ESTA 1034

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

ELECTRICAL SERVICE TECHNICIAN "A" EXAMINATION

17 November 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.

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); 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) The flexible cord supplying a double insulated 230V electric clock from a three pin socket is to be replaced. The most appropriate type of flexible cord to use would be:

1. Twisted conductor three core unsheathed
2. Two single core conductors, unsheathed
3. Ordinary duty three core tough plastic sheathed
4. Light duty two core tough plastic sheathed

(b) To comply with the Electricity Regulations, a double insulated handheld electrical appliance used in a damp indoor situation requires:

1. A supply from an isolating transformer
2. No additional protection
3. Earthing by a separate protective earthing conductor
4. To be fitted with a flexible cord having a braided metallic outer covering

(c) What power is dissipated by an electrical appliance with a resistance of 55.56 ohms when drawing a current of 6 amps?

1. 2.0 kW
2. 15 kW
3. 1.5 kW
4. 0.3 kW

(turn over)

Question 1 continued

(d) An analogue multimeter is being used to check the 230V single phase supply connected to a heating element which is in good condition.

Directly following the successful voltage test, the meter probes are reconnected in series with the element to measure the current. However, by mistake neither the meter jack plugs nor the range switch have been altered from the previous (voltage) setting.

When the circuit is switched on, the meter will:

1. Burn out
2. Indicate zero volts
3. Cause the circuit fuse to blow
4. Reduce the expected current flow through the element and indicate 230V

(e) If the current in a circuit decreases, the power dissipated by that circuit will:

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

(f) The minimum permitted insulation resistance of a Class I electrical appliance when measured between the earth and phase pins of the supply plug is:

1. 1.25 ohms
2. 1 Megohm
3. 1.5 ohms
4. 1 ohm

(turn over)

Question 1 continued

(g) 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

(h) An HRC fuse has a minimum fusing current of 24 amps and an Utilisation category (fusing factor) of 1.5. The current rating of this fuse is:

1. 25A
2. 13.75A
3. 15.625
4. 16A

(i) In a series circuit, the component which has the highest voltage drop also has the:

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

(turn over)

Question 1 continued

(j) On the nameplate of an electrical appliance which of the following would indicate that the appliance is double insulated:

1. The New Zealand Standards symbol.

2. The term "Class I" ☐

3. The symbol "square within a square"

4. The Electrical Workers Registration Board logo

(turn over)

Question 2

(a) A fuse has blown on a switchboard circuit supplying a single-phase plug-in electrical appliance. The appliance has been taken away to be tested. For safe working the main switch on the switchboard should be turned off before repairing the fuse. What important check should be made before turning off the main switch?

(1 mark)

_____

_____

(b) Refer to the Electricity Regulations and state what is meant by the term **personal protective equipment**?

(2 marks)

_____

_____

_____

_____

Ref: .....

(c) (i) For a faulty plug-in electrical appliance:

(1) What does "switching off" the appliance mean?

(1 mark)

_____

_____

(2) What does "isolating" the appliance mean?

(1 mark)

_____

_____

(turn over)

Question 2 continued

(ii) Describe a method of safely ensuring the continued isolation of a plug-in electrical appliance.

(1 mark)

_____

_____

(d) You are connecting test instruments to measure voltage and current values of a live 230V electrical appliance. When doing this work it is important to observe set procedures to ensure personal safety. Briefly describe **FOUR** important electrical precautions relating to the test instruments that will promote personal 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.

(4 marks)

(1) _____

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(2) _____

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(3) _____

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(4) _____

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(turn over)

Question 3

(a) The Electricity Act requires that a registered electrical service technician who works for payment of reward must hold an additional type of licence. Refer to the Act and state:

(i) The name of the licence?

(1 mark)

_____

Ref: .....

(ii) The date in any year does the licence expire?

(1 mark)

_____

Ref: ....

(iii) To whom must application be made for the licence?

(1 mark)

_____

Ref: .....

(b) With the licence you have stated in (a)(i), for how long does the licence remain current?

(1 mark)

_____

Ref: .....

(c) Registered electrical service technicians are one of SEVEN classes of persons listed in the Electricity Act who may do, or assist in doing prescribed electrical work. Refer to the Electricity Act and list **TWO** classes of person who may do or assist in doing prescribed electrical work.

(2 marks)

(1) _____

(2) _____

Ref: .....

(turn over)

Question 3 continued

(d) No electrical service technician shall assist to carry out prescribed electrical work unless they have completed safety tuition in **FOUR** specific subjects within the previous 24 months. Refer to the Electricity Regulations and state those **FOUR** subjects.

