ESTA 1025

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

ELECTRICAL SERVICE TECHNICIAN "A" EXAMINATION

5 May 2007

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. Show all working to TWO decimal places.

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 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); 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) A blown HRC fuse protecting a 230V subcircuit is to be replaced. The load is a fixed wired electrical appliance rated at 3000W at 230V. Which of the following fuse current ratings would be most appropriate to protect the appliance subcircuit?

1. 20A
2. 6A
3. 16A
4. 10A

(b) Before carrying out repairs on a single phase plug-in electrical appliance, which of the following actions would be the most effective in ensuring safety against electric shock?

1. Withdraw the appliance plug from the socket
2. Turn off the main switch at the switchboard
3. Tag the electrical appliance as unsafe
4. Remove the fuse that protects the plug socket

(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. NZ 3019
3. AS 1939
4. AS/NZS 3760

(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. A Schedule 2 Licence
2. A Practising Licence
3. A Registration Licence
4. A Workers Licence

(e) Which of the following three core flexible cords has the least conductor resistance?

1. 5 metres of 0.75mm² cord
2. 10 metres of 1.0mm² cord
3. 5 metres of 1.0mm² cord
4. 10 metres of 0.75mm² cord

(f) The symbol of a **square within a square** found on many electrical appliances is used to indicate:

1. An extra-low voltage electrical appliance
2. A New Zealand Standard approved electrical appliance
3. An electrical appliance to be supplied from an isolating transformer
4. A double insulated electrical appliance

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

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

(turn over)

Question 1 continued

(h) If a 230V, Class I portable electrical appliance with a phase to framework fault and broken protective earthing conductor (earth continuity conductor) is being used outdoors, which of the following protection devices will prevent the passage of an electric current through the operator's body?

1. An HRC fuse
2. A rewireable fuse
3. An overload relay
4. A 230/230 volt isolating transformer

(i) Under which of the following circuit conditions is a thermal overload specifically designed to operate (trip)?

1. A high motor starting current
2. A small overload of short duration
3. A sustained overload
4. A short circuit condition

(j) It is recommended that not more than one portable electrical appliance is used at any one time from an isolating transformer. The reason for this is to:

1. Prevent transformer overloading.
2. Minimise the possibility of electric shock.
3. Minimise the problem of excessive voltage drop.
4. Prevent polarity interchange.

(turn over)

Question 2

(a) 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 in the appliance.

(3 marks)

(1) _____

_____

_____

(2) _____

_____

_____

(3) _____

_____

_____

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

(1 mark)

_____

_____

(turn over)

Question 2 continued

(c) A Class I, 230 V single-phase plug-in faulty washing machine was put back into service without being repaired. It was plugged into a live socket outlet and turned on and the homeowner received an electric shock.

The outlet is protected by a 15A HRC fuse with a 1.5 Utilisation category (fusing factor).

A protective earthing conductor test was carried out on the washing machine. It was found that there was a resistance of 7Ω between the earth pin of the plug and the frame of the machine.

(i) Calculate the current that would have flowed in the protective earthing conductor.

(2 marks)

(ii) Calculate the power that would have dissipated in the protective earthing conductor.

(2 marks)

(turn over)

Question 2 continued

(iii) Determine by calculation whether or not the fuse should have operated.

(2 marks)

(turn over)

Question 3

(a) Replacement flexible cords are to be fitted to some electrical appliances: (7 marks)

(i) What is the minimum number of cores required for a flexible cord for a Class I electrical appliance?

_____

(ii) What is the colour coding required for the cores of a flexible cord for a Class I electrical appliance?

_____

_____

_____

(iii) What is the minimum number of cores required for a flexible cord for a Class II electrical appliance?

_____

(iv) What is the colour coding required for the cores of a flexible cord for a Class II electrical appliance?

_____

_____

_____

(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.

(i) Describe how the cord might fail if it is used while still wound on the drum.

(1 mark)

_____

_____

(ii) 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) _____

_____

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(2) _____

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(turn over)

Question 4

(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 describe **FIVE** visual checks that should be carried out.

Note: The answers must relate only to a plug-in electrical appliance.

(5 marks)

(1) _____

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_____

(2) _____

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(3) _____

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(4) _____

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_____

(5) _____

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Ref: .....

(turn over)

Question 4 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 at least **TWO** reasons why a bayonet cap adaptor must not be used to supply the Class I plug-in heater.

(2 marks)

(1) _____

_____

(2) _____

_____

(turn over)

Question 5

(a) A new fuse needs to be inserted into a fuse carrier to replace a *blown* fuse on a domestic switchboard. The circuit protected by the fuse supplies a 230V plug-in electrical appliance.

