

# TRADESPERSONS ELECTRICAL WORK CERTIFICATE 133 - MARKING SCHEDULE

Note: (1 mark) means that the preceding statement earns 1 mark.

This schedule sets out the expected answers to the examination questions. The marker can exercise their discretion and decide on the overall accuracy of any answer that is presented in the candidate's own words.

## Section 1 – All Candidates

### Question 1

(a) Any TWO of:

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

(2 marks)

(b) 
$$W = \frac{V^2}{R}$$
$$= \frac{240 \times 240}{23}$$
$$= 2504W \text{ (also accept 2.5kW)}$$

(2 marks)

- (c) • Where the operator of an electrical appliance can make simultaneous contact between the exposed metal of the appliance and earth or earthed metal,
- There is no possibility of the exposed metal of the appliance becoming live under any circumstances.

(2 marks)

(d) Any TWO of:

- Timber floor.
- Vinyl or cork floor.
- Rubber underlay.
- Carpet.

(2 marks)

(e) • The cross sectional area of the flexible cord conductors.

(1 mark)

- The length of the flexible cord conductors.

(1 mark)

## Question 2

$$\begin{aligned} \text{(a) } I &= \frac{W}{V} \\ &= \frac{1000}{230} \\ &= 4.35\text{A} \end{aligned}$$

(2 marks)

- (b)
- Brown.
  - Light blue (or blue).

(2 marks)

(c) Any TWO 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.

(2 marks)

(d) • A fault in the fixed wiring.

(1 mark)

- A registered electrician must be called to repair the fault.

(1 mark)

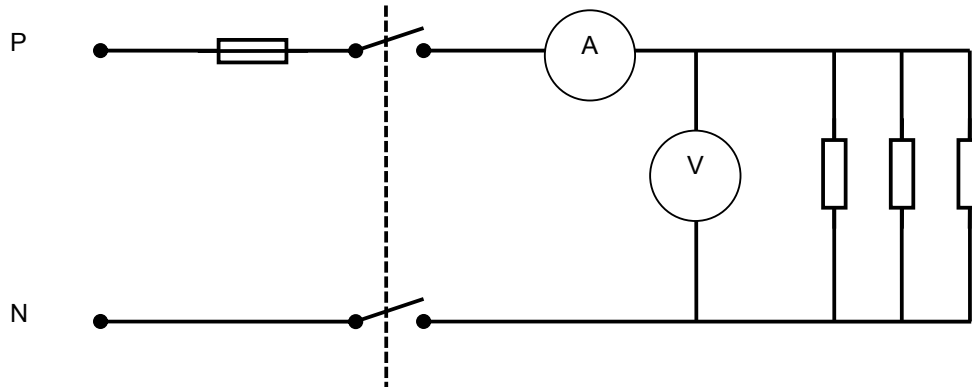
(e) Any TWO of:

- Maximum terminal or connection contact.
- Minimise the risk of shock.
- Minimise the risk of short-circuit.

(2 marks)

### Question 3

(a)



- Correct polarity (1 mark)
  - Correctly connected fuse (1 mark)
  - Correctly connected switch (1 mark)
  - Correctly connected voltmeter (1 mark)
  - Correctly connected ammeter (1 mark)
  - Correctly connected resistors. (1 mark)
- (6 marks)

(b)  $I = \frac{V}{R}$   
 $= \frac{230}{50}$   
 $= 4.6 \text{ amps}$

(2 marks)

(c)  $W = VA$   
 $= 230 \times 4.6$   
 $= 1058W \text{ or } 1.058 \text{ kW}$

(2 marks)

#### Question 4

Answers in bold/italic

Circuit	Supply Volts	Total Ohms resistance	Current	Watts
One	230	<b>23 ohms</b>	10	<b>2300 watts</b>
Two	200	<b>40 ohms</b>	<b>5 amps</b>	1000
Three	<b>230 volts</b>	46	5	1150

One

$$\begin{aligned} R &= \frac{V}{I} \\ &= \frac{230}{10} \\ &= 23 \text{ ohms} \\ W &= V \times I \\ &= 230 \times 10 \\ &= 2300 \text{ watts (or 2.3 kW)} \end{aligned}$$

(4 marks)

Two

$$\begin{aligned} I &= \frac{W}{V} \\ &= \frac{1000}{200} \\ &= 5 \text{ amps} \\ R &= \frac{V}{I} \\ &= \frac{200}{5} \\ &= 40 \text{ ohms} \end{aligned}$$

(4 marks)

Three

$$\begin{aligned} V &= IR \\ &= 5 \times 46 \\ &= 230 \text{ volts} \\ \text{or} \\ \frac{V}{I} &= \frac{W}{I} \\ &= \frac{1150}{5} \\ &= 230 \text{ volts} \end{aligned}$$

(2 marks)

### Question 5

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

alternatively this may be expressed as:

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

- (ii) The lower the **Utilisation category (fusing factor)**, the less excess current is required to blow the fuse.  
(2 marks)

(b) I =  $\frac{W}{V}$   
=  $\frac{3000}{230}$   
= 13A  
(1 mark)

(1 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)

## Question 6

- (a) (i) 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  
(2 marks)

OR

- A degree of protection in accordance with AS 1939.  
AS/NZS 3000: 1.4.58

- (ii) • 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  
(2 marks)

OR

- The degree of protection against solid objects
- Protection of persons against access to hazardous parts.  
AS/NZS 3000: 1.4.58

- (iii) • 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  
(2 marks)

OR

- The degree of protection against solid objects
- Protection of persons against access to hazardous parts.  
AS/NZS 3000: 1.4.58

- (b) (i) Number 2  
Protection of fingers against access to hazardous parts, and protection of equipment against objects larger than 12.5 mm.  
(Note accept 12.5 mm<sup>2</sup> as this is how it is presented in some documents)

(1 mark)

- (ii) Number 3  
Protection against spraying water at up to 60° from the vertical

(1 mark)

AS 1939 Supplement 1:1990

- (c) A **damp situation** is a situation in which moisture is either permanently or intermittently present to such an extent as would be likely impair the effectiveness or safety of an electrical installation.

