

2005- 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.

Text in italics are the amendments.

Question 1

(a) Any TWO of:

- The cable has three individually insulated phase conductors
 - That is surrounded by a bare stranded earth conductor –
or
copper strands are wound around and enclose these insulated conductors
 - Then a heavy PVC sheath is formed over all four conductors
- (2 marks)

(b) Detects excessive current drawn and disconnects the motor from the supply.
(2 marks)

(c) Watts produced at 245V = $\frac{V^2}{R}$ (1/2 mark)

= $\frac{245 \times 245}{26.46}$ (1/2 mark)

= 2268 watts (1 mark)

or

Watts produced at 245V = $V \times I$

= 245 x 9.2

= 2254 watts

(d) (i) *“5” means – Protection against the entry of dust in sufficient quantity to interfere with the satisfactory operation of equipment.*
(1 mark)

(ii) *“6” means – Protection against heavy seas or a strong jet of water from all directions.*
(1 mark)

(e) Any TWO of:

- Each conductor must be made electrically safe.
- Each conductor must be marked or labelled to ensure reconnection to correct terminals.
- Mechanically protect cables.
- Prevent access to cables.

(2 marks)

Question 2

(a) Table 3.5 of AS/NZS 3000

COLOURS OF CABLE CORES		
Function	Identifying colours	
	Recommended	Alternative
Earth/bonding	Green/yellow	Green
Neutral	Black	light blue
Active	Red	Any colour except green/yellow, green, black, light blue

(2 marks)

(b) 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:
ER 77(3)(a)
- The appliance is supplied with electricity from a safety extra-low voltage source:
ER 77(3)(b)
- The appliance is double-insulated and is supplied with electricity through a residual current device.
ER 77(3)(c)
- The appliance is supplied with electricity from a monitored earth circuit where the supply to the appliance is automatically disconnected if the earth to the appliance is broken or disconnected:
ER 77(4)(b)
- The appliance is supplied with electricity from a source connected to earth so that the voltage to earth will not be greater than 55 volts a.c.:
ER 77(4)(c)
- The appliance is supplied with electricity through a residual current device:
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
ER 77(4)(e)
- The appliance is double insulated.
ER 77(4)(f)

- (c) • When they are double insulated
• When they are supplied from an isolating transformer

(2 marks)

- (d) 218.5 V (5% of 230 V).
or
204.7 V (11% of 230 V)

(2 marks)
ER53(3)(b)

- (e) Three years qualifying experience

(2 marks)
(EA 2)

Question 3

Any **FIVE** of:

- Avoid damage to metal sheath - (earthing and ingress of moisture).
- Maintain loop or "S" bend in cable - (absorbs vibration).
- Do not disturb pot seal - (ingress of moisture).
- Do not flex the solid conductors - (breakage).
- Ensure all conductor connections tight - (vibration - loose joints).
- Ensure gland is clean and tight - (earth continuity).

(2 marks per correct answer total 10 marks)

Question 4

(a) The motor's original direction of rotation will be reversed.

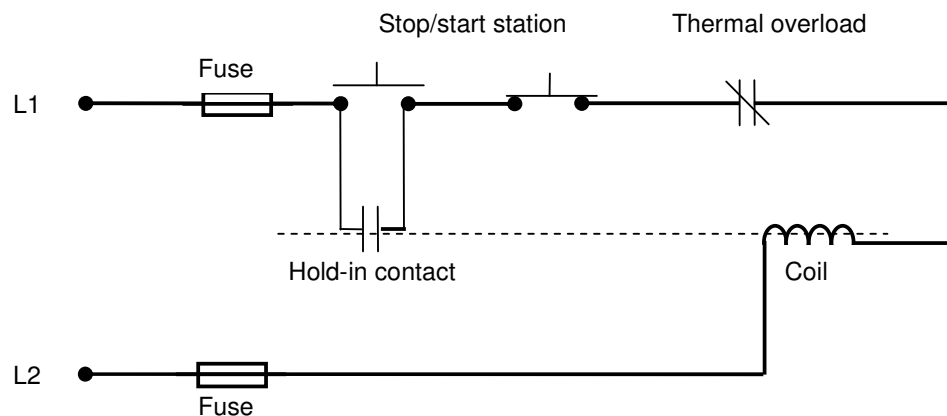
(1 mark)

(b) Any ONE of:

- Variable frequency drive
- Auto-transformer starter
- Soft starter
- Primary resistance
- Star-delta starter

(1 mark)

(c) (i)



- Correct supply (two line/phase supply)

(½ mark)

- Fuse in both phases

(1 mark)

- Stop/start station correctly connected

(1 mark)

- Hold-in contacts and coil correctly connected

(2 marks)

- Overload contacts or RTD correctly connected

(½ mark)

(Total 5 marks)

(ii) • The excess line current cause by the mechanical causes heating in the thermal overload bi-metal strip.

