TEWC 140 - TRADESPERSONS ELECTRICAL WORK CERTIFICATE
MARKING SCHEDULE

Notes:1. (1 mark) means that the preceding statement/answer earns 1 mark.

2. 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.

3. Symbols and terms - alternatives

Power	W or P
Voltage	V or E or U
Phase	Active

4. Key to abbreviated terms:

EA	Electricity Act 1992
ER	Electricity Regulations 1997
AS/NZS	Australia and New Zealand Joint Standard
NZS	New Zealand Standard
AS	Australian Standard
ECP	New Zealand Electrical Code of Practice
GK	General Knowledge

Section 1 – All Candidates

Question 1

(a) Any TWO of:

- Permanently disqualify the person from doing or assisting to do prescribed electrical work.
- Disqualify the person until he/she passes an examination.
- Disqualify the person until he/she completes a period of training.
- Disqualify the person until he/she attends a course of instruction.
- Limit the work the person is permitted to do.
- Limit the person to working on approved premises.
- Limit the person to working with an approved employer.
- Censure the person
- Make no order

EA 127(e), (f), (h), (i)
(2 marks)

(b) Failure will be by heat build-up, leading to melting of sheath and insulation deterioration.

(2 marks)

(c) Any ONE of:

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

(2 marks)

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

(½ mark)

$= \frac{240 \times 240}{35}$

(½ mark)

$= 1645.71W$

(1 mark)

(e) Any TWO of:

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

(2 marks)

(f) Any TWO of:

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

(2 marks)

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

(2 marks)

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

(½ mark)

$= \frac{1500}{230}$

(½ mark)

$= 6.52$ A

(1 mark)

(i) A fuse will isolate a circuit when excess current flows.

(2 marks)

(j) A 230/230 volt isolating transformer

(2 marks)

Question 2

(a)
- The supply and/or the appliance would be short-circuited.

(2 marks)

- Meter protection would operate,
  or
  The circuit protection would operate.
  or
  A personal hazard – flash burns.
  or
  Meter and/or appliance components could be damaged.

(1 mark)

(b) Any THREE of:

- The instrument prevents the appliance from operating.
- A 230 volt reading indicates only that the appliance is turned on.
- A 230 volt reading indicates only that the load circuit in the appliance is continuous.
- A 230 volt reading indicates only the supply voltage, but the appliance will not operate.
- A 230 volt reading indicates only the supply voltage.
- A 0 volt reading can lead to the false conclusion that the circuit is dead.
- A 0 volt reading will be obtained if the appliance load is open circuited (by a switch or element)

(3 marks)

(c) Any FOUR of:

- Select a meter setting that will ensure that the expected voltage value will read mid-range.
- Keep clearance between instrument clips, leads and probes
- Avoid contact with live conductors or earth or earthed metal when the circuit is live
- All equipment (leads, meter, and probes) is in good condition.
- Prove-test-prove the meter.
- Select a meter with a fault duty comparable to that of the circuit being tested.
- Ensure connections are correct

(4 marks)

Question 3

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

(4 marks)

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

(2 marks)

(c) To disconnect a large fault current safely.

(1 mark)

(d)
- 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.

(3 marks)

Question 4

(a) Any FIVE 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)

(5 marks)

(b) So that the transformer protects the extension leads as well as the portable appliance.

(2 marks)

(c) No voltage can exist between either of the secondary terminals and earth.

(2 marks)

(d) Any ONE of:

- By use of the appropriate wording - double insulation.
- By use of the international symbol for double insulated equipment.
- By the wording **Class II** on the appliance.

(1 mark)

Section 2 - Plumbers Only

Question 5

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.
  or
  Subtract the resistance of the leads from the final reading to obtain the correct value.

(3 marks)

(ii) The resistance of the leads are known so an accurate reading can be obtained.

