

2002- 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.

Question 1

(a) Divide the wattage by 230 volts to find the current, then $R = V/I$

or alternatively

$$R = V^2/P, \text{ or } I = W/V, \text{ then } R = V/I$$

(2 marks)

(b) (i) $W = V^2/R$

(1 mark)

(ii) the current flow - the power dissipated

(1 mark)

(c) A nominal voltage of 230 volts between phase and neutral.

Ref: ER2
(2 marks)

(d) Interchange any two of the supply phase connections.

(2 marks)

(e) Resistance - Current carried

(2 marks)

Question 2

- (a) 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.

Ref: AS/NZS 3000: 1.4.37
(2 marks)

- (b) Any TWO of:

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

(2 marks)

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

(2 marks)

- (d) Means an area in which an explosive atmosphere is present, or may be expected to be present, in quantities that require special precautions for the construction, installation, and use of electrical equipment

(2 marks)

- (e) The sub-circuit must be fitted with either a phase failure relay or phase reversal protection. A thermal overload is an alternative

(2 marks)

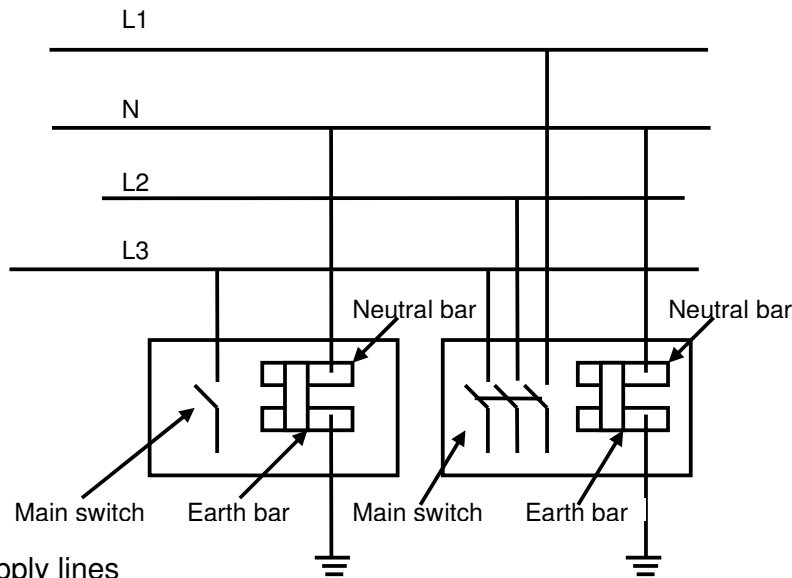
Question 3

- (a) "Multiple Earthed Neutral System" or "MEN System" means a system of supply of electricity in which the neutral is connected to earth
- (a) at the source of supply; and
 - (b) at points on the supply system; and
 - (c) at every electrical installation connected to that system.

(2 marks)
Ref: ER 2

- (b) Any TWO of:
- Low resistance path to the star point
 - Parallel path to the star point.
 - Ties the voltage between phase and earth to 230V (standard low voltage)
- (2 marks)

(c)



- Supply lines (1 mark)
 - Single-phase consumer
 - main switch (1/2 mark)
 - and neutral bar connections. (1/2 mark)
 - earth bar connections. (1/2 mark)
 - Three-phase consumer
 - main switch (1/2 mark)
 - and neutral bar connections. (1/2 mark)
 - earth bar connections. (1/2 mark)
 - Earthing arrangements
 - electrodes (1 mark)
 - links. (1 mark)
- (Total 6 marks)

