



(d) It is a continuous circuit that has a "break" in it. (2 marks)

(e) Any TWO of:

- 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.
- CPR
- Basic first aid

ER 26  
(2 marks)

(f) 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.
- Censure
- Make no order

EA 127  
(2 marks)

(g) Any TWO of:

- Damage to the circuit wiring.
- Overheating or fire hazard.
- Shock hazard

(2 marks)

(h) (i) 250V d.c.

(1 mark)

(ii) 500V d.c.

(1 mark)

(i) Any ONE of:

- 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.
- Ensure that the basic insulation exposed for the purpose of termination is kept to a minimum

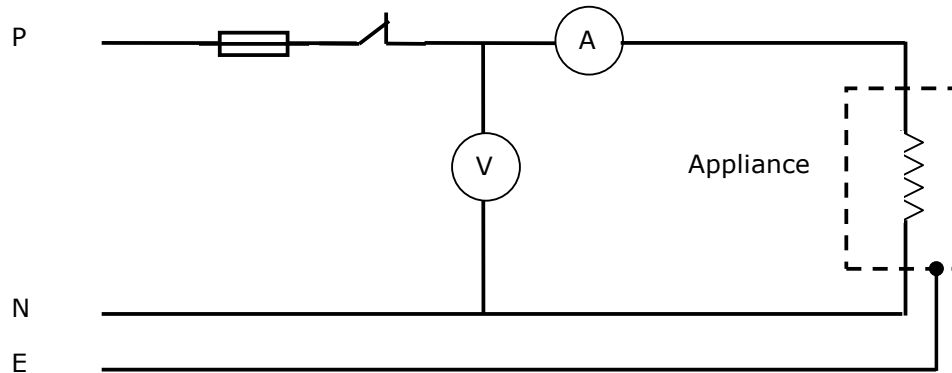
(2 marks)

(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 (1½ marks)
- The fuse protects the whole circuit. (½ mark)
- The single-pole switch controls the whole circuit. (½ mark)
- The voltmeter is in parallel with the appliance on the load side of the switch. (½ mark)
- The ammeter is in series with the appliance and in the phase on the load side of the switch. (½ mark)
- The appliance is earthed (½ mark)
- Working circuit (2 marks)

(b)  $R = \frac{V^2}{W}$  (½ mark)

$= \frac{230 \times 230}{1500}$  (½ mark)

$= 35.27 \text{ ohms}$  (1 mark)

(c)  $I = \frac{W}{V}$  (½ mark)

$= \frac{1500}{230}$  (½ mark)

$= 6.52A$  (1 mark)

### Question 3

- (a) (i) • To protect the fixed wiring against excess current flow  
or  
• Safely interrupt and disconnect a faulty circuit (2 marks)
- (ii) To provide personal protection to the user of an appliance that is connected to the circuit protected by the RCD. (2 marks)
- (b) 45A Is the maximum current the fuse can continuously carry (1/2 mark)  
without deterioration. (1/2 mark)
- 415V is the maximum voltage the fuse can withstand (1/2 mark)  
without flashover. (1/2 mark)
- AC46 40,000AC is the maximum prospective short circuit current (1/2 mark)  
the fuse can safely interrupt (1/2 mark)
- (c) Any TWO of:
- It prevents the fuse element from bulging out the side of the carrier and being accessible to touch.
  - Under overload conditions the heat produced in the element is confined to the tunnel area.
  - Under short-circuit conditions the arc and molten element is confined within the fuse carrier and base.
- (2 marks)
- (d) To disconnect a large fault current safely. (1 mark)

#### Question 4

(a) Any TWO of:

- There might 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)

(b) Any THREE of:

- To prevent basic insulation being exposed
- To prevent live terminals being exposed
- To prevent access to moving parts
- To prevent ingress of foreign matter or liquids

(3 marks)

(c) (i) Any THREE of:

- The flexible conduit has become detached exposing basic insulation.
- Broken isolating switch cover.
- There is no cover on the appliance terminals.
- Poor termination of cables

(3 marks)

(ii) Any TWO of:

- To prevent basic insulation from being exposed.
- To prevent the connections pulling away in the event of strain on the flexible conduit.
- To prevent damage to cables.
- Double insulation is maintained

(2 marks)

