (ii) • To ensure the integrity of the insulation between live mains parts and exposed or external metal parts.
Ref: AS/NZS3760: Foreword
- or
- To ensure that the insulation resistance:
- between active and neutral and between neutral and earth
 - between active and earth
- (1 mark)
- is not less than 10,000 ohms.
(1 mark)
- (iii) • Ensure phase, neutral and earth conductors are terminated at the correct terminals
- Ensure switch and thermostat are in the phase conductor.
(2 marks)
- (b) • Use a meter that can accurately read values of 1 ohm or less.
(1 mark)
- Touch the leads together and adjust for zero.
(1 mark)
- Test between the earth pin of the plug and the frame of the appliance.
(1 mark)
- To obtain an accurate reading choose a point that will provide a good connection to earth i.e. free from paint, corrosion etc.
(1 mark)
- Maximum acceptable value 1 ohm.
(1 mark)

Question 12

- (a) • Check the test instrument on a known live source. This proves that the meter is working correctly. (2 marks)
- Test for isolation (between all conductors) on the circuit being isolated. (1 mark)
- Re-check the test instrument on the known live source. This ensures that it is working correctly. (2 marks)
- (b) (i) To ensure the highest standard of safety for electrical workers and others. (1 mark)
- (ii) • Danger tag system. (1 mark)
- 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)
- or
- Out of service tag system. (1 mark)
- When no person is working on a machine or circuit which is out of service to be worked on. (1 mark)
- Where restoration of power could cause damage or may injure personnel. (1 mark)
- Used when equipment which is available for use is seen to be faulty. The tag is attached and the matter reported to the Supervisor. (1 mark)

Question 13

- (a) • Replace fittings incorporated in gas-fired equipment that have an electrical rating of not more than 230 volts and 15 amperes.
- Disconnect from and reconnect to fixed wiring, fittings incorporated in gas-fired equipment that have an electrical rating of not more than 230 volts and 15 amperes.
- Remove and replace fusible links in relation to gasfitting work.
- (3 marks)

- (b) (i) There is no significant risk of injury or death to any person or damage to any property as a result of the use of electricity.

ER 69(2)
(2 marks)

- (ii) Means contact, by any person or animal, with live parts, including contact by any thing being carried or worn by that person or animal.

ER 2
(1 mark)

- (iii) In relation to fittings or electrical appliances, means that the fittings or appliances are deliberately disconnected from any source of electricity

ER 2
(1 mark)

- (iv) Means charged with electricity so that a difference in voltage exists to earth or between conductors

ER 2
(1 mark)

- (c) Any TWO of:

- Prosecute the person.
- Disqualify or suspend the person for doing or assisting to do prescribed electrical work.
- Require a person to sit and pass any specified examination.
- Require a person to complete a period of training.
- Require a person to attend a specified course of instruction.
- Limit the work the person is permitted to do .

EA 127
(2 marks)

Question 14

- (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.
- If the RCCB fails to operate, the PEC will carry the full load current for which it is not designed. (1 mark)
- (c) • The motor will not operate (1 mark)
- Its framework will be alive at 230V to earth (1 mark)
- An immediate and serious shock hazard exists. (1 mark)
- The MCB would operate. (1 mark)
- (d) Any TWO of:
- Earth continuity test
 - Polarity test
 - Insulation resistance test between the phase conductor and the motor frame. (2 marks)