



Candidate Code No.	
For Board Use Only	
Result	Result
Date	Date
Int	Int

ELECTRICAL SERVICE TECHNICIAN "A" EXAMINATION

20 September 2008

QUESTION AND ANSWER BOOKLET

Time Allowed: 2 Hours

INSTRUCTIONS – READ CAREFULLY

You have 10 minutes to read this paper but do not start writing until instructed to do so by the supervisor.

Write your Candidate Code Number in the box provided above. Your name must NOT appear anywhere in this paper.

Answer all questions.

The pass mark for this examination is 60 marks.

Use a pen for written answers. **Do not** use a pencil or a red pen.

Drawing instruments and pencils may be used when diagrams are required. Marks are allocated on the basis of correctness.

Do not use correcting fluid or correcting tape.

Non-programmable calculators may be used.

It is recommended that the reference source for your answers be included in the space provided if a question can be answered from the Act, Regulations, Standard or Code. However, just stating a reference only will earn no marks.

For calculation questions all workings, including formulae, must be shown to gain full marks.

Warning – You could get 0 marks for any question, or part of a question, if you show anything hazardous or dangerous in your answer.

You will need to use some of the following documents in this examination:

- The Electricity Act 1992 and amendments or The Electricity Act 1992 reprint dated 19 August 2005.
- The Electricity Regulations 1997 reprint dated 5 September 2005.
- AS 60529 or AS 1939 supplement 1 – 1990; AS/NZS 3000:2000 (including amendments 1, 2, A and 3) or AS/NZS 3000:2007; AS/NZS 3760:2001 or AS/NZS 3760:2003.

**PLEASE HAND THIS PAPER TO THE SUPERVISOR BEFORE LEAVING THE ROOM
(turn over)**

Question 1

Each part in this question is worth 2 marks. Write your answer for each part in the box provided

(a) Which of the following voltage ranges defines **extra-low voltage** in accordance with the Electricity Regulations?

1. 0 V to 120V a.c.
0 V to 32V ripple-free d.c.
2. 50 V to 115V a.c.
50 V to 115V d.c.
3. 0 V to 50V a.c.
0 V to 120V ripple-free d.c.
4. 50 V to 120 V a.c.
12 V to 50V ripple-free d.c.

(b) A switch controls two heating elements both of the same resistance. The settings that can be selected on the switch are "high", "medium" and "low". When the "medium" position is selected on the switch, it will connect:

1. One element only across the supply
2. One element in series with a suitable resistance
3. Two elements in series with the supply
4. Two elements in parallel across the supply

(c) Which of the following documents specifies the tests to be carried out on an electrical appliance which is for hire or lease?

1. AS/NZS 3000
2. AS/NZS 3760
3. AS 1939
4. NZ 3019

(turn over)

Question 1 continued

(d) The Electricity Act requires that a registered electrical service technician who works for payment of reward must hold an additional type of licence. The name of that licence is:

1. An Electrical Workers Licence
2. An Electrical Practising Licence
3. A Workers Licence
4. A Practising Licence

(e) Which of the following wiring changes would reverse the direction of rotation of a single-phase, split-phase induction motor?

1. Reverse the connections of the run winding
2. Reverse the connections of the start windings and the run windings
3. Reverse the phase and neutral supply conductor connections at the motor terminal block.
4. Turn the rotor around.

(f) In a parallel circuit, the section which has the lowest resistance also has the:

1. Greatest voltage drop
2. Highest heating effect
3. Lowest current
4. Smallest voltage drop

(turn over)

Question 1 continued

(g) To comply with the Electricity Regulations, the maximum voltage to earth which can be used to supply a handheld electrical appliance is?

1. 230 Volts
2. 32 Volts
3. 400 Volts
4. 250 Volts

(h) What power is consumed by an electrical appliance with a resistance of 80 ohms when drawing a current of 5 amps?

1. 0.4 kW
2. 16 kW
3. 2 kW
4. 3.2 kW

(i) In accordance with the Electricity Regulations, which of the following voltages is **standard low voltage** in respect to a single phase MEN system?

1. 120V.
2. 110V.
3. 50V.
4. 230V.

(turn over)

Question 1 continued

(j) An HRC fuse with a Utilisation category (fusing factor) of 1.5 has a minimum fusing current of 30 amps. The current rating of this fuse is:

1. 20A
2. 31.5A
3. 45A
4. 30A



(turn over)

Question 2

- (a) You are connecting test instruments to measure voltage and current values of a live 230V electrical appliance. Briefly describe **THREE** important electrical precautions relating to the test instruments that will promote your safety.