## Section 2 - Plumbers Only

### Question 5

(a) (i) Any ONE of:

- A coding system to indicate the degree of protection provided by the enclosure against access to live parts from solid objects, or the ingress of water or other liquids  
AS 1939 supplement 1 – 1990
- Degrees of enclosure protection for electrical equipment  
AS 60529
- A degree of protection in accordance with AS 1939.  
AS/NZS 3000:2000: 1.4.58
- A degree of protection in accordance with AS 60529.  
AS/NZS 3000:2007: 1.4.61
- A degree of protection of an item of enclosed equipment is expressed as an IP (International Protection) rating in accordance with AS 60529.  
AS/NZS 3000:2007: G1  
(2 marks)

(ii) Any ONE of:

- The degree of protection of persons against live or moving parts inside the enclosure  
And protection of the fitting against ingress of solid foreign bodies  
AS 1939 supplement 1 – 1990
- Protection against solid objects  
AS 60529
- The degree of protection against solid objects
- Protection of persons against access to hazardous parts.  
AS/NZS 3000:2000: 1.4.58
- Protection of against ingress of solid objects.  
AS/NZS 3000:2007: Table G1(a)  
(2 marks)

(iii) Any ONE of:

- Protection of equipment against harmful ingress of water.  
AS 1939 supplement 1 – 1990
- Protection against liquids  
AS 60529
- A degree of protection against entry of water with harmful effects.  
AS/NZS 3000:2000: 1.4.58
- Protection of against harmful ingress of water.  
AS/NZS 3000:2007: Table G1(b)  
(2 marks)

(b) **3** Any ONE of:

- Protection of persons holding tools or wires (larger than 2.5 mm) and protection of equipment against objects larger than 2.5mm<sup>2</sup>.  
AS 1939 supplement 1
- Protected against solid objects over 2.5 mm (tools and small wires)  
AS 60529
- The access probe of 2.5 mm diameter shall not penetrate.  
AS/NZS 3000:2007: Table G1(a)  
(1 mark)

**4** Any ONE of:

- Protection against splashing and spraying water from all practicable directions.  
AS 1939 supplement 1
- Protection against water sprayed from all directions – limited ingress permitted.  
AS 60529
- Protection against water splashed from all directions. Limited ingress permitted.  
AS/NZS 3000:2007: Table G1(b)  
(1 mark)

(c) A situation in which moisture is either permanently present, or intermittently present to such an extent as would be likely to impair the effectiveness or safety of an electrical installation which complies with this Standard for ordinary situations.

AS/NZS 3000:2000 1.4.37  
AS/NZS 3000:2007 1.4.40  
(2 marks)

### Question 6

(a) It is the maximum current that a flexible cord is designed to carry safely without overheating.

(2 marks)

(b) The insulation deteriorates and breaks down

(2 marks)

(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 7

(a) (i) The method has to show:

- Identification of the fuse on the switchboard for the water heater. (1 mark)
- Removing the load from circuit and removing fuse carrier (1 mark)
- Testing for isolation at the supply side of the permanent connect unit using the prove-test-prove method. (2 marks)

(ii) The method has to show:

- Identification of the correct fuse on the switchboard by a process of elimination. (1 mark)
- Re-testing for isolation at the supply side of the permanent connect unit using the prove-test-prove method. (2 marks)
- Attaching a danger tag to the fuses. (1 mark)

(b) • Ensure the permanent connection unit cover is securely fixed in place to prevent access to live parts. (2 marks)

### Question 8

(a) The procedure has to cover:

- The control switches turned on: (1 mark)
- Bridging the active (phase) and neutral conductors. (1 mark)
- Use of an insulation resistance tester. (1 mark)
- Testing between the bridged active (phase) and neutral and the appliance frame. (1 mark)
- The result must not be less than 1 M $\Omega$ . (1 mark)

(b) To ensure that the insulation will be able to withstand the applied voltage without failure. (2 marks)

(c) Any THREE of:

- Visual inspection
- Continuity of conductors
- Continuity of earthing
- Correct circuit connections (polarity)

(3 marks)

### Question 9

- (a) Utilisation category (fusing factor) is the ratio of minimum fusing current to the current rating of the fuse.

