2004- Electrical Service Technician "B"
Answer 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 adequacy of any answer that is presented in the candidate's own words.

With calculation questions award ½ marks if only the correct answer is stated

Question 1

(a)

Application	**Motor Type**
A desk fan	***Shaded Pole***
A vacuum cleaner	***Universal or series***
A commercial extraction fan	***Capacitor start/cap run*** ***Capacitor start/induction run***
A concrete mixer	***Capacitor start/induction run*** ***Split-phase***

(2 marks)

(b) Any TWO of:

- Resistance
- Current
- Length
- Cross-sectional area

(2 marks)

(c) (i) $I = \frac{W}{V}$

$= \frac{2000}{230}$

$= 8.69$ amps

(1 mark)

(ii) 10 amps

(1 mark)

(d) 230 – 11.5 = 218.5 V (230 x 5% = 11.5V)

ER 53(3)(b)
(2 marks)

(e) (d) (i) 1 Megohm
(ii) 1 ohm

(2 marks)

Question 2

(a) Any TWO of:

- An ammeter is a very low resistance instrument and if connected in parallel with the load it will draw a large current
- Which may damage the meter and cause a shock or fire.
- The internal fuse or the circuit protection will operate if the meter is protected against over-current.

(2 marks)

(b) Switches the load on/off on time basis independent of the load

(2 marks)

(c) Any ONE of:

- A supervisor of electrical work whose registration allows that supervisor to do the work
- A registered person whose registration allows that person to do the work, where the registered person is under the supervision of a supervisor of electrical work whose registration allows that supervisor to do the work

ER 23(a),(b)
(2 marks)

(d) (i) Effectively connected to the general mass of Earth

(1 mark)

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

(1 mark)
ER2

(e) (i) **One element only across** the supply

(ii) **Two elements in series with** the supply

(2 marks)

Question 3

(a)

Phase to Phase	=	400V or alternatively L1-L2, L1-L3, L2-L3 = 400V
Phase to Neutral	=	230V or alternatively L1-N, L2-N, L3-N = 230V
Phase to Earth	=	230V or alternatively L1-E, L2-E, L3-E = 230V
Neutral to Earth	=	0 V

(4 marks)

(b)
- The final subcircuit neutral conductor provides the return path from the loads back to the distribution transformer for the resultant "out-of-balance" current from the three phases

(2 marks)

- The neutral conductor is required to ensure that the potential across each single phase load is 230V with respect to earth.

(2 marks)

(c)
- An MEN switchboard has an MEN link between the neutral and earth busbars

or
- A distribution switchboard does not have an MEN link between the neutral and earth busbars.

(1 mark)

(d) MEN switchboard

(1 mark)

Question 4

(a) and (b)

1. Locate and identify the fuses on the switchboard for the motor.
(1 mark)
2. Switch off the circuit power supply and remove fuse carriers.
(1 mark)
3. Attach Danger tag to fuse bases.
(1 mark)
4. Remove the isolator cover and test for isolation power at the supply side of the isolator using the prove-test-prove method.
(2 marks)

Note: No.s 1 and2 must occur first, No.s 3 and 4 can be in any order.

(c)
- Replace the isolator.
(1 mark)
- Remove the motor.
(1 mark)

(d)
- Insulate and mechanically protect motor supply cables.
(2 marks)
- Replace "Danger" tag with an "Out of Service" tag.
(1 mark)

Question 5

(a) Any THREE of:

* Completed such training as prescribed.
* Has had such experience as prescribed.
* Has completed training in resuscitation, safe working practices and testing.
* Has passed the prescribed examinations.

EA 74
(3 marks)

(b) (i) A practising licence

EA 95(1)
(1 mark)

(ii) 30 June of the year it is stated to expire.
(also accept 1 July)

Electricity Amendment Act 1997 4(2)(b)
(1 mark)

(iii) The Registrar

EA 96(1) or 100(4)
(1 mark)

(c) (i) (1) Safe working practices appropriate to the work being undertaken.
(2) Testing to ensure safety before/during and after completion of the work.
(3) Basic first aid
(4) CPR

ER 26(2)
(2 marks)

(ii) ● At 24 month intervals

or

● Safe working practices, testing and basic first aid at intervals not exceeding 14 months, CPR at intervals not exceeding 7 months.

