

ESTB 2009- 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 and terms - alternatives
Power W or P
Voltage V or E or U
Phase Active
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) Divide the wattage by 230 volts to find the current, then $R = V/I$

or

 $R = V^2/P$, or $I = W/V$, then $R = V/I$ (2 marks)
- (b) Any TWO of:
- Current rating
 - Voltage rating
 - Category of duty (Rupturing Capacity, short-circuit capacity, KA rating))
 - Utilisation category (fusing factor) (Class)
- (2 marks)
- (c) Three years qualifying experience. (2 marks)
EA: 2
- (d) 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)

(e) (i) 50Hz

(1 mark)

(ii) 230 volts or 400 volts Or 460 volts

(1 mark)

Question 2

(a) The isolator must be locked in the off position before starting any work.

(2 marks)

(b) Any TWO of:

- It will safely interrupt short circuit currents of much higher values or higher rupturing capacity.
- It eliminates arcing because the fuse element is sealed.
- It is obtainable in a range of Utilisation category (fusing factors).
- Current rating is clearly marked.
- Reliable operation within prescribed limits.
- Good discrimination.
- Constant fusing characteristics.
- Faster operation/acting.
- Doesn't deteriorate over time.

(2 marks)

(c) 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)

(2 marks)

(d) Any ONE of:

- A supervisor of electrical work whose registration allows that supervisor to do the work
- A registered person whose registration allows that person to do the work, where the registered person is under the supervision of a supervisor of electrical work whose registration allows that supervisor to do the work

ER 23(a),(b)
(2 marks)

(e) 216.5 V (5% of 230 V).

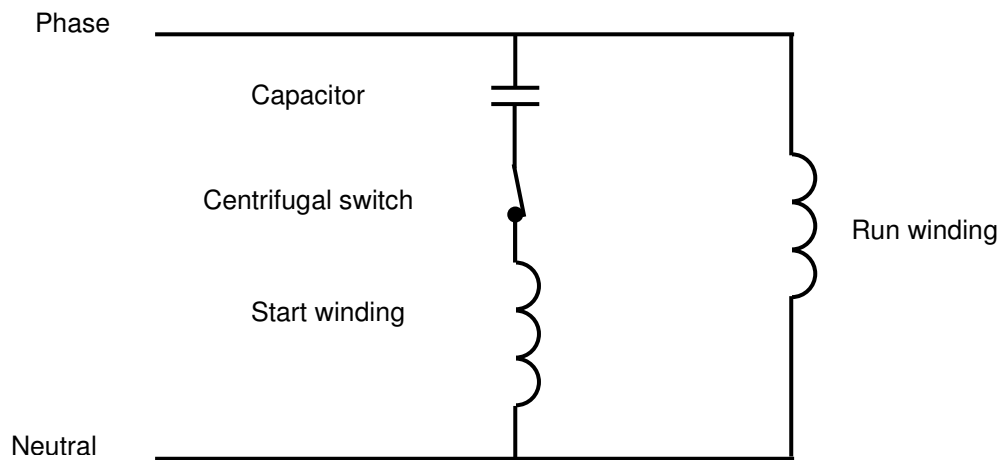
or

205.4 V (6% of 230 V = 13.8V + 5% of 216.2V = 10.81V – 24.6V drop in total)

ER53(3)(b)
(2 marks)

Question 3

(a) (i)