alternatively this may be expressed as:

$$\text{Utilisation category (fusing factor)} = \frac{\text{Minimum Fusing Current}}{\text{Current Rating}} \quad (2 \text{ marks})$$

$$\begin{aligned} \text{(b) } I &= \frac{W}{V} && (1/2 \text{ mark}) \\ &= \frac{3000}{230} && (1/2 \text{ mark}) \\ &= 13A && (1 \text{ mark}) \end{aligned}$$

16 amp fuse (15 amp fuse is also acceptable) would be purchased. (1 mark)

- (c) Any FIVE of:

- Replace storage water cylinder heater elements that have an electrical rating of not more than 230 volts and 15 amperes; and
- Replace storage water cylinder thermostats that have an electrical rating of not more than 230 volts and 15 amperes; and
- Disconnect from and reconnect to fixed wiring waste disposal units that have an electrical rating of not more than 230 volts and 15 amperes:
- Disconnect from and reconnect to fixed wiring dishwashing units that have an electrical rating of not more than 230 volts and 15 amperes:
- Disconnect from and reconnect to fixed wiring electronic water control units that have an electrical rating of not more than 230 volts and 15 amperes:
- Disconnect from and reconnect to fixed wiring water pressure devices that have an electrical rating of not more than 230 volts and 15 amperes:
- Disconnect from and reconnect to fixed wiring storage water heater cylinders that have an electrical rating of not more than 230 volts and 15 amperes:
- Remove and replace fusible links in relation to plumbing work.

(5 marks)  
ER 49(6)

## Section 3 – Gasfitters Only

### Question 10

- (a) (i) Three (1 marks)
- (ii) • Brown, light blue (or blue) and green/yellow  
or  
• Red, black, green (3 marks)
- (iii) Two (1 marks)
- (iv) • Brown and light blue (or blue)  
or  
• Red and black (2 marks)
- (b) (i) If strain is applied to the flexible cord the protective earthing conductor (earth continuity conductor) will be the last to pull away from the terminals. (1 mark)
- (ii) If all conductors are the same length, the earth may pull away first leaving the appliance operational but unearthed. (2 marks)

### Question 11

(a) It is the maximum current that a flexible cord is designed to carry safely without overheating.

(2 marks)

(b) The insulation deteriorates and breaks down

(2 marks)

(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 12

(a) (i) The method has to show:

- Identification of the fuse on the switchboard for the boiler. (1 mark)
- Removing the load from circuit and removing fuse carrier (1 mark)
- Testing for isolation at the supply side of the permanent connect unit using the prove-test-prove method. (2 marks)

(ii) The method has to show:

- Identification of the correct fuse on the switchboard by a process of elimination. (1 mark)
- Re-testing for isolation at the supply side of the permanent connect unit using the prove-test-prove method. (2 marks)
- Attaching a danger tag to the fuses. (1 mark)

(b) • Ensure the permanent connection unit cover is securely fixed in place to prevent access to live parts. (2 marks)

### Question 13

(a) The procedure has to cover:

- The control switches turned on: (1 mark)
- Bridging the active (phase) and neutral conductors. (1 mark)
- Use of an insulation resistance tester. (1 mark)
- Testing between the bridged active (phase) and neutral and the appliance frame. (1 mark)
- The result must not be less than 1 M $\Omega$ . (1 mark)

(b) To ensure that the insulation will be able to withstand the applied voltage without failure. (2 marks)

(c) Any THREE of:

- Visual inspection
- Continuity of conductors
- Continuity of earthing
- Correct circuit connections (polarity)

(3 marks)

### Question 14

- (a) Utilisation category (fusing factor) is the ratio of minimum fusing current to the current rating of the fuse.

alternatively this may be expressed as:

$$\text{Utilisation category (fusing factor)} = \frac{\text{Minimum Fusing Current}}{\text{Current Rating}} \quad (2 \text{ marks})$$

(b)  $I = \frac{W}{V}$  (1/2 mark)

$$= \frac{3000}{230} \quad (1/2 \text{ mark})$$
$$= 13A \quad (1 \text{ mark})$$

16 amp fuse (15 amp fuse is also acceptable) would be purchased. (1 mark)

- (c) To ensure that the replacement fuse link will safely interrupt the prospective short-circuit current level for that circuit. (2 marks)

- (d) • 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.

ER 49(7)  
(3 marks)