(1 mark)

• The bi-metal strip distorts and operates the contact in the overload unit.

(1 mark)

• Which open-circuits the starter coil and de-energises the 3 phases.

(1 mark)

Note: The preferred response is above. However, a description of how the control circuit operates when there is a mechanical overload is equally valid.

Question 5

- (a) • To ensure that the test meter/instrument - is operating correctly. (2 marks)
- To ensure that the ~~correct~~ circuit has been isolated before it is worked on. (2 marks)
- (b) • First - prove the meter is operating correctly on a known live circuit. (2 marks)
- Then – test that the circuit is isolated. (2 marks)
- Then - prove again that the meter is still operating correctly on a known live circuit. (2 marks)

Question 6

- (a)
- All control switches are on. (1 mark)
 - Test with a 500V d.c. insulation resistance tester. (1 mark)
 - Check that the meter operates correctly and select the correct scale. (1 mark)
 - Bridge between phase and neutral to avoid damage to electronic components when testing. (2 marks)
 - Test between the bridged conductors and the appliance frame. (1 mark)
 - The result must not be less than 1 Megohm (1 mark)
- (b) Any **THREE** of:
- Visual inspection
 - Continuity of conductors
 - Verification of polarity
 - Continuity of Earthing
- (3 marks)

Question 7

(a) (i) Reverse connections to either start or run winding, but not to both ~~with respect to the incoming supply conductors.~~

(2 marks)

(ii) Reverse connections to either the field windings or armature windings, but not to both ~~with respect to the incoming supply conductors.~~

(2 marks)

(b) (i) Split phase.

Any TWO of:

- Washing machine
- Dishwasher
- Bench grinder
- Clothes dryer
- Drill press

(2 marks)

(ii) Shaded pole.

- Desk fan
- Fan heater
- Hair dryer
- Electric toys

(2 marks)

(iii) Capacitor start/capacitor run.

- Saw bench
- Air conditioner
- Compressor
- To obtain high starting and running torque

(2 marks)

Question 8

(a) Any *THREE* of:

- Overload caused by too many appliances in use.
- A faulty appliance
- A faulty circuit.
- *Incorrectly rated fuse.*

(3 marks)

(b) Any *THREE* of the following:

(i) Overload caused by too many appliances in use.

Action taken to establish that this is the cause

- Total up the rating of appliances from their name-plates

(1 mark)

Remedial action taken or recommended

- Recommend to the manager that fewer appliances be used.

(1 mark)

(ii) A faulty appliance.

Action taken to establish that this is the cause

- Carry out an insulation resistance test of each appliance in turn to establish which is faulty.

(1 mark)

Remedial action taken or recommended

- Repair the faulty appliance or send away for repair.

(1 mark)

(iii) A faulty circuit.

Action taken to establish that this is the cause

- Disconnect circuit at switchboard. (1 mark)
- Carry out an insulation resistance test of the circuit to establish fault. (1 mark)

(1 mark)

Remedial action taken or recommended

- Recommend to the manager that they get an electrician to repair the fault.

(1 mark)

(iv) *Incorrectly rated fuse.*

Action taken to establish that this is the cause

- *Establish the size of the cable.* (1 mark)
- *Consult Standard to determine current rating of cable.* (1 mark)

Remedial action taken or recommended

- *Replace fuse with one of the correct rating.* (1 mark)

Question 9

- (a) 1 If correctly threaded, prevents fuse element from bulging out the side of the carrier and being contacted.
or
If incorrectly threaded, contact could be made with the fuse element. (1 mark)
- 2 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. (1 mark)
- 3 If correctly threaded, under fault 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. (1 mark)
- (b) (i) The ratio of minimum fusing current to the current rating of the fuse.
or
Utilisation category (fusing factor) = $\frac{\text{Minimum Fusing Current}}{\text{Current Rating}}$ (3 marks)
- (ii) For a given fault current, a fuse with a lower the utilisation category (fusing factor) will operate in a shorter time than a fuse with a higher utilisation category. (2 marks)
- (iii) To ensure that the replacement fuse link will safely interrupt the prospective short circuit current level for that circuit. (2 marks)
- (c) An RCD with overload protection (2 marks)

Question 10

- (a) (i) • Connect low reading ohmmeter or meter on low ohms scale (1 mark)
- Between the motor framework and a known good earth point (not the motor circuit's protective earth conductor) (2 marks)
- (ii) (1) Resistance must not exceed 0.5 ohm. (1 mark)
- (2) NZS 3019 (½ mark)
- (3) Clause 4.3 (½ mark)
- (iii) • To ensure the rapid operation of the protective device when a fault to earth occurs. (1 mark)
- Or*
To ensure a low impedance path to earth for fault current.
- To ensure that the frame stays at earth potential. (1 mark)
- (b) Any **THREE** of:
- Visual inspection
 - Continuity of conductors
 - Verification of polarity
 - *Insulation resistance test.*
- (3 marks)