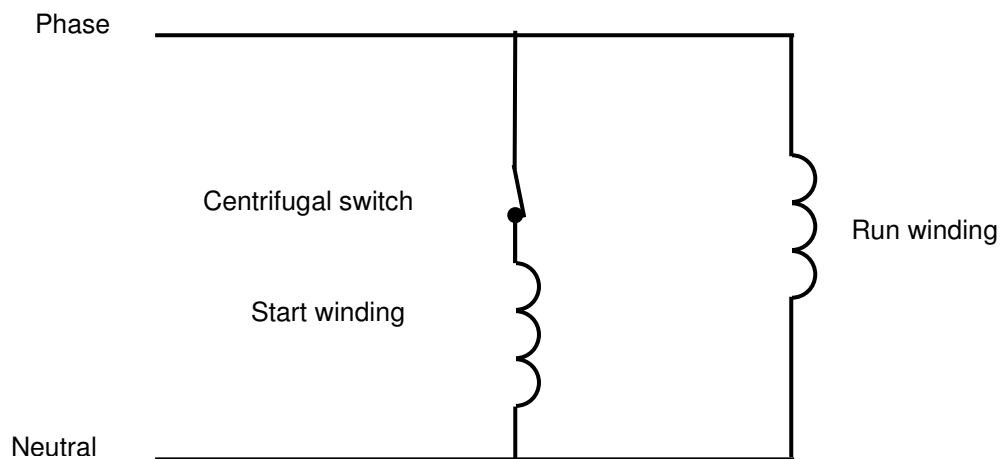


- Correctly connected start winding, capacitor and centrifugal switch (1½ marks)
- Correctly connected run winding (½ mark)

(ii) Reverse the connections of the start winding or the run winding. (2 marks)

(b) Reverse connections to the field windings or armature windings (or brush-holder connections). (2 marks)

(c) (i)



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

(ii) Reverse the connections of the start winding or the run winding. (2 marks)

Question 4

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

(b) RCD

- To ensure the tripping mechanism has not become stuck or "frozen"
- or
- To ensure it works correctly (rapidly)
- 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 supply is re-established. (1 mark)

- (c) (i) 300ms or 0.3 seconds (1 mark)

- (ii) 40ms or 0.04 seconds (1 mark)

(d) Any THREE of:

- If correctly threaded, prevents fuse element from bulging out the side of the carrier and being accessible to touch.
or
If incorrectly threaded, contact could be made with the fuse element.
- 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.
- 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.
- If correctly threaded, the fuse wire is sheltered in the tunnel and well clear of the terminals which act as a heat sink.
Or
If incorrectly threaded, will be slow to respond to overload fault.

(3 marks)

Question 5

(a) Table 3.5 of AS/NZS 3000

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

(4 marks)

(b) Any ONE of:

- The cross sectional area of the flexible cord conductors (conductor size)
- Insulation material

(2 marks)

(b) Any FOUR of:

- Minimum number of cores required
- Colour Coding
- Mechanical strength if weight is 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.

(4 marks)

Question 6

- (a) 1. Locate and identify the fuses on the switchboard for the motor. (1 mark)
2. Switch off the circuit power supply and remove fuse carriers. (1 mark)
3. Attach Danger tag to fuse bases. (1 mark)
4. Remove the isolator cover and test for voltage at the supply side of the isolator using the prove-test-prove method. (2 marks)

Note: Nos 1 and 2 must occur first, No.s 3 and 4 can be in any order.

- (b) (1) Replace the isolator. (1 mark)
- (2) Remove the motor. (1 mark)
- (c) (1) Insulate and mechanically protect motor supply cables. (2 marks)
- (2) Replace "Danger" tag with an "Out of Service" tag. (1 mark)

Question 7

- (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.

AS/NZS 3000: 1.4.37
(2 marks)

- (b) Any ONE of:

- A degree of protection in accordance with AS 1939.
- 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/NZS 3000: 1.4.8

AS 1939 supplement 1 – 1990

AS 1939 supplement 1 – 1990

(2 marks)

- (c) (i) • The degree of protection of persons against live or moving parts inside the enclosure
- And protection of the equipment against ingress of solid objects

AS 1939 supplement 1 – 1990

(2 marks)

- (ii) The degree of protection of equipment against the ingress of water or other liquids

AS 1939 supplement 1 – 1990

(2 marks)

