



<b>Candidate Code No.</b>	
<b>For Board Use Only</b>	
Result	Result
Date	Date
Int	Int

## TRADESPERSON ELECTRICAL WORK CERTIFICATE EXAMINATION

**9 May 2009**

### **PLUMBERS OR GASFITTERS** **QUESTION AND ANSWER BOOKLET**

**Time Allowed      two hours and 30 minutes**

#### **INSTRUCTIONS – READ CAREFULLY**

You have 10 minutes to read this paper but do not start writing until you are told to do so by the supervisor.

**Write your Candidate Code Number in the box provided above. Your name must NOT appear anywhere on this paper**

**The pass mark for this examination is 60 marks.**

**Plumbers                    must attempt all questions in Sections 1 and 2.**

**Gasfitters                 must attempt all questions in Sections 1 and 3.**

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 reprinted at 19 August 2005.
- The Electricity Regulations 1997 reprinted at 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; NZS 3019:2004 **or** AS/NZS 3019:2007; AS/NZS 3760:2003 and Amendment 1.

**PLEASE HAND THIS PAPER TO THE SUPERVISOR BEFORE LEAVING THE ROOM**  
**(turn over)**

## SECTION 1 – ALL CANDIDATES

### Question 1

- (a) (i) State the term used for the electrical output of an appliance. (1 mark)

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- (ii) State another common term used to describe the "phase" conductor. (1 mark)

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- (b) A Class I, 230V, portable electrical appliance with a phase to framework fault is being used outdoors. State **TWO** types of protection device that will disconnect the electricity supply. (2 marks)

(1) \_\_\_\_\_

(2) \_\_\_\_\_

- (c) Rewireable fuses and HRC fuses may be found on switchboards. What is the main function of a fuse? (2 marks)

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**(turn over)**

**Question 1 continued**

(d) Refer to the Electricity Regulations and state what is meant by the term **Standard Low Voltage** for a single phase MEN system.

(2 marks)

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Ref: .....

(e) State **TWO** characteristics an insulating material must possess to be suitable for use as insulation in a flexible cord.

(2 marks)

(1) \_\_\_\_\_  
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(2) \_\_\_\_\_  
\_\_\_\_\_

(f) The Electricity Regulations state that four subjects that must be covered in refresher courses for the holders of a Tradespersons Electrical Work Certificate. Two of those subjects are CPR and basic first aid. Refer to the Electricity Regulations and state the other **TWO** subjects.

(2 marks)

(1) \_\_\_\_\_  
\_\_\_\_\_

(2) \_\_\_\_\_  
\_\_\_\_\_

Ref: .....

**(turn over)**

## Question 1 continued

- (g) Work is being carried out on a 230V plug-in electrical appliance. The only instrument available is an ohmmeter which gives a reading of 32 ohms when connected to the appliance's flexible cord plug.

Calculate the power (in watts) the appliance will consume.

(2 marks)

- (h) The label of an HRC fuse cartridge states information about its manufacture and operating characteristics. A new fuse includes the following information:

- 415 Volts
- AC 46

Briefly describe the meaning of each of these items of information.

(2 marks)

415 volts \_\_\_\_\_

\_\_\_\_\_

AC 46 \_\_\_\_\_

\_\_\_\_\_

- (i) Briefly explain how an isolating transformer protects the user of a Class I electrical appliance from receiving an electric shock, when a phase to earth fault occurs.

(2 marks)

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\_\_\_\_\_

**(turn over)**

## **Question 1 continued**

- (j) State the maximum permitted resistance of the protective earthing conductor when measured between the earth pin of the supply plug and the metal framework of a Class I electrical appliance.

(2 marks)

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**(turn over)**

## Question 2

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

- Two load resistors, 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 2 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 3

- (a) Replacement flexible cords are being fitted to a single phase Class I electrical appliance and a Class II electrical appliance.

(7 marks)

- (i) For the Class I appliance:

- (A) What is the minimum number of cores required in the flexible cord?

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- (B) What colour coding is required for the cores of the flexible cord? State the polarity for each core.

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- (ii) For the Class II appliance:

- (A) What is the minimum number of cores required in the flexible cord?

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- (B) What colour coding is required for the cores of the flexible cord? State the polarity for each core.

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**(turn over)**

### Question 3 continued

- (b) A replacement flexible cord is being fitted to a single phase double insulated electrical appliance. List **THREE** technical factors that must be considered when selecting the flexible cord.