AS/NZS 3000: 1.4.37  
(2 marks)

### Question 7

- (a)
- An ammeter is a very low resistance instrument.
  - If connected in parallel with the load it will draw a large current which may damage the meter.
  - Arcing may injure the user.

(3 marks)

- (b)
- Insulation must be tested to, at least, 500V voltage.

(1 mark)

And ONE of:

- A standard multimeter or ohmmeter will not deliver the required voltage.
- A standard multimeter or ohmmeter applies a very low test voltage to the circuit and will therefore not subject the insulation to the same stress as the applied voltage.
- A standard multimeter or ohmmeter only applies a very low voltage which won't expose any weakness in the insulation resistance.

(1 mark)

### Question 8

Candidates are required to answer either (a) or (b) - not both.

(a) Analogue ohmmeters:

- (i)
  - Select the appropriate ohm scale to be used.
  - Short out the test probes by bringing them together.
  - Then adjust the meter to produce a zero reading. (3 marks)
  
- (ii)
  - Compensate for the resistance in the test leads.
  - To compensate for variations in the internal battery voltages. (2 marks)

(b) Digital ohmmeters:

- (i)
  - Select the appropriate ohm scale to be used.
  - Short out the test probes by bringing them together.
  - Record or note the resistance of the leads. (3 marks)
  
- (ii) The resistance of the leads are known so an accurate reading can be obtained. (2 marks)

## Section 2 – Plumbers and Plumber/Gasfitters Only

### Question 9

$$\begin{aligned} \text{(a) } I &= \frac{W}{V} \\ &= \frac{3000}{230} \\ &= 13.04 \text{ amps.} \end{aligned}$$

The permanent connection unit is not of an adequate rating to supply the 3000W element.

(2 marks)

- (b)
- Is the current rating of the thermostat adequate to handle the extra current drawn?
  - Are the sub circuit cables of an adequate rating to supply the new element?
  - Is the sub-circuit fuse of the appropriate rating?

(3 marks)

### Question 10

(a) Any THREE of:

- TPS cable entering the switch with bare exposed basic insulation.
- Broken switch cover.
- Flexible conduit removed from its clamp.
- Cover off the element thermostat enclosure or not fitted.

(3 marks)

(b) ● To prevent basic insulation from being exposed.  
● To prevent the connections pulling away in the event of strain on the flexible cord.

(2 marks)

### Question 11

(a) Any THREE of:

- An incorrect component has been connected in the appliance which increased the current.
- The cross-sectional area of the flexible cord is too small.
- The flexible cord is too long.
- Fault in the appliance.

(3 marks)

- (b)
- By using a flexible cord with an increased cross sectional area.
  - Reduce the length of the cord.
  - Install the correct component in the appliance.
  - Repair the fault in the appliance.

(2 marks)

**Question 12**

- (a) AS/NZS 3760 (1 mark)
- (b) (i) (I) Low reading ohmmeter. (1 mark)  
(II) 1 ohm maximum (1 mark)
- (ii) (I) Insulation resistance tester. (1 mark)  
(II) 1 M $\Omega$  minimum (1 mark)

### Question 13

- Use a 500V d.c. insulation tester. (1 mark)
- Check meter's operation. (1 mark)
- Bridge the phase and neutral. (1 mark)
- Test between the phase/neutral and accessible metal on the appliance. (1 mark)
- Minimum acceptable value - 10,000 $\Omega$ . (1 mark)

#### Question 14

- (a) • 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)

- (b) • 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)

- (c) • 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)

### Section 3 – Gasfitters and Plumber/Gasfitters Only

#### Question 15

- With all control switches on: (1 mark)
- Join phase and neutral joined together to avoid damage to electronic components. (2 marks)
- Test with a 500V insulation resistance tester from the appliance framework to phase and neutral (1 mark)
- The result must not be less than 1 MΩ. (1 mark)

#### Alternatively

- With all control switches on: (1 mark)
- Test with a 250V insulation resistance tester from the appliance framework to phase and neutral (3 marks)
- The result must not be less than 1 MΩ. (1 mark)

### Question 16

- (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.

ER 49(7)  
(3 marks)

- (b) Any ONE 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.

(1 mark)

### Question 17

- (a) • The motor will operate normally (1 mark)
- But the on/off switch would effectively be in the neutral (1 mark)
- The motor circuitry could be live whilst switched off (1 mark)
- A latent shock hazard is created. (1 mark)
- (b) • The motor will operate normally (1 mark)
- The protective earthing conductor is the wrong colour – potential hazard. (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)
- (d) Any ONE of:
- Earth continuity test
  - Polarity test
  - Insulation resistance test between the phase conductor and the motor frame. (1 mark)

**Question 18**

- (a) It must be able to read low ohms. (1 mark)
- (b) • To check that the instrument is functional. (1 mark)
- Either of:  
- To zero the meter for accuracy.  
OR  
- Compensate for the resistance of the leads. (1 mark)
- (c) • It may show an apparent reading of zero. (1 mark)
- It may be inaccurate when the protective earthing conductor (earth continuity conductor) resistance is high. (1 mark)

### Question 19

- (a) • To ensure that the multimeter - even though indicating zero - is operating correctly. (1 mark)
- To ensure that the correct circuit has been isolated before it is worked on. (1 mark)
- (b) • 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)