ER 26(4)(a), (b)
(2 marks)

Question 6

(a)
- Tag to be sufficiently large and conspicuous with prominent, bold lettering.
(2 marks)
- Must have words printed on both sides, like **"Danger"**, **"Hold"**, **"Safety Critical"**, **"Do Not Operate"**, **"Do Not Remove"**, etc.
(2 marks)
- It should also carry information as follows:
  – **Your name**
  – **Date** and time of placing tag
  – **Identification and location of machine**
  – **Reasons or comments as applicable**
(2 marks)

(b)
- When two persons are working simultaneously on the machine.
(2 marks)
- When one person is working on machine and the supervisor has also placed his tag, e.g., an "Out of Service" tag.
(2 marks)

Question 7

(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) **5** Protection against entry of dust in sufficient quantities to interfere with the satisfactory operation of equipment.

AS 1939 supplement 1
(1 mark)

6 Protection against heavy seas or a strong jet of water from all practicable directions

. AS 1939 supplement 1
(1 mark)

(c) (i) Must have a minimum degree of protection of IPX4

AS/NZS 3000: 7.1.4.1(b)
AS/NZS 3000 Amendment 3: 7.1.4.1(b) or Table 7.1
(1 mark)

(ii) Must have a minimum degree of protection of IPX4

AS/NZS 3000: 7.1.4.1(b)
AS/NZS 3000 Amendment 3: 7.1.4.1(b) or Table 7.1
(1 mark)

Question 8

(a) The maximum current that a fuse-link will carry continuously without deterioration or operating.

(2 marks)

(b) (i)
- The fuse would blow well below the circuit full-load current.
- Will cause nuisance tripping

(1 mark)

(ii) The current could damage subcircuit wiring and fittings before the fuse operates.

(1 mark)

(iii) The phase failure relay detects the loss of voltage and trips out the circuit.

(1 mark)

(iv) The phase reversal relay detects a reversal of supply rotation and trips the circuit.

(1 mark)

(c)
- The HRC fuses are capable of safely interrupting far higher levels of PSSC than the thermal overload in a fault situation

(1 mark)
- The HRC fuses operate much faster than the thermal overload under short circuit conditions, and they will disconnect the circuit before any damage occurs.

(1 mark)

(d) Any TWO of:

- To prevent an arc from developing between the terminals when the fuse blows
- It also ensures that the fuse element blows where required by concentrating heat in that area.
- Contain the arc against splattering outside of the covered section

(2 marks)

Question 9

(a) Any TWO of:

- Mechanical overload
- Supply voltage insufficient
- Loss of one line
- Seized motor
- Open circuit rotor

(2 marks)

(b) Any TWO of

- Loss of one line
- Open circuited rotor bars
- Shorts on the stator windings
- Reversal of polarity of stator winding

(2 marks)

(c) Any TWO of:

- The pole faces of the contactor iron circuit are not making correctly – excessive dirt or dust
- Insufficient voltage to close the iron circuit.
- Broken or missing shading ring in the laminated iron core of the contactor
- Pole face is cracked or core laminations are loose.

(2 marks)

(d)
- The maintaining circuit is open-circuited.
- The maintaining contact across the start button is incomplete.
- Incorrectly wired circuit

(2 marks)

(e) Any TWO of:

- Open circuited or short-circuited or faulty capacitor
- Open circuited centrifugal switch at rest
- Open start winding circuit

(2 marks)

Question 10

(a) and (b)

1. Locate and identify the MCB on the switchboard and ensure it is in the off position.

(1 mark)

2. Attach Danger tag to the MCB.

(1 mark)

3. Unscrew the socket outlet closest to the switchboard and test for isolation using the prove-test-prove method.

(2 marks)

Note: No.1 must occur first, No.s 2 and 3 can be in any order.

(c) • Conduct an insulation resistance test and circuit continuity test on the socket outlet circuit.

(2 marks)

• Conduct an insulation resistance test and protective earthing conductor test on each appliance in turn.

(2 marks)

(d) • If the fault is in the socket outlet circuit, contact an electrician.

(1 mark)

Or

• If the fault is in an appliance, repair the appliance

(1 mark)