

ESTB 2039 - 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) The answer has to cover the following points:

There is no significant risk of injury or death to any person, or of damage to any property, as a result of the use of electricity.

ER69(2)
(2 marks)

- (b) Any TWO of:

- If in normal use, or in the event of abnormal operation, it functions unsafely so as to cause danger to persons, property, or animals; or
- If it has inadequate protection against direct contact or indirect contact; or
- If its unearthed conductive parts are separated from live parts only by basic insulation.
- If the voltage at which the appliances operates is not adequately marked on the appliance; or
- If it is used for a use other than its normal use, and is not provided, or used in conjunction, with suitable safeguards; or
- If it is constructed that it is not safe under both normal and abnormal conditions of use.

ER76A)
(2 marks)

- (c) 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 3000:2000: 1.4.58
AS/NZS 3000:2007: 1.4.61
AS/NZS 3000:2007: G1
(2 marks)
- (d) Any TWO of -
- Other equipment could fail or stop during an essential operation (lift or elevator control circuit)
 - The motor intended to be disconnected is remains energised.
 - The motor intended to be disconnected is remains energised, creating a mechanical hazard if restarted.
(2 marks)
- (e) • Insulation resistance
• Fusing factor
(2 marks)
- (f) (i) (A) Two
(B) In parallel
(1/2 mark)
(1/2 mark)
- (ii) (A) Two
(B) In series
(1/2 mark)
(1/2 mark)
- (g) (1) Before beginning the work, to check that any associated equipment and personal protective equipment to be used by that person is in good order and condition, and is safe for its intended use
ER 36(2)(a)
(1 mark)
- (2) To use the associated equipment and the personal protective equipment provided in a competent manner.
ER 36(2)(c)
(1 mark)
- (h) • A fault in the fixed wiring circuit
(1 mark)
- A registered electrician must be called to fix it
(1 mark)

(i) **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
- The access probe of 2.5 mm diameter shall not penetrate.
AS/NZS 3000:2007: Table G1(a)
(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
- Protection against water splashed from all directions. Limited ingress permitted.
AS/NZS 3000:2007: Table G1(b)
(1 mark)

(j) Class I 6 months
Class II 12 months

AS/NZS 3760:2001: Table 2
AS/NZS 3760:2003: Table 2
(2 marks)

Question 2

- (a) • If one appliance has a phase to frame fault (1 mark)
- And the other has a neutral to frame fault (1 mark)
- And there is a break in the earth bonding (1 mark)
- Simultaneous contact with both appliances when switched "on" can result in severe electric shock. (1 mark)
- (b) To provide protection to both the appliance and the extension lead. (1 mark)
- (c) • Portable or hand-held appliances do not automatically restart when supply is restored. (1 mark)
- The PRCD has to be manually reset to restore the supply. (1 mark)
- (d) • 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)
(3 marks)

Question 3

- (a) • AS: /NZS 3760 (1/2 mark)

- Regulation 38 (1/2 mark)

(b)

Test using test instruments	Type of instrument required	Acceptable test result
Protective earthing conductor test	Ohmmeter Or Any meter that can accurately read values of less than 1 ohm	1 Ω - maximum
Insulation resistance test	Insulation resistance tester	10,000Ω – minimum

AS/NZS 3760: 2.3.3
(3 marks)

(c) Any TWO of:

- They are effectively anchored.
- The inner cores are not exposed or twisted;
- The external sheaths are not cut, abraded, twisted, or damaged to such an extent that the insulation of the inner cores is visible
- Unprotected conductors or insulation tape are not in evidence.

AS/NZS 3760: 2.3.2
(2 marks)

(d) Any TWO of:

From AS/NZS 3760:2001

- 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

Or

From AS/NZS 3760:2003

- 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.

AS/NZS 3760: 2.3.2
(2 marks)

- (e) • Test between each phase and earth (½ mark)
- Test between neutral and earth (½ mark)
- (f) Test between the earth pin of the plug and the frame of the appliance (1 mark)

Question 4

(a) (i) Reverse the connections to the start winding
or
Reverse the connections to the run winding. (1 mark)

(ii) Reverse the connections to the field windings
or
Reverse the connections to the armature windings. (1 mark)