(4 marks)

(1) _____

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(2) _____

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(3) _____

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(4) _____

_____

Ref: .....

(turn over)

Question 4

(a) The test report for a Class I, 230V, 2000W fan heater states that:

- The protective earthing conductor resistance is 7Ω.
- The insulation resistance test shows that there is a phase to frame fault with the appliance switch off.

The heater is plugged into a live socket outlet without being repaired, with the appliance switch in the "off" position.

(i) Calculate the current flowing in the protective earthing (earth continuity) conductor. Assume that the there is no resistance in the fault.

(2 marks)

(ii) The 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 4 continued

(b) A 230V, Class I, plug-in electrical appliance is controlled by a single pole switch. Following repairs, the internal conductors were transposed, with the neutral conductor connected to the switch instead of the phase conductor.

(i) State **ONE** effect on the safe operation of the electrical appliance this transposition could create.

(2 marks)

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_____

(ii) Describe **FOUR** other situations that would cause the neutral to be switched instead of the phase in such an appliance.

(4 marks)

(1) _____

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(2) _____

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(3) _____

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(4) _____

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(turn over)

Question 5

(a) A thermal overload protecting a single-phase motor has operated. What has the thermal overload detected that would cause it to operate?

(1 mark)

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_____

(b) When replacing an HRC cartridge fuse which has blown, the replacement must have characteristics the same as the original. State **FOUR** electrical characteristics to be checked for similarity.

(4 marks)

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(c) Briefly explain how a Residual Current Device (RCD) operates to provide safety to the user of an electrical appliance when an earth leakage fault occurs.

(4 marks)

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(turn over)

Question 5 continued

(d) What does the term "PRCD" stand for?

(1 mark)

_____

_____

(turn over)

Question 6

(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) _____

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_____

(2) _____

_____

_____

(ii) The electrical appliance has been disconnected. When the fuse is replaced and the main switch is turned on, the fuse blows again.

(1) What is the probable cause of the fault?

(1 mark)

_____

(2) Who should be called to repair the fault?

(1 mark)

_____

(turn over)

Question 6 continued

(b) An isolating transformer is constructed with one socket outlet terminal to permit the use of only one electrical appliance. Two electrical appliances are used with this isolating transformer with the use of an EPOD.

Explain how the simultaneous use of two electrical appliances from this isolating transformer increases the possibility of electric shock?

(4 marks)

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(c) List **TWO** electrical protective devices which could be used with a Class I electrical appliance to provide personal safety when operating outdoors.

(2 marks)

(1) _____

(2) _____

(turn over)

Question 7

(a) A polarity test should be carried out on a Class I electrical appliance after a replacement flexible cord has been fitted. The appliance is controlled by a single-pole switch. Detail the **FOUR** important points this polarity test will confirm?

(4 marks)

(1) _____

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(2) _____

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(3) _____

_____

(4) _____

_____

(b) (i) What type of test instrument would you use to test for polarity?

(½ mark)

_____

(ii) What range would you select on the test instrument?

(½ mark)

_____

(turn over)

Question 7 continued

(c) 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**

(d) (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 3760 and state the test current and maximum permitted tripping time for the RCD.

(1 mark)

_____

_____

Ref: .....

(turn over)

Question 8

(a) 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 the cord is used, but not unwound from the cable drum

(1 mark)

_____

_____

_____

_____

(ii) State the **TWO** precautions, other than mechanical protection, either of which could be taken to prevent damage to the cord when in use.

(2 marks)

(1) _____

_____

(2) _____

_____

(b) What factors influence the voltage drop in a flexible cord?

(2 marks)

_____

_____

(turn over)

Question 8 continued

(c) (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 (c)(i) above can be reduced.

(2 marks)

(1) _____

_____

(2) _____

_____

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

(2 marks)

_____

_____

_____

_____

(turn over)

Question 9

(a) You are carrying out an insulation resistance test on an 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) Following repairs to the electric motor and flexible supply cord of a 230V, Class I, concrete mixer, an insulation resistance test must be carried out.

(i) What instrument should be used to make this test?

(1 mark)

_____

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

(1 mark)

_____

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

(1 mark)

_____

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

(2 marks)

_____

_____

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_____

(turn over)

Question 9 continued

(c) A 230 V plug-in 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 insulation test voltage that should be applied.

(1 mark)

_____

Ref: .....

(ii) State the **TWO** reasons why the test voltage you have stated in (c)(i) is applied.

(2 marks)

(1) _____

_____

(2) _____

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Ref: .....

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		
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TOTAL		