Question 4

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

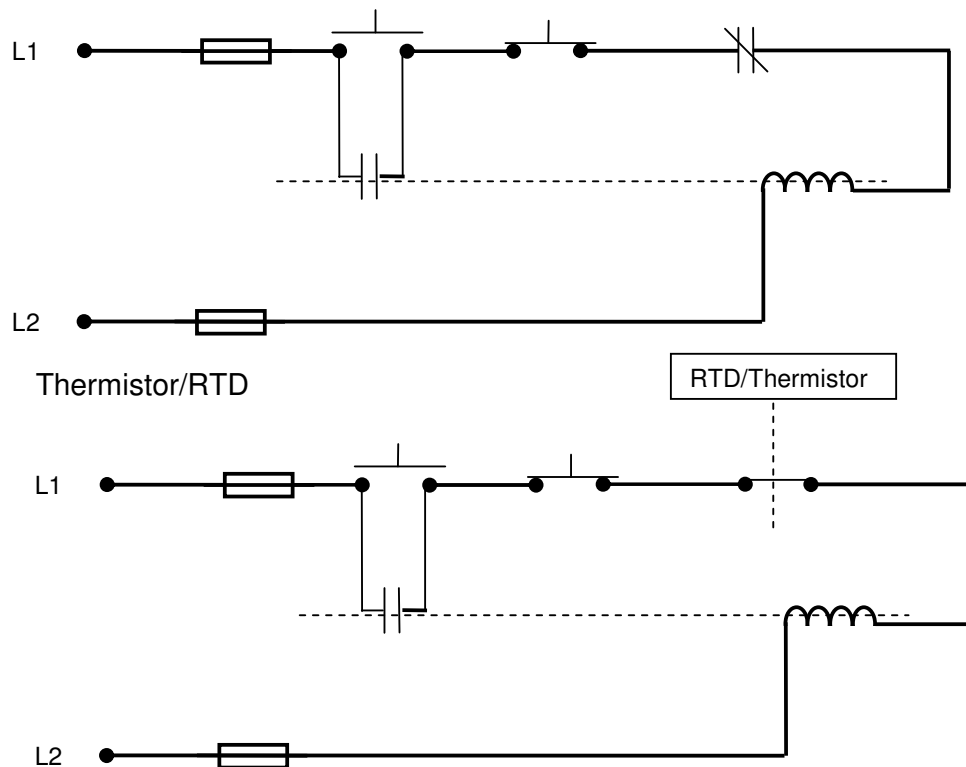
(1 mark)

(b) Any ONE of:

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

(1 mark)

(c) (i) Thermal overload



- 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) For thermal overload

- The excess line current causes heating (1 mark)
- And a bi-metal strip operates a contact in the overload unit (1 mark)
- Which open-circuits the starter coil and de-energises the 3 phases. (1 mark)

For thermistor/RTD

- The excess line current causes heating in the motor windings (1 mark)
- Which causes a sudden increase in temperature of the thermistor (1 mark)
- Which open-circuits the relay in the starter coil circuit and de-energises the 3 phases. (1 mark)

Question 5

(a) Any FOUR of:

- Isolate and tag circuit
 - Each conductor must be insulated and made electrically safe.
 - Each conductor should be marked and labelled to permit reconnection to the correct terminals.
 - Mechanical protection of the cables
 - Steps taken to prevent access to the cables.
- (4 marks)

- (b) Isolation – means deliberately disconnected from the electricity supply and precautions taken to prevent reconnection
 Switched off means that the electricity ceases to be supplied to the appliance
 (3 marks)

(c) Any THREE of:

- Withdrawal of fuses supplying the current plus attaching safety warning tag
 - Locking open of appliance or circuit isolating switch plus attaching safety warning tag
 - Tripping and locking open of supply circuit breaker, plus attaching safety warning tag
 - Removal of appliance plug from socket, plus attaching safety warning tag to appliance
 - Access permit or “hold card” system.
- (3 marks)