- Note:
1. All the necessary safety equipment (overalls, rubber mats etc.) is available.
 2. Set procedures are available.
 3. All conductive items (e.g., rings) have been removed.

(3 marks)

(1) _____

(2) _____

(3) _____

- (b) An isolating transformer is constructed with two socket outlet terminals to permit the use of two or more electrical appliances. The socket outlet earth terminals are required to be bonded together, but they must not be earthed. State **TWO** reasons why the bonding is necessary to prevent electric shock to the users of the appliances.

(2 marks)

(1) _____

(2) _____

(turn over)

Question 2 continued

- (c) You need to insert a new HRC fuse link into a fuse carrier to replace a *blown* fuse on a switchboard. You **cannot** turn the main switch off on the switchboard. Briefly describe **TWO** actions you would take to ensure your own safety.

(4 marks)

(1) _____

(2) _____

- (d) An HRC fuse protecting a circuit supplying two socket outlets has blown on a switchboard. You have disconnected all of the electrical appliances from the two socket outlets. When you inserted a new HRC fuse link into the fuse carrier, it blew again. Where could the fault be?

(1 mark)

(turn over)

Question 3

(a) Sketch a circuit diagram using all of the following electrical components connected to a 230V a.c. supply:

- A 23 ohm resistor and a 46 ohm resistor are in series
- A 40 ohm resistor is parallel in with the series resistors.
- A control switch.
- A fuse that protects the entire circuit.
- The polarity

(3 marks)

(b) Calculate the power the 40Ω resistor will consume.

(2 marks)

(turn over)

Question 3 continued

(c) Calculate the current drawn by the series resistors

(2 marks)

(d) Calculate the power consumed by the circuit if the 46Ω resistor was short-circuited

(3 marks)

(turn over)

Question 4

(a) You are required to carry out a protective earthing conductor test on a 230V, Class I plug-in electrical appliance.

(i) State the instrument that should be used for this test.

(1 mark)

(ii) Briefly explain how the test should be carried out.

(2 marks)

(iii) (1) What is the acceptable resistance for this test?

(1 mark)

(2) Is this resistance a minimum or maximum value?

(1 mark)

(turn over)

Question 4 continued

- (b) After repairs have been carried out to a Class I plug-in heater, visual checks (inspections) should be carried out in addition to the prescribed electrical tests. Refer to AS/NZS 3760 and describe **FIVE** visual checks (inspections) that should be carried out

Note: The visual checks (inspections) must relate only to a Class I plug-in heater

(5 marks)

(1) _____

(2) _____

(3) _____

(4) _____

(5) _____

Ref:

(turn over)

Question 5

Rewireable fuses, HRC fuses and MCBs may be found on switchboards.

(a) It is important to replace a blown fuse with one of the correct current rating. What would be the overall effect on a subcircuit if you used a replacement fuse that had:

(i) An under-rated current rating for the subcircuit it protects? (1 mark)

(ii) An over-rated current rating for the subcircuit it protects? (1 mark)

(b) State **THREE** advantages that HRC fuses have when compared to rewireable fuses. (3 marks)

(1) _____

(2) _____

(3) _____

(turn over)

Question 5 continued

- (c) Briefly state **THREE** safety reasons why it is not permitted to bridge the terminals of HRC fuse carriers with fuse wire of the same current rating as the blown cartridge.

(3 marks)

(1) _____

(2) _____

(3) _____

- (d) (i) Under which circuit conditions is the thermal overload mechanism of an MCB specifically designed to operate (trip)?

(1 mark)

- (ii) Under which circuit conditions is a HRC fuse specifically designed to operate?

(1 mark)

(turn over)

Question 6

(a) A 230 V plug-in, Class I, electrical appliance has MOV surge protection fitted. You have repaired the appliance and need to carry out an insulation resistance test. Refer to AS/NZS 3760 and answer the following:

(i) State the insulation resistance test voltage that should be applied.
(1 mark)

Ref:

(ii) State the acceptable test result from the insulation resistance test.
(1 mark)

Ref:

(b) A 230 V plug-in, Class I, electrical appliance has MOV surge protection fitted. You have repaired the appliance **but you do not want to** carry out an insulation resistance test. Refer to AS/NZS 3760 and answer the following:

(i) State the type of test that can be carried out instead of an insulation resistance test.
(1 mark)

Ref:

(ii) State the acceptable test result from the test you have stated in (b)(i).
(1 mark)

Ref:

(turn over)

Question 6 continued

- (c) You are carrying out an insulation resistance test on an electrical appliance that has semi-conductor devices used in the internal circuitry. The semi-conductor devices cannot be disconnected.