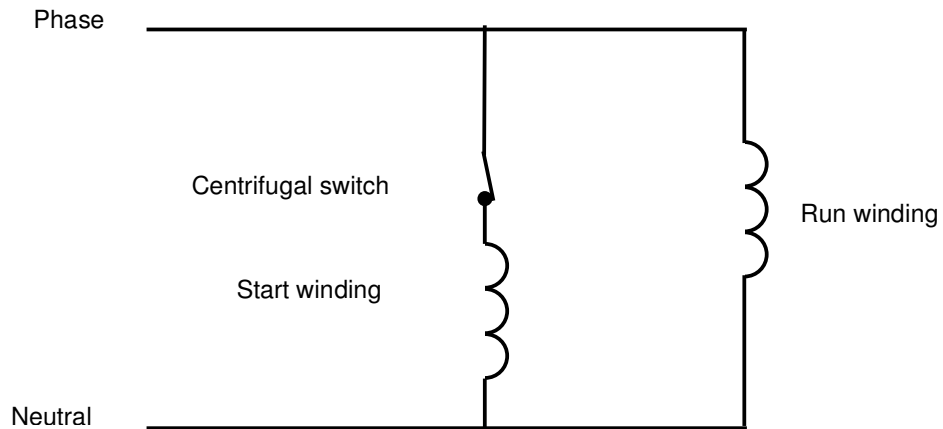
(b) Power = 746 x 0.75 (1/2 mark)
= 559.5 watts (1/2 mark)

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

= $\frac{560}{230}$ (1/2 mark)

= 2.43A (1 mark)

(c) (i)



- Correctly connected start winding (1/2 mark)

- Correctly connected centrifugal switch (1/2 mark)

- Correctly connected run winding (1/2 mark)

- Working circuit

(½ mark)

(ii) An external current relay.

(1 mark)

(d) Any ONE of:

- It may create arcing in the switch causing possible damage.
- Damage could occur to the motor drive assembly

(2 marks)

Question 5

- (a) • That the test meter/instrument - is operating correctly.
• That the appliance has been isolated before it is worked on. (2 marks)
- (b) Any FOUR of:
- Attach a safety warning tag to the fuse bases
 - Attach a safety warning tag to the isolating switch
 - Lock open the isolating switch.
 - Disconnect the circuit at the fuses
 - Access permit or "hold card" system. (4 marks)
- (c) • Each conductor must be 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)

Question 6

(a) Set 1

Brown	Phase	(1 mark)
Blue	Neutral	(1 mark)
Green or Green/Yellow	Earth	(1 mark)

Note: To gain marks for this set all the colours and polarity must be accurately stated.

Set 2

Red	Phase	(1 mark)
Black	Neutral	(1 mark)
Green	Earth	(1 mark)

Note: To gain marks for this set all the colours and polarity must be accurately stated.

(b) From AS/NZS 3000:2000: Table 3.5

Actives Any colour except green/yellow, green, black or light blue.
Earth Green or green/yellow

Or

From AS/NZS 3000:2007: Figure 3.2

- Actives Red, white, dark blue
Earth Green
- (2 marks)

Note: To gain marks for this question one set of the colours and polarity must be accurately stated.

(c) The current rating of the cord. (1 mark)

(d) Voltage is dropped as the load current passes through the conductor resistance (1 mark)

Question 7

- (a) • The control circuit operates on the phase on which there is no fault. (1 mark)
- The elements are connected in star, which is connected to the neutral. (1 mark)
- (b) (i) (1) The wiring between the isolator and contactor. (½ mark)
- (2) The wiring between the contactor and oven. (½ mark)
- (3) The oven elements. (½ mark)
- (ii) • An insulation resistance test (½ mark)
- Insulation resistance tester (½ mark)
- 500V d.c. (½ mark)
- (iii) (1) The wiring between the isolator and contactor. Test between:
- each phase and earth. (½ mark)
 - each phase and neutral. (½ mark)
 - phases. (½ mark)
- The test result will be much less than $1M\Omega$ on the phases with the faults. (½ mark)
- (2) The wiring between the contactor and the oven. Test between:
- each faulty phase and earth. (½ mark)
 - each phase and neutral. (½ mark)
 - phases. (½ mark)
- The test result will be much less than $1M\Omega$ on the phases with the faults. (½ mark)
- (3) The oven elements.
- Test between each element and earth. (½ mark)
 - The test result will be much less than $10,000\Omega$ on the phases with the faults. (½ mark)

Question 8

- (a) • Carry out an insulation test (½ mark)
- Use an insulation resistance tester. (½ mark)
 - The test voltage is 500V d.c. (½ mark)
 - Test between each motor winding and earth. (1½ marks)
 - The test result shown be very low or zero on the phase with the earth fault. (1 mark)
- (b) • Short between a winding and earth
- Short between one phase and earth within either the flexible conduit or internally in the machine (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 9

- (a) (i) The Electrical Workers Registration Board
ER 12(1)
(1 mark)
- (ii) When working for payment or reward.
ER 12(4)
(1 mark)
- (b) (i) Within 2 years
ER Schedule 5 (2)
(1 mark)
- (ii) Any FOUR of:
- Safe working practices
 - Testing
 - Basic first aid
 - CPR
 - The technical content of problem areas identified by the Board
- ER Schedule 5 (2)
(4 marks)
- (c) Any THREE of:
- Registered electricians
 - Registered line mechanics
 - Registered electrical inspectors
 - Registered electrical service technicians
 - Persons who are authorised to carry out such work under a provisional licence
 - Qualified engineers
- EA 108 (2)
(3 marks)