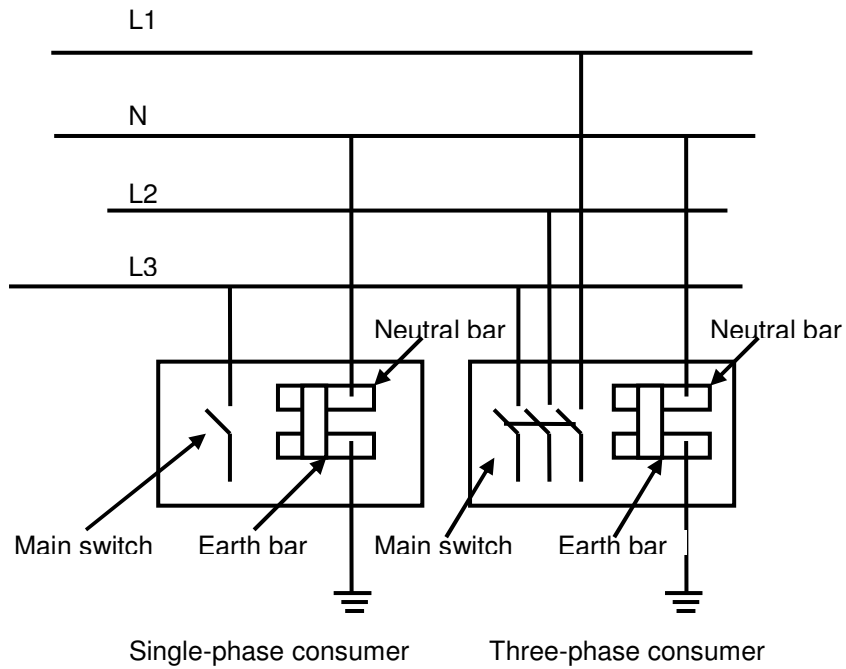
- (d) • Protection against solid bodies greater than 1 mm
- Protection against splashing water from all directions

AS 1939 supplement 1 – 1990

(2 marks)

Question 8

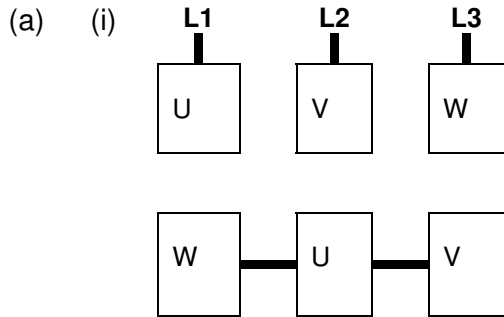
(a)



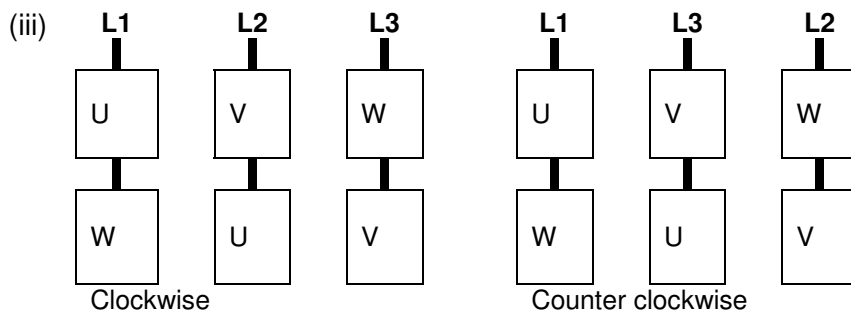
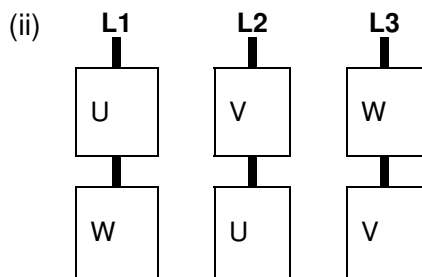
- Supply lines (1 mark)
- Single-phase consumer:
 - main switch (1/2 mark)
 - neutral bar connections. (1/2 mark)
 - earth bar connections. (1/2 mark)
- Three-phase consumer
 - main switch (1/2 mark)
 - neutral bar connections. (1/2 mark)
 - earth bar connections. (1/2 mark)
- Earthing arrangements
 - electrodes (1 mark)
 - links. (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 with respect to earth.
(2 marks)

Question 9



(2 marks)



(4 marks)

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

(2 marks)

Question 10

- (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 magnetic circuit will protect and act on the occurrence of a short circuit or large 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)