State **TWO** methods of carrying out the insulation resistance test that will not cause damage to the semi conductor devices.

(2 marks)

(1) _____

(2) _____

- (d) Following repairs to the electric motor and flexible supply cord of a 230V, Class I, concrete mixer, an insulation resistance test with an insulation resistance tester is to be carried out.

- (i) What is the test voltage used for the insulation resistance test.

(1 mark)

- (ii) State the acceptable result for this test.

(1 mark)

- (iii) Briefly describe how you would carry out this test.

(2 marks)

(turn over)

Question 7

Read the entire question before attempting to answer it.

In an office in a sawmill, a 20A HRC with a fusing factor of 1.5 protects a final subcircuit consisting of two plug sockets supplying various 230V plug-in electrical appliances. The fuse has blown. When the fuse is replaced, it blows again when the supply is restored to the circuit.

- **The fuse is correctly rated for the circuit and is not faulty.**
- **The circuit has been tested and found to be clear of faults.**

There are **TWO** possible causes of this fault, one of which requires the use of a test instrument to locate the fault.

(a) The first fault

You do not need test instruments to diagnose this fault.

(i) State the type of fault that has occurred.

(1 mark)

(ii) State the action you would take to establish the cause of the fault.

(2 marks)

(iii) State the action taken to fix the fault.

(1 mark)

(turn over)

Question 7 continued

(b) The second fault

You need a test instrument to diagnose this fault.

(i) State the type of fault that has occurred.

(1 mark)

(ii) State the action you would take to establish the cause of the fault. Include in your answer:

- The type of test
- The type of test instrument used
- The test voltage
- The likely test result if a fault has occurred.

(4 marks)

(iii) State the action taken to fix the fault.

(1 mark)

(turn over)

Question 8

(a) A socket outlet in an electrical installation operates at a nominal voltage of 230V. The Electricity Regulations permit the voltage-drop at the socket outlet to be not more than 5%.

(i) Calculate the maximum permitted voltage drop (1½ marks)

(ii) Calculate the minimum permitted voltage. (1½ marks)

(b) An ohmmeter is used to measure the resistance of a 230V plug-in heater. When connected to the heater's flexible cord plug-top the ohmmeter gives a reading of 24Ω .

(i) Calculate the power (watts) the heater will consume when operating at 230V. (2 marks)

(turn over)

Question 8 continued

- (ii) Refer to your answer in (a) above and calculate the power the heater will consume when operating at the minimum permitted voltage.

(2 marks)

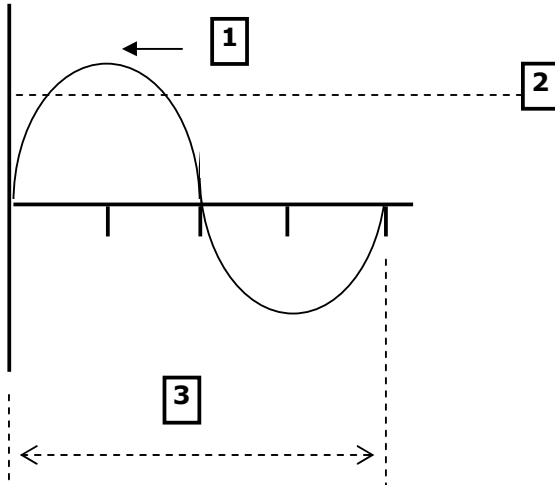
- (iii) Calculate the percentage difference in the power consumed between the heater operating at 230V and operating at the minimum permitted voltage.

(3 marks)

(turn over)

Question 9

(a) The following diagram shows a 230V wave form.



(i) Is it an a.c. voltage or d.c. voltage waveform?

(1 mark)

(ii) Name the numbered items and state the value that applies to each item

(3 marks)

1. _____

2. _____

3. _____

(b) The New Zealand single phase 230V a.c. supply operates at a frequency of 50 Hz. Briefly describe the meaning of the term Hz.

(1 mark)

(turn over)

Question 9 continued

(c) It is necessary to have a reliable protective earthing conductor for a Class I electrical appliance.

(i) Briefly describe how this conductor contributes to the electrical safety of the appliance.

(2 marks)

(ii) You have completed repairing a plug-in, Class I electrical appliance and the protective earthing conductor test result was 15Ω . State the sequence of actions you would take to rectify the high resistance and to ensure the appliance complies with AS/NZS 3760.

(3 marks)

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In the box, write the number of **EXTRA** sheets you have used. Write **NIL** if you have not used any

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Questions Answered	Marks	
1		
2		
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