



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

## TRADESPERSON ELECTRICAL WORK CERTIFICATE EXAMINATION

**10 May 2008**

**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 (Int):2002 or NZS 3019:2004; AS/NZS 3760:2001 or AS/NZS 3760:2003.

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

## SECTION 1 – ALL CANDIDATES

### Question 1

- (a) Calculate the resistance of an electrical appliance with a rating of 2300 watts when it is supplied at 230V.

(2 marks)

- (b) State the meaning of the term "rupturing capacity" for fuses or circuit breakers.

(2 marks)

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- (c) For a Class I, 230V electrical appliance:

- (i) 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 the electrical appliance

(1 mark)

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- (ii) State the minimum acceptable insulation resistance between the active conductor and metal frame of the appliance.

(1 mark)

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- (d) Explain what is meant by the term "closed circuit".

(2 marks)

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**(turn over)**

**Question 1 continued**

(e) State **ONE** reason why a 500V insulation tester set on MΩ scale, must not be used to carry out an protective earthing conductor test on a Class I electrical appliance

(2 marks)

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(f) Refer to AS/NZS 3000 and define the term "damp situation".

(2 marks)

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Ref: .....

(g) State **TWO** reasons why covers must be in place and secured before returning a repaired appliance to a customer.

(2 marks)

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

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

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**(turn over)**

## Question 1 continued

- (h) State the main reason why an ohmmeter is unsuitable to carry out an insulation resistance test on a 230V, Class I electrical appliance. (2 marks)

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- (i) (i) A normally closed pressure switch has opened. Briefly explain what the pressure switch has detected. (1 mark)

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- (ii) A normally closed thermostat has opened. Briefly explain what the thermostat has detected. (1 mark)

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- (j) A single-phase fixed-wired electrical appliance is supplied from a circuit protected by an HRC fuse. When testing for isolation, it is found that there are live conductors at the terminals of the appliance after an isolating switch has been turned to the off position. State **TWO** circumstances that may cause such a situation to occur.

- Note:
1. The circuit wiring installation is not damaged
  2. The isolating switch is not damaged
  3. There is no capacitor in the circuit.

(2 marks)

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

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

**(turn over)**

## Question 2

(a) A single-phase fixed wired electrical appliance is connected to a final subcircuit protected by a fuse on a three-phase switchboard. On that switchboard what voltage would you expect:

(i) Between any two active conductors.

(1/2 mark)

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(ii) Between any active conductor and a neutral conductor.

(1/2 mark)

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(iii) Between any active conductor and an earth conductor

(1/2 mark)

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(iv) Between a neutral conductor and an earth conductor.

(1/2 mark)

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(b) Explain why the earth pin of a standard New Zealand three-pin, 10A plug is longer than the active (phase) and neutral pins.

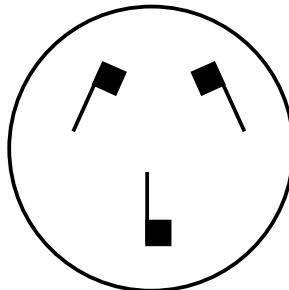
(2 marks)

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(c) The figure below represents the rear of the plug of an appliance after the cover has been removed. Indicate on the figure the active (phase), neutral and earth terminals.

(3 marks)



**(turn over)**

**Question 2 continued**

(d) It is necessary to have a reliable protective earthing conductor on a Class I portable electrical appliance.

(i) State the maximum resistance value for this conductor as required by AS/NZS 3760.

(1 mark)

\_\_\_\_\_

Ref: .....

(ii) Describe **TWO** ways in which the protective earthing conductor contributes to the electrical safety of the Class I electrical appliance.

(2 marks)

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

\_\_\_\_\_

\_\_\_\_\_

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

\_\_\_\_\_

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**(turn over)**





## Question 4

An ohmmeter is to be used to measure the resistance of a plug-in electrical appliance designed for use on 230V supply. The appliance has two elements of  $40\Omega$  and  $50\Omega$  connected in parallel.