(2 marks)

(c) (i) To ensure it can accurately read values of 1 ohm or less

(1 mark)

(ii)
- 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)

(iii)
- 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 6

(a) (i) 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)

(ii) Any TWO of – from AS/NZS 3760:2001:

- Check for obvious damage or defects in the accessories, connectors or plugs.
- Check that flexible cords are effectively anchored to equipment and plugs.
- Check for damage to flexible cords - the inner cores of flexible supply cords are not exposed or twisted;
- Check for damage to flexible cords the external sheaths are not cut, abraded, twisted, or damaged to such an extent that the insulation of the inner cores is visible; and (In) 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
(2 marks)

Or

Any TWO of – from AS/NZS 3760:2003:

- Check for obvious damage or defects in the accessories, connectors or plugs and for discolouration that may indicate exposure to heat, chemicals and moisture.
- Check that flexible cords are effectively anchored to equipment and plugs.
- Check for damage to flexible cords - the inner cores of flexible supply cords are not exposed or twisted;
- Check for damage to flexible cords - the external sheaths are not cut, abraded, twisted, or damaged to such an extent that the insulation of the inner cores is visible.
- Check for damage to flexible cords - 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, and, if fitted, the shroud on cord extension sockets.

AS/NZS 3760: 2.3.2
(2 marks)

(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

(a) 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)

(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)

Question 8

(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)
- Earth continuity test
- Polarity test

(2 marks)

(b) 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.
- The isolating switch is single pole, and is connected in the neutral conductor.

(2 marks)

Question 9

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

(3 marks)

(b) Any TWO of:

- By using a flexible cord with an increased cross sectional area.
- Install the correct component in the appliance.
- Repair the fault in the appliance.

(2 marks)

(c) 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)

(d) Any THREE 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.

(3 marks)

Section 3 – Gasfitters Only

Question 10

(a)
- 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)
- Maximum acceptable value 1 ohm.
(1 mark)

(b) (i) To establish that a low resistance exists of no greater than 1 ohm.
(2 marks)

(ii)
- To ensure the insulation will not fail at its operating electrical voltage.

OR

- To verify that the insulation of current carrying components is capable of withstanding the normal supply voltage.
(2 marks)

(iii) To ensure that the phase, neutral and earth conductors are terminated at the correct terminals and that the switch is in the phase conductor.
(2 marks)

Question 11

(a) (i) 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)

(ii) Any TWO of – from AS/NZS 3760:2001:

- Check for obvious damage or defects in the accessories, connectors or plugs.
- Check that flexible cords are effectively anchored to equipment and plugs.
- Check for damage to flexible cords - the inner cores of flexible supply cords are not exposed or twisted;
- Check for damage to flexible cords the external sheaths are not cut, abraded, twisted, or damaged to such an extent that the insulation of the inner cores is visible; and (In) 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
(2 marks)

Or

Any TWO of – from AS/NZS 3760:2003:

- Check for obvious damage or defects in the accessories, connectors or plugs and for discolouration that may indicate exposure to heat, chemicals and moisture.
- Check that flexible cords are effectively anchored to equipment and plugs.
- Check for damage to flexible cords - the inner cores of flexible supply cords are not exposed or twisted;
- Check for damage to flexible cords - the external sheaths are not cut, abraded, twisted, or damaged to such an extent that the insulation of the inner cores is visible.
- Check for damage to flexible cords - 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, and, if fitted, the shroud on cord extension sockets.

AS/NZS 3760: 2.3.2
(2 marks)

(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 12

(a)
- Replace fittings incorporated in gas-fired equipment that have an electrical rating of not more than 230 volts and 15 amperes; and
- 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; and
- Remove and replace fusible links in relation to gasfitting work.

(3 marks)
ER 49(7)

(b) Any TWO of:

- Testing to ensure safety.
- Basic first aid.
- CPR.

(2 marks)
ER 49(4)

(c) (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)

Question 13

(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)
- Earth continuity test
- Polarity test (2 marks)

(b) 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.
- The isolating switch is single pole, and is connected in the neutral conductor. (2 marks)

Question 14

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

(3 marks)

(b) Any TWO of:

- By using a flexible cord with an increased cross-sectional area.
- Install the correct component in the appliance.
- Repair the fault in the appliance.

(2 marks)

(c) 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)

(d) Any THREE 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.

(3 marks)