

## 2007- Electrical Service Technician “B” Answer Schedule

- Notes:1. (1 mark) means that the preceding statement/answer earns 1 mark.
2. This schedule sets out the expected answers to the examination questions. The marker can exercise their discretion and decide on the overall accuracy of any answer that is presented in the candidate's own words.
3. Symbols  
Power W or P  
Voltage V or E or U
4. 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

### Question 1

- (a) When supplied at a constant voltage any decrease in the electrical resistance of any appliance will result in an increase in **current** and **heat or power**  
(2 marks)
- (b) 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  
ER2  
(2 marks)
- (c) Any TWO of:
- Resistance
  - Current
  - Length
  - Cross-sectional area
- (2 marks)
- (d) The nominal voltage existing between a neutral conductor and earth in normal circumstances should ideally be **zero or nil**  
(2 marks)

- (e) Means that 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 the works, electrical installations, fittings, electrical appliances, or associated equipment, or the passage of electricity through those works, electrical installations, fittings, electrical appliances, or associated equipment, as the case may be.

ER69  
(2 marks)

## Question 2

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

(2 marks)

(b) Any TWO of:

- Internal connections of one winding reversed
- Mechanical overload
- Supply voltage insufficient
- Loss of one phase
- Mechanical faults (bent rotor, excessive bearing wear)

(2 marks)

(c) (i)  $I = \frac{V}{R}$   
 $= \frac{240}{24}$   
 $= 10A$

(½ mark)

(½ mark)

(ii)  $W = VA$   
 $= 240 \times 10$   
 $= 2400W$

(½ mark)

(½ mark)

or

$$\begin{aligned} &= I^2R \\ &= 10 \times 10 \times 24 \\ &= 2400W \end{aligned}$$

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

(2 marks)

(e) Any TWO of:

- When they are double insulated
- When they are supplied from an isolating transformer
- Any Class II equipment

(2 marks)

**Question 3**

(a)

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

(3 marks)

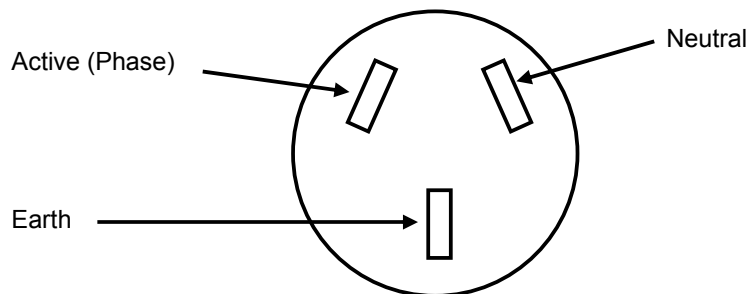
Ref: AS/NZS 3000: Table 3.5

(b) Any FOUR of:

- Number of cores - e.g., is a P.E.C required?
- Colour Coding - Conductor identification.
- Check for mechanical strength - is weight to be supported?
- Type of sheath - is it suitable for the environment it is to work in (i.e. water, abrasion, high temperature, oil, chemicals - could cause insulation failure if incorrect type of sheath is chosen).
- Conductor strand size - if flexibility a requirement.
- Cord shape - suitability to clamping/anchorage arrangement.
- Temperature rating

(4 marks)

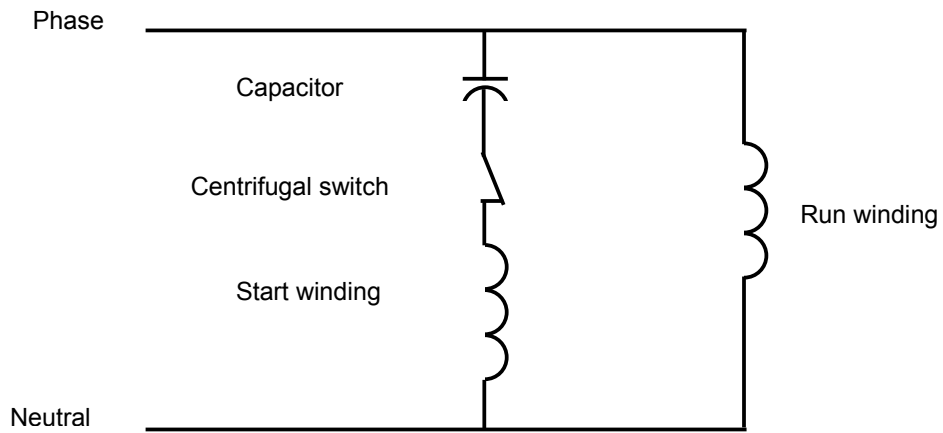
(c)



(3 marks)

#### Question 4

(a) (i)



- Correctly connected start winding, capacitor and centrifugal switch (1½ marks)
- Correctly connected run winding (½ mark)