(3 marks)

(1) \_\_\_\_\_

(2) \_\_\_\_\_

(3) \_\_\_\_\_

**(turn over)**

## Question 4

- (a) A Residual Current Device (RCD) - either a portable type or permanently connected type - is live even if no load is connected to the circuit in which it is installed.

State the **main** reason why the Residual Current Device (RCD) does not trip, even though it is live.

(1 mark)

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- (b) Briefly explain how the internal mechanism of a Residual Current Device (RCD) detects an earth fault and disconnects the supply from a faulty Class I electrical appliance.

(4 marks)

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- (c) Why should an RCD be operationally tested?

(1 mark)

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**(turn over)**

**Question 4 continued**

(d) Refer to NZS 3019 and state:

(i) The maximum time in which an RCD used for personal protection must operate at its rated residual current.

(1 mark)

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Ref: .....

(ii) The maximum time in which an RCD used for personal protection must operate at five times its rated residual current.

(1 mark)

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Ref: .....

(e) Briefly explain why a Portable Residual Current Device (PRCD) is "voltage dependent". That is, if the electricity supply to the device fails, the device trips.

(2 marks)

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## SECTION 2 - PLUMBERS ONLY

### Question 5

(a) You are required to disconnect a 230 volt fixed wired electrical appliance supplied from a permanent connection unit. It is to be removed for major servicing work and the disconnection is to take place at the permanent connection unit. The appliance is supplied by a circuit protected by an MCB.

(i) Explain the sequence of actions you will need to ensure your own safety before you carry out the disconnection.

(4 marks)

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(ii) Describe the checks you will make after you have disconnected the appliance to ensure the work site is safe to leave unattended.

(1 mark)

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**(turn over)**

**Question 5 continued**

(b) State **THREE** safety reasons why you would not complete a permanent isolation of a circuit by only removing the carrier of a fuse.

(3 marks)

(1) \_\_\_\_\_

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(2) \_\_\_\_\_

\_\_\_\_\_

(3) \_\_\_\_\_

\_\_\_\_\_

(c) State **TWO** reasons why covers must be in place and secured before returning the repaired appliance to service.

(2 marks)

(1) \_\_\_\_\_

\_\_\_\_\_

(2) \_\_\_\_\_

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**(turn over)**

## Question 6

All flexible cords are given a **current rating**.

- (a) Explain the meaning of the term **current rating**.

(2 marks)

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- (b) What could happen if the flexible cord was used to supply an electrical appliance that draws a current in excess of the cord's rating?

(2 marks)

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- (c) A flexible cord is to be fitted to a single phase electrical appliance. List **FOUR** considerations which may influence the selection of the cord.

(4 marks)

(1) \_\_\_\_\_

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(2) \_\_\_\_\_

\_\_\_\_\_

(3) \_\_\_\_\_

\_\_\_\_\_

(4) \_\_\_\_\_

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## Question 6 continued

- (d) The cores of a flexible cord are being terminated in an electrical appliance. Explain why it is important to remove the minimum amount of basic insulation from the cores?

(2 marks)

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**(turn over)**



**Question 7 continued**

(b) Refer to AS/NZS 3760 and state the insulation resistance permitted between the live supply conductors and earthed exposed metal parts of a Class I portable isolating transformer. State a reference to support your answer.

(1 mark)

\_\_\_\_\_

Ref: .....

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

(4 marks)

(1) \_\_\_\_\_

\_\_\_\_\_

(2) \_\_\_\_\_

\_\_\_\_\_

(3) \_\_\_\_\_

\_\_\_\_\_

(4) \_\_\_\_\_

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## Question 8

- (a) Describe how you would carry out a protective earthing conductor test on the Class I, 230 volt, plug-in electrical appliance. The answer must include the type of meter used, any test voltage that is applicable, and the maximum or minimum acceptable values.

(3 marks)

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- (b) Describe how you would carry out an insulation resistance test on the Class I, 230 volt, plug-in electrical appliance. The answer must include the type of meter used, any test voltage that is applicable, and the maximum or minimum acceptable values.

(5 marks)

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### Question 8 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)

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## Question 9

- (a) Electrical equipment designed for use in damp situations has an **IP rating** – an International Protection rating or Ingress protection rating. An **IP rating** consists of the initials IP followed by two numbers.

Refer to AS1939; AS 60529 or AS/NZS 3000 and answer the following:

- (i) What is an IP rating?

(2 marks)

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Ref: .....

- (ii) Explain what the first number after the letters IP indicates.

(2 marks)

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Ref: .....

