



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

ELECTRICAL SERVICE TECHNICIAN "A" EXAMINATION

21 November 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, A 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) What power is consumed by an electrical appliance that has resistance of 52.5Ω and draws a current of 6A?

1. 0.38 kW
2. 15.29 kW
3. 1.89kW
4. 1.57 kW

(b) 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. 30A
2. 31.5A
3. 45A
4. 20A

(c) Which of the following documents details the specific tests which must be carried out after fitting a new flexible cord and plug to a 230V, plug-in electric motor?

1. AS/NZS 3760
2. AS 6370
3. AS/NZS 3019
4. AS/NZS 3016

(turn over)

Question 1 continued

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

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

(e) The Electricity Act requires that a registered electrical service technician who works for payment 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 Practising Licence
4. A Workers Licence

(f) A fuse blows at 25 amps and has a Utilisation category (fusing factor) of 1.25. The rated current for this fuse is:

1. 12.5A
2. 10A
3. 20A
4. 31.25A

(turn over)

Question 1 continued

(g) State the reason why a bayonet cap adaptor must not be used to supply a Class I electrical appliance.

1. Wrong voltage rating
2. No earthing facility
3. Not mechanically strong enough
4. The cord supplying the adaptor is the wrong shape

(h) In a parallel circuit, the section which has the highest resistance also has the:

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

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

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

(j) What power is consumed by an electrical appliance that has resistance of 52.5Ω and draws a current of 6A?

1. 0.38 kW
2. 15.29 kW
3. 1.89kW
4. 1.57 kW

(turn over)

Question 2

(a) A Class I, 230V electrical appliance is used in damp conditions.

(i) Briefly describe how the damp conditions could affect the operation of the appliance.

(2 marks)

(ii) Briefly describe the danger that may exist for an operator who uses the appliance without an electrical safeguard and a phase to frame fault occurs.

(2 marks)

(b) State **TWO** technical qualities that an insulating material must possess to be suitable for use as insulation in a flexible cord.

(2 marks)

(1) _____

(2) _____

(turn over)

Question 2 continued

- (c) **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)

Question 3

A 230V plug-in heater has two elements controlled by a three-heat switch. Each element has a resistance of 35 ohms.

- (a) If the heater switch is set in the "low" position, **calculate the power consumed** by the heater.

(2 marks)

- (b) If the heater switch is set in the "medium" position, **calculate the current drawn** by the heater.

(2 marks)

(turn over)

Question 3 continued

- (c) If the heater switch is set in the "high" position, **calculate the power consumed** by the heater.

(4 marks)

- (d) The heater works when the switch is in the medium position. When the switch is switched to the high position, the MCB protecting the heater trips. State **TWO** reasons, either of which, could cause the MCB to trip.

(2 marks)

(1) _____

(2) _____

(turn over)

Question 4

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 4 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)

(turn over)

Question 5

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

(2 marks)

- (b) 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 and the range selected 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?

(½ mark)

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

(½ mark)

(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.

(2 marks)

- (d) You are testing an electrical appliance. State the **main safety reason** why you would not connect a voltmeter in series with the electrical appliance.

(2 marks)

(turn over)

Question 6

(a) The figure below represents the metal frame of a 230V, Class I, heater.

- Within the frame, draw and label the following components:
 - * A fuse that protects the whole circuit.
 - * A single-pole switch that controls the circuit.
 - * Two elements, one of 15 ohms and the other of 60 ohms.
 - * A two-position selector switch to connect the supply to either of the elements.
- Draw and label the supply to the heater.

(5 marks)



(b) For the heater in (a), calculate the **maximum current drawn**.

(2 marks)

(turn over)

Question 6 continued

- (c) For the heater in (a), calculate the **maximum power consumed**.
(2 marks)

- (d) For the heater in (a), state the most suitable rating for the fuse.
(1 mark)
-

(turn over)

Question 7

(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.

The cleaner incorporates a control switch. If the cleaner was plugged into a live socket outlet with the control switch in the "off" position:

(i) Calculate the fault current flowing in the appliance. The resistance in the phase to frame short circuit is 0 Ω .

(2 marks)

(ii) The cleaner is plugged into a circuit that 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 7 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 **THREE** situations that could cause the neutral to be switched instead of the phase.

(3 marks)

(1) _____

(2) _____

(3) _____

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

(1 mark)

(turn over)

Question 8

- (a) (i) Draw and label a circuit diagram of a single-phase capacitor start motor.

(3 marks)

- (ii) Describe how to reverse the direction of rotation in a single phase capacitor start motor.

(1 mark)

- (iii) How is the start winding in a single-phase capacitor start motor disconnected when the motor it up to speed?

(1 mark)

(turn over)

Question 8 continued

- (iv) What would be the affect on the performance of a single-phase capacitor start motor if the capacitor had become disconnected and the motor was switched on whilst connected to a load? State **ONE** reason to support your answer.

(2 marks)

- (b) (i) Describe how the direction of rotation can be reversed for a Universal (series) motor

(1 mark)

- (ii) State **TWO** typical applications for a Universal (series) motor

(2 marks)

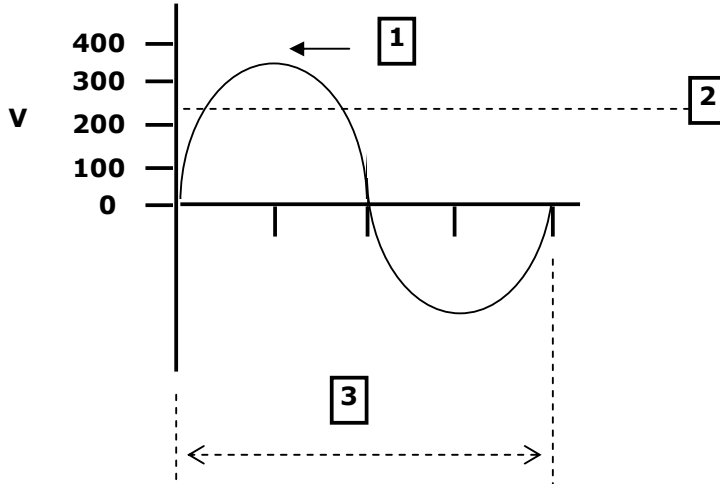
(1) _____

(2) _____

(turn over)

Question 9

(a) The following diagram shows a 230V, 50 Hz waveform.



(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)

Item	Name	Value
1		
2		
3		

(turn over)

Question 9 continued

- (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)

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

- (i) Briefly describe how a protective earthing conductor contributes to the electrical safety of a Class I electrical appliance.

(2 marks)

- (ii) Briefly describe the actions you would take if the protective earthing conductor test on a Class I electrical appliance **you have repaired** is 15Ω .

(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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7		
8		
9		
TOTAL		