Question 6

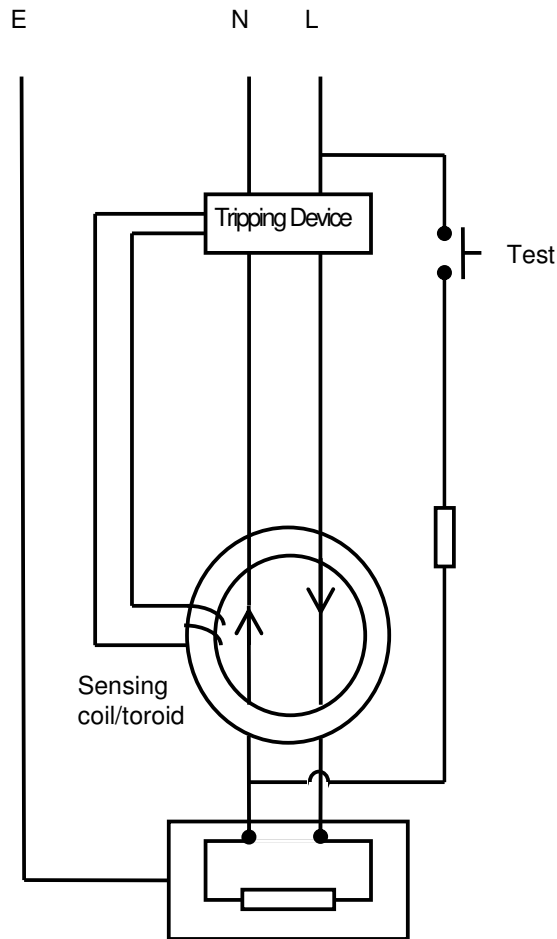
- (a) • Check and prove isolation using Prove-Test-Prove method. (1 mark)
- Add your own Danger Tag to the isolator. (1 mark)
- (b) For the sewing machine and flexible cord: (1 mark)
- Insulation resistance test between active and neutral, active and earth and neutral and earth. (1 mark)
- 500 v d.c insulation resistance tester - 1 M Ω minimum (1 mark)
- Protective earthing conductor test from machine frame to known good earth (1 mark)
- Low reading ohmmeter or multi meter – maximum 1 Ω (1 mark)
- (c) • Connect the machine supply cord and ensure the connections are correct (1 mark)
- Check all screens and guards are in place. (1 mark)
- Remove Danger Tag and check the machine for operational safety. (1 mark)

Question 7

- (a) (i) • To protect the fixed wiring (1 mark)
• Against excess current flow (1 mark)
- (ii) Any TWO of:
• To ensure that the point of circuit isolation is at a safe, accessible place.
• It is the origin the circuit the fuse protects
• To centralise all protection (2 marks)
- (b) (i) The current rating is too low for the circuit, and could blow for no apparent reason well below the circuit full-load current. (1 mark)
- (ii) The current rating is too large, and the circuit current could increase to a high level causing damage, before the fuse blows. (1 mark)
- (c) Any FOUR of:-
• It will safely interrupt short circuit currents of much higher values.
• It eliminates arcing because the fuse element is sealed.
• It is obtainable in a range of Utilisation category (fusing factors).
• It can provide "close" protection in P and Q1 Classes.
• It is not repairable – therefore wrong size of wire cannot be used.
• Current rating is clearly marked.
• Reliable operation within prescribed limits.
• Good discrimination.
• Constant fusing characteristics.
• Faster operation/acting.
• Doesn't deteriorate over time. (4 marks)

Question 8

(a)



- Correctly connected test circuit and resistance (1 mark)
 - Correctly connected sensing coil/toroid (1 mark)
 - Correctly connected load (1 mark)
 - Correctly connected tripping circuit (1 mark)
- (Total -4 marks)

- (b) (i)
- Neutral current equals the phase current. There is no out of balance current so no magnetic field is induced into the iron core. (1 mark)
 - Because there is no induced magnetic field there is no induced current in the sensing coil (1 mark)
 - The tripping coil is not energised. (1 mark)

- (ii) • Neutral current out of balance with the phase current. A magnetic field is induced into the iron core. (1 mark)
- The induced magnetic field induces a current in the sensing coil (1 mark)
- The tripping coil is energised, isolating the circuit (1 mark)

Question 9

- (a) AS/NZS 3760 (1 mark)
- (b) (1) Visual Inspection (1 mark)
- (2) Insulation Resistance (1 mark)
- (3) Protective earthing conductor continuity (1 mark)
- (c) (i) Test Insulation resistance test (1 mark)
- Instrument Insulation resistance tester (1 mark)
- Test result Minimum of 1 Megohm (1 mark)
- (ii) Test Protective earthing conductor continuity (1 mark)
- Instrument Low reading ohmmeter or multi meter (1 mark)
- Test result Maximum of 1 ohm (1 mark)

Question 10

- (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)