- (iii) Explain what the second number after the letters IP indicates.

(2 marks)

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Ref: .....

**(turn over)**

**Question 9 continued**

(b) Refer to AS1939, AS 60529 or AS/NZS 3000 and describe the level of protection offered by fittings rated at **IP34**.

(2 marks)

**3** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**4** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
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Ref: .....

(c) Refer to AS/NZS 3000 and state what is meant by the term "damp situation".

(2 marks)

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\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Ref: .....

## Section 3 – Gasfitters Only

### Question 10

An isolating switch supplying a 230V a.c. single phase induction motor in a gas boiler has been replaced. The motor has both RCD and MCB protection.

What would be the effect if:

- (a) The phase and neutral were accidentally interchanged at the supply side of the isolating switch.

(3 marks)

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- (b) The neutral and earth were accidentally interchanged at the supply side of the isolating switch.

(1 mark)

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**(turn over)**

### Question 10 continued

- (c) The phase and earth were accidentally interchanged at the supply side of the isolating switch and the RCCB failed to operate.

(4 marks)

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- (d) State **TWO** tests that would detect the interchange of the phase and earth conductors?

(2 marks)

(1) \_\_\_\_\_

(2) \_\_\_\_\_

**(turn over)**

## Question 11

All flexible cords are given a **current rating**.

- (a) Explain the meaning of the term **current rating**.

(2 marks)

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- (b) What could happen if the flexible cord was used to supply an electrical appliance that draws a current in excess of the cord's rating?

(2 marks)

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- (c) A flexible cord is to be fitted to a single phase electrical appliance. List **FOUR** considerations which may influence the selection of the cord.

(4 marks)

(1) \_\_\_\_\_

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(2) \_\_\_\_\_

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(3) \_\_\_\_\_

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(4) \_\_\_\_\_

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### **Question 11 continued**

- (d) The cores of a flexible cord are being terminated in an electrical appliance. Explain why it is important to remove the minimum amount of basic insulation from the cores?

(2 marks)

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**(turn over)**



**Question 12 continued**

(b) Refer to AS/NZS 3760 and state the insulation resistance permitted between the live supply conductors and earthed exposed metal parts of a Class I portable isolating transformer. State a reference to support your answer.

(1 mark)

\_\_\_\_\_

Ref: .....

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

(4 marks)

(1) \_\_\_\_\_

\_\_\_\_\_

(2) \_\_\_\_\_

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(3) \_\_\_\_\_

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(4) \_\_\_\_\_

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**(turn over)**

### Question 13

- (a) Describe how you would carry out a protective earthing conductor test on the Class I, 230 volt, plug-in electrical appliance. The answer must include the type of meter used, any test voltage that is applicable, and the maximum or minimum acceptable values.

(3 marks)

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- (b) Describe how you would carry out an insulation resistance test on the Class I, 230 volt, plug-in electrical appliance. The answer must include the type of meter used, any test voltage that is applicable, and the maximum or minimum acceptable values.

(5 marks)

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### Question 13 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)

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## Question 14

(a) The prove-test-prove method of testing is used for checking that isolation has been achieved.

(i) What are the **TWO** conditions that the prove-test-prove method is intended to verify?

(2 marks)

(1) \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(2) \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(ii) Explain how prove-test-prove method of testing is carried out.

(3 marks)

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(b) (i) Explain the **main** purpose of using a Danger Tag system.

(1 mark)

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## Question 14 continued

- (ii) Describe the main information that a worker must enter onto a danger tag

(2 marks)

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- (iii) When would you use a danger tag?

(2 marks)

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## For Candidate's Use

In the box, write the number of **EXTRA** sheets you have used. Write **NIL** if you have not used any

<b>For Examiner's Use Only</b>		
<b>Questions Answered</b>	<b>Marks</b>	
<b><u>Section 1</u></b>		
<b>1</b>		
<b>2</b>		
<b>3</b>		
<b>4</b>		
<b><u>Total Section 1</u></b>		
<b><u>Section 2</u></b>		
<b>5</b>		
<b>6</b>		
<b>7</b>		
<b>8</b>		
<b>9</b>		
<b><u>Total section 2</u></b>		
<b><u>Section 3</u></b>		
<b>10</b>		
<b>11</b>		
<b>12</b>		
<b>13</b>		
<b>14</b>		
<b><u>Total section 3</u></b>		
<b>TOTAL SECTIONS 1 &amp; 2</b>		
<b>OR</b>		
<b>TOTAL SECTIONS 1 &amp; 3</b>		