



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

ELECTRICAL SERVICE TECHNICIAN "A" EXAMINATION

15 November 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 of Practice. 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 the identifying number, 1 or 2 or 3 or 4, for each part in the box provided.

(a) 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.

(b) What power is dissipated by an electrical appliance with a resistance of 27.78 ohms when drawing a current of 6 amps?

1. 2.0 kW
2. 15 kW
3. 1.0 kW
4. 0.3 kW

(c) The Electricity Regulations requires that a registered electrical service technician completes refresher courses at regular intervals. At what intervals must those refresher courses be completed?

1. 5 years
2. 18 months
3. 24 months
4. 1 year

(turn over)

Question 1 continued

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

(e) 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

(f) When preparing flexible cord conductors for termination in a portable electric heating oven, the insulation should be removed:

1. Only far enough so the insulation touches the terminal post.
2. Only far enough to prevent heat deterioration of the insulation
3. At least 10mm from the terminal post
4. And replaced by vulcanised rubber tape

(turn over)

Question 1 continued

(g) To determine the voltage drop in a flexible cord, the information required is:

1. Voltage and cross-sectional area
2. Current and voltage
3. Resistance and cross-sectional area
4. Current and resistance

(h) The method of safely ensuring the isolation of a plug-in electrical appliance is:

1. Attaching an out-of-service tag to the electrical appliance
2. Turning off the main switch at the switchboard
3. Turning off the main switch in the appliance.
4. Removing the plug from the plug socket

(i) 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

(turn over)

Question 1 continued

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

1. Exceeding 120V a.c. or 32V ripple-free d.c. but not exceeding 1,000V a.c. or 1,500V d.c.
2. Exceeding 50V a.c. or 120V ripple-free d.c. but not exceeding 1,000V a.c. or 1,500V d.c.
3. Exceeding 50V a.c. or 120V ripple-free d.c. but not exceeding 2,000V a.c. or 3,500V d.c.
4. Exceeding 110V a.c. or 110V ripple-free d.c. but not exceeding 1,000V a.c. or 1,500V d.c.



(turn over)

Question 2

- (a) You are carrying out an insulation resistance test on a Class I electrical appliance that has semi-conductor devices used in its internal circuitry. It is impractical to disconnect the semi-conductors.

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

(2 marks)

(1) _____

(2) _____

- (b) You have repaired the electric motor and flexible supply cord of a 230V, Class I, plug-in dishwasher. You need to carry out an insulation resistance test.

- (i) What instrument should be used to make the insulation resistance test?

(1 mark)

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

(1 mark)

- (iii) State the permitted minimum insulation value for this test.

(1 mark)

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

(2 marks)

(turn over)

Question 2 continued

- (c) Briefly explain why a multimeter set on the low ohms scale should not be used to carry out an insulation resistance test on a portable electrical appliance.

(2 marks)

- (d) State **ONE** test, other than an insulation resistance test, that can be used to test the integrity of the insulation of a Class I, plug-in electrical appliance.

(1 mark)

(turn over)

Question 3

- (a) An electrical appliance is being supplied from a 25 metre three core flexible extension cord. The extension cord has been wound on a cable drum to provide a convenient means of storage.

Describe how the extension cord might fail if the cord is used, whilst not unwound from the cable drum

(1 mark)

- (b) An electrical appliance is being supplied from a 25 metre three core flexible extension cord. The extension cord has been wound on a cable drum to provide a convenient means of storage.

State the **TWO** precautions, either of which could be taken to prevent the extension cord failing when in use.

(2 marks)

(1) _____

(2) _____

- (c) State the electrical factors that determine the voltage drop in a flexible cord.

(2 marks)

(turn over)

Question 3 continued

- (d) (i) Explain why the voltage at the load end of a flexible cord extension set supplying current to an electrical appliance is less than that at the supply end of the cord?

(1 mark)

- (ii) State **TWO** ways in which the effect in (d)(i) above can be reduced.

(2 marks)

(1) _____

(2) _____

- (e) All flexible cords are given a **current rating**. What does **current rating** mean?

(2 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) 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 ensure the appliance complies with AS/NZS 3760. (4 marks)

- (c) State **ONE** technical quality that an insulating material must possess to be suitable for use as insulation in a flexible cord. (1 mark)

(turn over)

Question 5

- (a) After repairs have been carried out to a Class I plug-in heater, a **visual** inspection should be carried out in addition to the prescribed electrical tests. Refer to AS/NZS 3760 and answer the following:

Note: The visual inspections must relate specifically to the Class I heater.

- (i) State **THREE** visual inspections relating specifically to the plug and flexible cord (but not the appliance)

(3 marks)

(1) _____

(2) _____

(3) _____

Ref:

- (ii) State **TWO** visual inspections relating specifically to the appliance (but not the plug and flexible cord)

(2 marks)

(1) _____

(2) _____

Ref:

(turn over)

Question 5 continued

- (b) A microgap switch, rated at 10 amp 230V a.c. only, is used as the control switch on the Class I heater. State **ONE** reason why this switch would not be suitable for use on a d.c. circuit of similar current and voltage.

(1 mark)

- (c) Explain why the earth pin of a standard New Zealand 3 pin 10 amp plug used to supply the Class I heater is longer than the phase or neutral pins.

(2 marks)

- (d) State **TWO** reasons why a bayonet cap adaptor must not be used to supply a Class I plug-in heater.

(2 marks)

(1) _____

(2) _____

(turn over)

Question 6

(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 6 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 7

(a) You have tested a Class I, 230V, 2000W fan heater and find that:

- The resistance between the earth pin of the plug and the frame of the heater is 7Ω .
- The insulation resistance test shows that there is a phase to frame fault with the appliance switch off.

If the heater was plugged into a live socket outlet without being repaired:

- (i) Calculate the current that would flow in the protective earthing conductor. Assume that there is no resistance in the fault.
(2 marks)

- (ii) The live socket outlet is protected by a 10A HRC fuse with a 1.5 Utilisation category (fusing factor). Explain with the aid of calculations the effect on the operation of the fuse.
(2 marks)

(turn over)

Question 7 continued

(b) A 230V, Class I, plug-in electrical appliance is controlled by a single pole switch. Following repairs to the appliance a phase – neutral transposition occurred.

(i) State the effect of a phase – neutral transposition on the safe operation of the electrical appliance.

(1 mark)

(ii) Describe the **THREE** areas in the appliance where a phase – neutral transposition can occur.

(3 marks)

(1) _____

(2) _____

(3) _____

(c) Briefly explain how a low protective earthing conductor resistance value contributes to the electrical safety of the appliance when a fault occurs between the phase and exposed metal.

(2 marks)

(turn over)

Question 8

Rewirable 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 rewirable fuses. (3 marks)

(1) _____

(2) _____

(3) _____

(turn over)

Question 8 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 condition 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 9

- (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 9 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)

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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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