

ESTB 2018 - 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) Phase failure relay. (2 marks)
- (b)
 - Resistance
 - Cross-sectional area(2 marks)
- (c) 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)

(d) • = 230 – (230 x 5%) (1 mark)
= 218.5 V (1 mark)

ER53(3)(b)

(e) A registered electrical service technician who has had in total not less than three years' qualifying experience.

EA 2
(2 marks)

(f) Any TWO of:

- The wrong isolating switch has been operated.
- The wrong fuses or circuit breakers have been operated.
- The wiring is damaged or faulty.
- 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.

(2 marks)

Question 2

- (a) Phase to Phase = 400V or alternatively L1-L2, L1-L3, L2-L3 = 400V
Phase to Neutral = 230V or alternatively L1-N, L2-N, L3-N = 230V
Phase to Earth = 230V or alternatively L1-E, L2-E, L3-E = 230V
Neutral to Earth = 0 V
(2 marks)
- (b) "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
- (c) • When the load on each phase is identical and no out of balance current exists
• When the load connected in delta
(4 marks)
- (d) (i) 50Hz
(1 mark)
(ii) 325 volts
(1 mark)

Question 3

- (a) (i) 1. Phase
2. Neutral
3. Fuse
4. Start button
5. Hold-in contact
6. Coil
7. Stop button
8. Thermal overload

(4 marks)

- (ii) 110V or 230V

(1 mark)

- (b) (i) The thermal overload:

- Protects the motor against a small sustained overload or over current.
or
 - Protects the motor against the phase imbalance of single-phasing
- (2 marks)

- (ii) The thermistor:

Detects a rise in temperature in the motor windings and opens the control circuit when the temperature exceeds a pre-set level

(2 marks)

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

(1 mark)

Question 4

(a) The description has to cover:

1. An insulation resistance test showing:
 - the use of an insulation resistance tester (½ mark)
 - a 500V d.c. test voltage (½ mark)
 - testing between phase and earth and neutral and earth (½ mark)
 - an expected test result of 10,000 ohms or 0.01 Mohms (½ mark)
 - the test result being a minimum value (1 mark)
2. A protective earthing conductor test showing:
 - the use of a meter that can accurately read values of 1 ohm or less (½ mark)
 - a testing between the PEC conductor of the flexible cord and the case of the cylinder (½ mark)
 - an expected test result of 1 ohm (½ mark)
 - the test result being a maximum value (½ mark)

(b) The procedure has to cover:

- Identifying the correct fuse on the switchboard. (1 mark)
- Attaching a Danger tag to the circuit. (1 mark)
- Removing the isolator cover and testing for voltage at the supply side of the isolator using the prove-test-prove method. (2 marks)

Question 5

- (a) • The supply and/or the appliance would be short-circuited. (2 marks)
- Meter protection would operate,
or
The circuit protection would operate.
or
A personal hazard – flash burns.
or
Meter and/or appliance components could be damaged. (1 mark)
- (b) Any THREE of:
- The instrument prevents the appliance from operating.
 - A 230 volt reading indicates only that the appliance is turned on.
 - A 230 volt reading indicates only that the appliance element is OK.
 - A 230 volt reading indicates only the supply voltage.
 - A 0 volt reading can lead to the false conclusion that the circuit is dead.
 - A 0 volt reading will be obtained if the appliance load is open circuited (by a switch or element) (3 marks)
- (b) Any FOUR of:
- Inspect instrument, clips, leads and probes to ensure they are in good condition.
 - Don't energise circuit until all connections have been completed.
 - Don't make any changes to circuit while power is on.
 - Ensure correct range is selected on the instrument.
 - Ensure leads are correctly connected. (4 marks)

Question 6

- (a) (i) • To protect the fixed wiring against excess current flow
or
• Safely interrupt and disconnect a faulty circuit (2 marks)
- (ii) To provide personal protection to the user of an appliance that is connected to the circuit controlled by the RCD. (2 marks)

- (b) The maximum current that a fuse-link will carry continuously without deterioration or operating.

OR

The maximum level of protection for the circuit (2 marks)

- (c) • The HRC fuses are capable of safely interrupting far higher levels of PSSC than the thermal overload in a fault situation (1 mark)
- The HRC fuses operate much faster than the thermal overload under short circuit conditions, and they will disconnect the circuit before any damage occurs. (1 mark)

- (d) Any TWO 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 short-circuit 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. (2 marks)

Question 7

- (a) (i) Current flowing I = $\frac{V}{R}$ (½ mark)
- = $\frac{230}{20}$ (½ mark)
- = 11.5 A fault current would flow (1 mark)
- (ii) W = V x I (½ mark)
- = 230 x 11.5A (½ mark)
- = 2645 W (1 mark)
- (iii) • The minimum fusing current of the fuse = 15 x 1.25 = 18.75A (1 mark)
- The fuse will not operate because the fault current is only 11.5A (1 mark)
- (b) • The neutral conductor was connected to the switch instead of the phase conductor
- The phase and neutral can be transposed at the plug on the flexible cord
- The phase and neutral can be transposed at the internal terminals in the appliance (other than at the switch) (3 marks)
- (c) Most of the internal wiring will be alive at 230V to earth with the switch in the "OFF" position. (1 mark)

Question 8

- (a) • The motor will operate normally (1 mark)
- The neutral would be switched (1 mark)
- The motor circuitry would be live when the isolating switch is in the "off" position. (1 mark)
- (b) • The RCCB will trip.
- If the RCCB fails to operate, the PEC will carry the full load current for which it is not designed. (1 mark)
- (c) Any ONE of:
- - The MCB would not operate (1 mark)
- The motor will not operate (1 mark)
- Its framework will be alive at 230V to earth. (If the response is "an immediate and serious shock hazard exists" then award only 1 mark) (2 marks)
- The MCB would trip only if there was a fortuitous connection between the frame of the motor and earth. (4 marks)
- (d) Any TWO of:
- Earth continuity test
- Polarity test
- Insulation resistance test between the phase conductor and the motor frame. (2 marks)

Question 9

(a) Any FOUR of:

- Number of cores
- Colour Coding
- Mechanical strength if weight is to be supported?
- Sheath suitable for the environment
- Cord shape

(4 marks)

(b)

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

(2 marks)

Ref: AS/NZS 3000: Table 3.5

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

(1 mark)

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

(1 mark)

• Reduce the length of the cord

(1 mark)

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

(1 mark)