(ii) Reverse the connections on the start winding or the run winding but not both (2 marks)

(b) (i) Reverse connections to either start or run winding, but not to both. (2 marks)

(ii) Reverse connections to either the field windings or armature or brush connections but not both. (2 marks)

(c) Any TWO of:

- Open circuited capacitor
- Open circuited centrifugal switch
- Open start winding circuit

(2 marks)

### Question 5

- (a) (i) • The maintenance of electrical appliances. (1 mark)
- The maintenance or replacement of fittings of works or electrical installations other than the installation of conductors: (1 mark)
- The connection or disconnection of an electrical appliance to or from a conductor that is to supply electricity to that electrical appliance: (1 mark)
- The replacement of fuse links
- The construction, repair, or replacement of flexible cord sets (1 mark)
- ER 18
- (ii) The work described in (a)(i) is limited to fittings and appliances rated up to an including 460V. (1 mark)
- (b) (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 for installations (1 mark)
- Safe working practices, testing and basic first aid at intervals not exceeding 14 months, CPR at intervals not exceeding 7 months. (1 mark)
- ER 26(4)(a), (b)

### Question 6

- (a) (i) A bi-metal strip bends when heated and trips the circuit breaker out the heating of the strip is caused by the current flowing through it – or through a heater coil.  
(2 marks)
- (ii) As the current increases, the magnetic field increases, and at a predetermined point, it attracts an armature that trips out the circuit breaker.  
(2 marks)
- (iii) Combined thermal/magnetic breakers have both a bimetal strip and an armature coil. The bimetal protects and will operate on the occurrence of a sustained overload and the armature circuit will protect and act on the occurrence of a short circuit or sudden increase in current.  
(3 marks)
- (b) The maximum current that a fuse-link will carry continuously without deterioration or operating.  
(2 marks)
- (c) Any ONE of:
- The fuse would blow well below the circuit full-load current.
  - Will cause nuisance operation
  - May not be able to supply the connected load
- (1 mark)

### Question 7

(a) Any FOUR of:

- 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.
- Maintain isolation

(4 marks)

(b) An isolator cannot be inadvertently turned back on.

(2 marks)

(c) Any FOUR 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
- Opening 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.

(4 marks)

### Question 8

- (a)
- Purpose -  
An earth continuity conductor provides a safeguard against electric shock by maintaining the machine framework at earth potential.  
(2 marks)
  - Care & Termination -  
Care in termination is necessary to ensure the minimum possible resistance (frame to earth) and the maximum current carrying capacity (avoid broken strands etc)  
(2 marks)
  - In order to operate the machine circuit protection devices in the event of a phase (active) to framework short circuit.  
(1 mark)
  - Testing -  
The protective earthing resistance should not exceed 1 ohm  
or  
The protective earthing resistance should not exceed 0.5 ohms  
or  
The protective earthing resistance is such that the protection will operate within 0.4 s  
(1 mark)
- (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.  
(2 marks)

### Question 9

(a) AS/NZS 3760 (1 mark)

(b) AS/NZS 3760: 2001 or AS/NZS 3760: 2003

(1) Visual Inspection (1 mark)  
Ref: Clause 2.3.2

(2) Insulation Resistance (1 mark)  
Ref: Clause 2.3.3.2

(3) Protective earthing conductor continuity (1 mark)  
Ref: Clause 2.3.3.1

(c) AS/NZS 3760: 2001 or AS/NZS 3760: 2003

(1) Test Insulation resistance test Ref: Clause 2.3.3.2  
(1 mark)

Instrument Insulation resistance tester (1 mark)

Test result Minimum of 1 Megohm Ref: Clause 2.3.3.2  
(1 mark)

(2) Test Protective earthing conductor continuity Ref: Clause 2.3.3.1  
(1 mark)

Instrument Low reading ohmmeter or multi meter (1 mark)

Test result Maximum of 1 ohm Ref: Clause 2.3.3.1  
(1 mark)

**Question 10**

- (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) • When an earth fault occurs, some current is diverted to earth (1 mark)
- This causes an imbalance between phase (active) and neutral currents (1 mark)
- Which is detected by the sensing coil. (1 mark)
- The coil trips and disconnects the supply to the load (1 mark)

(c) RCD

- To ensure the tripping mechanism has not become stuck or "frozen"

or

- To ensure it works correctly

or

PRCD

- To ensure the tripping mechanism has not become stuck or "frozen"

or

- To ensure PRCD does not reset to the "on" position after loss of supply.

(1 mark)

(d) (i) 300mS or 0.3 seconds

(1 mark)

Ref: NZS 3019: 4.8.2.1(a)(i)

(ii) 40mS or 0.04 seconds

(1 mark)

Ref: NZS 3019: 4.8.2.1(a)(ii)