

ESTB 2024 - Electrical Service Technician "B" Answer Schedule

- Notes:
- (1 mark) means that the preceding statement/answer earns 1 mark.
 - This schedule sets out the accepted answers to the examination questions. A marker can exercise their discretion and decide on the overall accuracy of any answer that is presented in the candidate's own words.
 - Symbols and terms - alternatives
Power W or P
Voltage V or E or U
Phase Active
 - 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
 - Those parts of an answer that are under-lined indicate the parts required to be covered by a candidate.

Question 1

(a) Any TWO of:

- Safe working practices
- Testing
- Basic first aid
- CPR
- The technical content of problem areas identified by the Board

ER 26
ER Schedule 5 (2)
(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)
(2 marks)

(c) $I = \frac{P}{V}$ (1/2 mark)

$= \frac{92}{240}$ (1/2 mark)

$= 0.38A$ (1 mark)

(d) Any TWO of:

- The wrong isolating switch has been operated.
- The wrong fuses or circuit breakers have been operated.
- The isolating switch is faulty.
- The circuit is being fed from two different sources.
- The isolating switch is not in the active conductor.
- A capacitor has not been discharged.
- Damaged wiring

(2 marks)

(e) (i) Test Insulation resistance test
 Test result Minimum of 1 Megohm
 AS/NZS 3760: 2.3.3.2
 (1 mark)

(ii) Test Protective earthing conductor continuity
 Test result Maximum of 1 ohm
 AS/NZS 3760: 2.3.3.1
 (1 mark)

(f) Any ONE of:

- A sustained overload
- The loss of one phase

(2 marks)

(g) A rise in temperature in the motor windings.

(2 marks)

(h) (i) A fault in the fixed wiring.

(1 mark)

(ii) Call an electrician to repair it.

(1 mark)

GK

- (i) • Open circuited centrifugal switch
 • Open start winding circuit

(2 marks)

(j) (i) Zero or nil

(1 mark)

(i) 230V

(1 mark)

Question 2

(a) (i) a.c.

(1 mark)

(ii) 1 • Peak value

(½ mark)

• 325V

(½ mark)

2. • RMS value

(½ mark)

• 230V

(½ mark)

3. • Periodic time or time interval or cycle for a 50 Hz waveform

(½ mark)

• 0.02s or 20 milliseconds

(½ mark)

(b) The number of complete changes/cycles per second.

(1 mark)

(c) (i) Any TWO of:

- It maintains the voltage of the frame of the appliance to about 0 volts.
- It provides a low resistance path for the fault current.
- Ensures sufficient fault current can flow to operate the protection.

(2 marks)

(ii) The method has to show:

- Testing to detect source of the high resistance.

(1 mark)

- Repair faulty terminations or replace faulty cord or replacement of faulty plug.

(1 mark)

- Re-testing of the protective earthing conductor to ensure resistance is less than 1 Ω ,

(1 mark)

Question 3

Solution 1 – Insulation resistance test

- (a)
- Disconnect straps on motor terminal block (1 mark)
 - Use an insulation resistance tester. (1 mark)
 - Test between each motor winding and between each winding and earth. (1 mark)
 - The test result shown on the tester should be very low or zero. (1 mark)
- (b) Any TWO of:
- Short between windings
 - Short between a winding and earth
 - Short between the circuit and earth (2 marks)

Solution 2 –Circuit continuity test

- (a)
- Use an ohmmeter that can accurately read values of less than 1 ohm. (1 mark)
 - Test between each phase at the beginning of the cable (1½ marks)
 - The test result shown on the tester should show a high resistance or open-circuit between two of the phases. (1½ marks)
- (b)
- Open-circuited phase conductor to the motor
 - Open-circuited motor winding. (2 marks)
- (c)
- Ensure the connections are correct (1 mark)
 - Check all screens and guards are in place. (1 mark)
 - Ensure rotation is correct (1 mark)
 - Ensure the motor is functionally earthed. (1 mark)

Question 4

(a) (i) Any ONE of:

- 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
- Degrees of enclosure protection for electrical equipment
AS 60529
- A degree of protection in accordance with AS 1939.
AS/NZS 3000: 1.4.58
(2 marks)

(ii) Any ONE of:

- 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
- Protection against solid objects
AS 60529
- The degree of protection against solid objects
- Protection of persons against access to hazardous parts.
AS/NZS 3000: 1.4.58
(2 marks)

(iii) Any ONE of:

- Protection of equipment against harmful ingress of water.
AS 1939 supplement 1 – 1990
- Protection against liquids
AS 60529
- A degree of protection against entry of water with harmful effects.
AS/NZS 3000: 1.4.58
(2 marks)

(b) **3** Any ONE of:

- Protection of persons holding tools or wires (larger than 2.5 mm) and protection of equipment against objects larger than 2.5mm².
AS 1939 supplement 1
- Protected against solid objects over 2.5 mm (tools and small wires)
AS 60529
(1 mark)

4 Any ONE of:

- Protection against splashing and spraying water from all practicable directions.
AS 1939 supplement 1
- Protection against water sprayed from all directions – limited egress permitted.
AS 60529
(1 mark)