(i) Briefly describe the **TWO** main safety reasons why it is recommended that the main switch should be turned off before removing the fuse carrier or replacing it into the fuse base.

(2 marks)

(1) _____

_____

_____

(2) _____

_____

_____

(ii) The electrical appliance has been disconnected. When the fuse is replaced and the main switch is turned on, the fuse blows again. What is the probable cause of the fault?

(1 mark)

_____

_____

(b) Describe a method of safely ensuring the <u>continued</u> isolation of a plug-in electrical appliance.

(1 mark)

_____

(turn over)

Question 5 continued

(c) What is the essential safety difference between switching an electrical appliance off and isolating it?

(2 marks)

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(d) Refer to the Electricity Regulations and state:

(i) What is meant by the term **personal protective equipment**?

(2 marks)

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_____

(ii) The **TWO** practical steps an employee must take when carrying out work requiring personal protective equipment.

(2 marks)

(1) _____

_____

_____

(2) _____

_____

_____

Ref: ……..

(turn over)

Question 6

(a) Draw and label a circuit diagram of a single phase circuit supplying three resistors. Include the following:

- A fuse that protects the entire circuit and all components.
- A single pole switch that controls the entire circuit and all components (except the fuse)
- An ammeter to measure the total circuit current
- A voltmeter to measure the voltage across the resistors

Resistor 1 (R1) is 150 Ω
Resistor 2 (R2) is 100 Ω
Resistor 3 (R3) is 75 Ω

R1 and R2 are connected in series. R3 is connected in parallel with the series resistors.

(4 marks)

(turn over)

Question 6 continued

(b) If the voltmeter reads 230V, determine by calculation:

(i) The reading on the ammeter.

(4 marks)

(ii) The total power dissipated by the resistors?

(2 marks)

(turn over)

Question 7

(a) 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)

_____

_____

(b) State **TWO** ways in which the effect in (a) above can be reduced.

(2 marks)

(1) _____

_____

(2) _____

_____

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

(2 marks)

_____

_____

_____

_____

(turn over)

Question 7 continued

(d) Describe briefly, the main sequence of actions involved in fitting a three-pin plug to a three-conductor PVC sheathed flexible cord supplying a Class I electric heater. The action taken to ensure the appliance is safe must be included

(5 marks)

(turn over)

Question 8

(a) When selecting a flexible cord for fitting to a single phase electrical appliance, it is necessary to consider various factors that may affect the performance of the appliance. List **FIVE** factors which may need to be considered when selecting the cord

(5 marks)

(1) _____

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_____

(2) _____

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(3) _____

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(4) _____

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(5) _____

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(turn over)

Question 8 continued

(b) You have replaced the mineral insulated metal sheathed (MIMS) element and flexible cord in a Class I portable oven. The Electricity Regulations require certain checks and tests be carried out in accordance with a Standard before the oven is returned to service.

Refer to that Standard and complete the following table.

(3 marks)

Test	**Type of test instrument**	**Minimum or maximum test result value**

(c) (i) Describe how you would carry out a test on a Class A, Type II RCD installed in a flexible lead.

(1 mark)

_____

_____

_____

_____

(ii) Refer to AS/NZS 3000 and state the test current and maximum permitted tripping time for the RCD.

(1 mark)

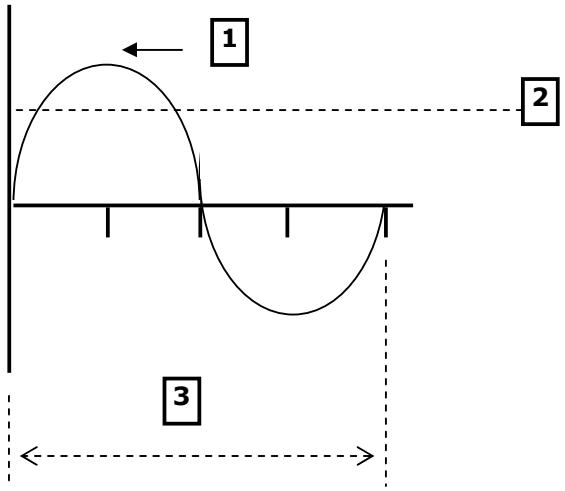
_____

_____

(turn over)

Question 9

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



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

(1 mark)

_____

(ii) Name the numbered items and state the values 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) Briefly describe how a protective earthing conductor contributes to the electrical safety of an electrical appliance.

(2 marks)

(d) 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)

For Candidate's Use

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		
3		
4		
5		
6		
7		
8		
9		
TOTAL MARKS		