- (a) Calculate the current the appliance draw when it is turned on. (4 marks)

- (b) Calculate the power (watts) the appliance will consume when it is turned on. (2 marks)

**(turn over)**

### Question 4 continued

- (c) Calculate the difference in the power (watts) the appliance will consume when it is turned on but the  $50\Omega$  resistor is open-circuited.

(3 marks)

- (d) With all elements working, would the power the appliance consumes increase if the supply voltage was increased to 240V? Give **ONE** reason to support your answer.

**(turn over)**

## SECTION 2 - PLUMBERS ONLY

### Question 5

(a) New flexible cords are to be fitted to a Class I single-phase electrical appliance and a Class II single-phase electrical appliance:

(i) What is the minimum number of conductors the flexible cord needs to have for the Class I single-phase electrical appliance?

(1 mark)

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(ii) What is the minimum number of conductors the flexible cord needs to have for the Class II single-phase electrical appliance?

(1 mark)

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(iii) In both flexible cords, the conductors are identified by colour. Refer to AS/NZS 3000 and complete the following table.

(3 marks)

Function	Identifying colours	
	Recommended	Alternative
Active (Phase)		
Neutral		
Earth		

Ref: .....

**(turn over)**

## Question 5 continued

(b) Terminating flexible cords

- (i) 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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- (ii) When connecting a flexible cord to an appliance, state **ONE** method of minimising the possibility of basic insulation becoming exposed during normal use.

(1 mark)

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- (iii) When a three core flexible cord is fitted to a Class I electrical appliance, it is recommended that the protective earthing conductor should be longer than the phase and neutral conductors.

- (1) State **ONE** reason why this is recommended.

(1 mark)

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- (2) Explain how this recommendation contributes to electrical safety.

(1 mark)

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## Question 6 continued

- (b) The cylinder connects directly via a flexible cord to the isolating switch. You have fitted a new flexible cord to the new cylinder.

You need to make **TWO** tests using test instruments to ensure that the cylinder is safe to connect to the power supply. For each test:

- Describe how you would carry out the test
- State the type of instrument used
- State the test voltage applied - if applicable.
- State the permitted test result
- State whether the test result is a minimum or maximum value

(6 marks)

### Test 1

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### Test 2

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## Question 7

- (a) Electrical equipment designed for use in damp situations has an International Protection Classification (IP rating). This is often referred to as ingress protection.

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) State what is meant by an International Protection Classification (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 7 continued**

- (b) Refer to AS1939 or AS 60529 or AS/NZS 3000:2007 and describe the level of protection offered by fittings rated at IP34. (2 marks)

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Ref: .....

- (c) When an electrical appliance is permanently connected it becomes part of an electrical installation. There are three damp situations relating to electrical appliances which are deemed **not to be electrically safe**. Refer to the Electricity Regulations and state **ONE** of those damp situations. (2 marks)

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Ref: .....

**(turn over)**

## Question 8

(a) Briefly explain the reasons for carrying out the following tests on a Class I, plug-in 230V dishwasher.

(i) Protective earthing conductor resistance test.

(2 marks)

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(ii) Insulation resistance test.

(2 marks)

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(iii) Polarity test.

(1 mark)

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**(turn over)**



## Question 9

- (a) A Class I, single phase plug-in electrical appliance has been repaired. There is a single pole control switch on the appliance and the repairer has mistakenly connected the neutral through this switch.

The electrical appliance has been plugged into a live socket outlet and switched on.

- (i) State the potential hazard that could occur with the livening of this appliance.

(1 mark)

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- (ii) Describe **TWO** situations (other than connecting the neutral to the switch as stated above) where an error can cause the neutral to be switched in the appliance or the appliance flexible cord.

(2 marks)

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

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

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- (b) State **TWO** reasons why it is not permitted to complete a permanent isolation of a circuit by removing only the carrier of a fuse.

(2 marks)

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

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

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**(turn over)**

## Question 9 continued

- (c) (i) List **THREE** likely situations where exposed basic insulation or live terminals could become exposed on a hot water cylinder supplied by a TPS cable, a surface mounted switch and steel flexible conduit enclosing PVC conduit wire.