- (c) (i) Must have a minimum degree of protection of IPX5
AS/NZS 3000: 7.2.4.1(b)
(1 mark)
- (ii) Must have a minimum degree of protection of IPX4
AS/NZS 3000: 7.2.4.1(c)
(1 mark)

Question 5

- (a)
 - Overload caused by too many appliances in use.
 - A faulty appliance
 - A faulty circuit. (3 marks)

- (b) (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 that 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

Solution 1

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

Solution 2

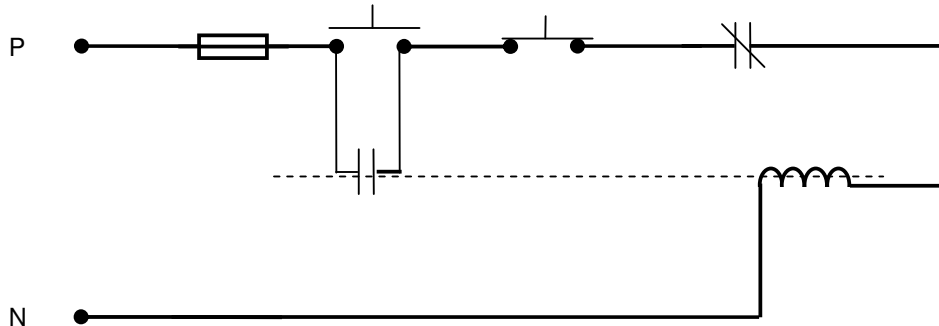
Remove fuses from carrier and attach an Out-of-Service tag or Danger Tag to circuit. (2 marks)

Remedial action taken or recommended

- Recommend an electrician be engaged to repair the fault. (1 mark)

Question 6

(a)

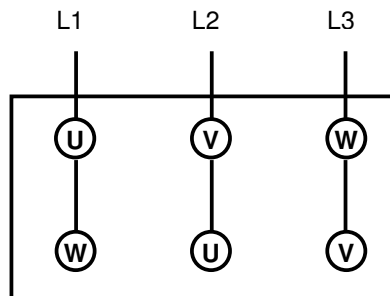


- Correct supply (phase and neutral) (1 mark)
- Fuse protecting circuit (½ mark)
- Stop/start station correctly connected (1 mark)
- Hold-in contacts and coil correctly connected (1 mark)
- Thermal overload contacts correctly connected (½ mark)

(b) (i) With an ohmmeter set on the lowest scale, test between each set of motor terminals in turn until the three lowest resistances between pairs of terminals is known.

(2 marks)

(ii)



(2 marks)

(c) Any TWO of:

- Removal of ventilation fan or fan cowling.
- Blocked ventilation ports
- Additional of covers that block ventilation ports
- Build-up of dust in motor
- Rise in ambient temperature

(2 marks)

Question 7

(a) Voltage is dropped as the load current passes through the conductor resistance

(1 mark)

(b) • Use a flexible cord with an increased cross-sectional area

(1 mark)

• Reduce the length of the cord

(1 mark)

(c) It is the maximum current that a flexible cord is designed to carry safely

(2 marks)

(d)

Existing cord conductor colours	Acceptable Colours in New Zealand	Polarity
Green	Green/Yellow	Earth
Black	Light Blue (or Blue)	Neutral
Red	Brown	Phase or Active or Live

(3 marks)

(e) Any ONE of:

• The load current is likely to arc across the micro gap as the switch contacts are opened and damage them.

• It is easier to extinguish an a.c. arc as the current goes through zero in each half-cycle.

(2 marks)

Question 8

(a) Any FOUR of:

- Inspect instrument, clips, leads and probes to ensure they are in good condition.
- Ensure correct function is selected on the instrument.
- Ensure correct (or highest) range is selected on the instrument.
- Ensure leads are correctly connected.

(4 marks)

- (b) (i) • To ensure that the test meter/instrument - is operating correctly.
• To ensure that the circuit has been isolated before it is worked on.

(2 marks)

- (ii) • First - prove the meter is operating correctly on a known live circuit.
(1 mark)

- Then - test that the circuit is isolated.
(1 mark)

- Then - prove again that the meter is still operating correctly on a known live circuit.
(1 mark)

(1 mark)

(c) Any ONE of:

- Locking open of isolating switch
- Locking open the supply circuit breaker
- Disconnect the fixed wiring

(1 mark)

Question 9

(a) (i) Current flowing I = $\frac{V}{R}$ (½ mark)

= $\frac{230}{10.6 + 2}$ (½ mark)

= 18.25A fault current (1 mark)

(ii) Fusing current of the fuse is $16 \times 1.5 = 24$ amps. (1 mark)

The fuse will not operate because the fault current is 18.25 amps. (1 mark)

(iii) W = V x I (½ mark)

= 230×18.25 (½ mark)

= 4197.5W (1 mark)

- (b) (i) • The neutral conductor was connected to the switch instead of the phase conductor on the supply side of the terminal block
- The neutral conductor was connected to the switch instead of the phase conductor on the load side of the terminal block
- The phase and neutral can be transposed at the plug on the flexible cord (3 marks)

(ii) Most of the internal wiring will be alive at 230V to earth with the switch in the "OFF" position. (1 mark)