



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

ELECTRICAL SERVICE TECHNICIAN "A" EXAMINATION

2 May 2009

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

- The Electricity Act 1992 reprint dated 19 August 2005
- The Electricity Regulations 1997 reprint dated 2 September 2005
- AS 60529 **or** AS 1939 Supplement 1-1990
- AS/NZS 3000:2000 and Amendments 1, 2 and 3 **or** AS/NZS 3000:2007
- AS/NZS 3760:2003 and Amendment 1

**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) If the resistance in a circuit is doubled and the applied voltage is increased four times, the current flow will now be:

1. The same
2. Doubled
3. Halved
4. Four times greater

(b) What is the power output of a small electric motor with a nameplate that reads:-

Voltage	230
Phases	1
Horsepower	0.75
Speed	1425 r.p.m.

1. 373.3 watts
2. 375.5 watts
3. 559.5 watts
4. 750.3 watts

(c) An HRC type fuse is used in a circuit primarily to:

1. Prevent an unauthorised increase in fuse rating
2. Reduce the possibility of electric shock
3. Disconnect an overload
4. Disconnect a large fault current

(turn over)

Question 1 continued

(d) A small electric heating element is rated at 230V, 100 watts. The current drawn by this element when operating will be:

1. 2.3 A
2. 435 mA
3. 230 mA
4. 4.35 A

(e) Select from the three-core flexible cords listed below, the cord which would have the most electrical resistance.

1. 10 metres of 1.0mm² cord
2. 3 metres of 1.0mm² cord
3. 10 metres of 0.75mm² cord
4. 3 metres of 0.75mm² cord

(f) In accordance with the Electricity Regulations, which of the following phrases defines **direct contact**?

1. Contact by any person or animal, with parts live at extra-low voltage.
2. Contact by a person or animal with exposed conductive parts that are live under fault conditions
3. Contact by any person or animal with live parts.
4. Contact by a person or animal with earthed metal

(turn over)

Question 1 continued

(g) 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

(h) 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

(i) If the current in a circuit decreases, the power consumed by that circuit will:

1. Stay the same
2. Double
3. Decrease
4. Increase

(turn over)

Question 1 continued

(j) At 15c per unit, what will be the cost of the electrical energy consumed in 2 hours by a heater which draws 10A from the 230V supply:

1. 20 cents
2. 69 cents
3. 200 cents
4. \$4.60



(turn over)

Question 2

A 230V plug-in electric blanket contains two heating elements, each having a rating of 55 watts. The blanket is controlled by a switch with three settings – “high”, “medium” and “low”.

Calculate the current drawn when the electric blanket is switched to:

(a) The “low” position.

(4 marks)

(b) The “medium” position.

(2 marks)

(turn over)

Question 2 continued

(c) The "high" position..

(4 marks)

(turn over)

Question 3 continued

- (b) A 25 metre three core flexible extension cord has been wound on a cable drum to provide a convenient means of storage.

State the **TWO** operational precautions, either of which could be taken, to prevent **failure** of the cord when it is in use.

(2 marks)

(1) _____

(2) _____

(turn over)

Question 4

(a) You have tested a plug-in Class I, 230V, 2000W commercial vacuum cleaner and the results are as follows:

- The resistance between the earth pin of the plug and the frame of the cleaner is 10.6 Ω .
- The insulation resistance test shows a phase to frame short circuit with the cleaner switch off.

If the cleaner was plugged into a live socket outlet but not switched on:

(i) Calculate the fault current flowing in the appliance.

(2 marks)

(ii) The circuit into which the cleaner is plugged is protected by a 16A HRC fuse with a utilisation category (fusing factor) of 1.5.

Calculate whether the fuse will operate (blow).

(2 marks)

(turn over)

Question 4 continued

(iii) Calculate the power consumed in the fault.

(2 marks)

- (b) (i) A 230V, Class I, plug-in electrical appliance is controlled by a single pole switch. You are testing the appliance with an ohmmeter and find that the neutral is switched.

Describe the **TWO** situations that could cause the neutral to be switched instead of the phase.

(3 marks)

(1) _____

(2) _____

- (ii) State **ONE** unsafe effect on the operation of an electrical appliance a phase and neutral transposition could create.

(1 mark)

(turn over)

Question 5

(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)

(b) Briefly explain why an ohmmeter is not the correct instrument to carry out an insulation resistance test on a portable electrical appliance. (2 marks)

(turn over)

Question 5 continued

- (c) You are using an ammeter to measure the current drawn by an electrical appliance. Describe what would happen if you connected the ammeter in parallel with that appliance.

(3 marks)

(turn over)

Question 6

- (a) In a Class I plug-in electrical appliance, semi-conductor devices are used in the circuitry. You are to carry out a test to establish the integrity of the insulation between the active conductor and earth in the appliance, but you cannot bridge out or disconnect the semi-conductor devices.

Therefore, you have to carry out the test but avoid damaging the semi-conductor devices.

The instrument you are able to use is an insulation resistance tester with 1000V and 500V ranges

Describe how you will carry out the insulation resistance test on appliance. Include in your answer:

- The test voltage applied.
- The minimum or maximum acceptable test result value

(5 marks)

- (b) Briefly explain **ONE** reason for carrying out the following **tests** on an electrical appliance.

- (i) Protective earthing conductor resistance test

(1 mark)

(turn over)

Question 6 continued

(ii) Polarity test

(1 mark)

(iii) Insulation resistance test

(1 mark)

(c) Briefly explain why it is important to carry out a Protective Earthing conductor test on a Class I electrical appliance before carrying out an insulation resistance test.

(2 marks)

(turn over)

Question 7

(a) Draw and label a circuit diagram of a 230V, Class I heater. The internal components of the heater are:

- Two load elements, one of 27 ohms and the other of 54 ohms.
- A two-position selector switch to connect the supply to either of the load resistors.
- A fuse that protects the whole circuit.

Your diagram must show the phase, neutral and earth connections.

(6 marks)

(turn over)

Question 7 continued

(b) Calculate the maximum power consumed by the heater.

(2 marks)

(c) Calculate the minimum current drawn by the heater.

(2 marks)

(turn over)

Question 8

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 8 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 9

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 9 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 condition is the electromagnetic mechanism of an MCB specifically designed to operate (trip)?

(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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