(3 marks)

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

\_\_\_\_\_

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

\_\_\_\_\_

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

\_\_\_\_\_

- (ii) You have carried out repairs to an existing hot water cylinder. State **TWO** reasons why the steel flexible conduit used to supply the cylinder must be securely clamped.

(2 marks)

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

\_\_\_\_\_

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

\_\_\_\_\_

### Section 3 – Gasfitters Only

#### Question 10

- (a) A Class I, single phase plug-in electrical appliance has been repaired. There is a single pole control switch on the appliance and the repairer has mistakenly connected the neutral through this switch.

The electrical appliance has been plugged into a live socket outlet and switched on.

- (i) State the potential hazard that could occur with the livening of this appliance.

(1 mark)

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- (ii) Describe **TWO** situations (other than connecting the neutral to the switch as stated above) where an error can cause the neutral to be switched in the appliance or the appliance flexible cord.

(2 marks)

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

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

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- (b) State **TWO** reasons why it is not permitted to complete a permanent isolation of a circuit by removing only the carrier of a fuse.

(2 marks)

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

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

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**(turn over)**

## Question 10 continued

- (c) (i) List **THREE** likely situations where exposed basic insulation or live terminals could become exposed on a gas boiler cylinder supplied by a TPS cable, a surface mounted switch and flexible conduit enclosing PVC conduit wire.

(3 marks)

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

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

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

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- (ii) You have carried out repairs to an existing 230V gas boiler. State **TWO** reasons why the steel conduit used to supply the boiler must be securely clamped.

(2 marks)

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

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

\_\_\_\_\_

**(turn over)**

## Question 11

(a) New flexible cords are to be fitted to a Class I single-phase electrical appliance and a Class II single-phase electrical appliance:

(i) What is the minimum number of conductors the flexible cord needs to have for the Class I single-phase electrical appliance?

(1 mark)

\_\_\_\_\_

(ii) What is the minimum number of conductors the flexible cord needs to have for the Class II single-phase electrical appliance?

(1 mark)

\_\_\_\_\_

(iii) In both flexible cords, the conductors are identified by colour. Refer to AS/NZS 3000 and complete the following table.

(3 marks)

Function	Identifying colours	
	Recommended	Alternative
Active (Phase)		
Neutral		
Earth		

Ref: .....

**(turn over)**

## Question 11 continued

(b) Terminating flexible cords

- (i) 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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- (ii) When connecting a flexible cord to an appliance, state ONE method of minimising the possibility of basic insulation becoming exposed during normal use.

(1 mark)

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- (iii) When a three core flexible cord is fitted to a Class I electrical appliance, it is recommended that the protective earthing conductor should be longer than the phase and neutral conductors.

- (1) State **ONE** reason why this is recommended.

(1 mark)

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- (2) Explain how this recommendation contributes to electrical safety.

(1 mark)

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**(turn over)**



## Question 12 continued

- (b) The boiler connects directly via a flexible cord to the isolating switch. You have fitted a new flexible cord to the new boiler.

You need to make **TWO** tests using test instruments to ensure that the boiler is safe to connect to the power supply. For each test:

- Describe how you would carry out the test
- State the type of instrument used
- State the test voltage applied - if applicable.
- State the permitted test result
- State whether the test result is a minimum or maximum value

(6 marks)

### Test 1

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### Test 2

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### Question 13

(a) Briefly explain the reasons for carrying out the following tests on a Class I, plug-in 230V dishwasher.

(i) Protective earthing conductor resistance test.

(2 marks)

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(ii) Insulation resistance test.

(2 marks)

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(iii) Polarity test.

(1 mark)

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**(turn over)**



## Question 14

(a) Before a Class I, 230V gas appliance is returned to service after being repaired, AS/NZS 3760 requires that it must be inspected and two tests carried out using test instruments. Refer to AS/NZS 3760 and:

(i) (1) State the type of inspection required. (1 mark)

\_\_\_\_\_

(2) State how the inspection should be carried out. (1 mark)

\_\_\_\_\_

Ref: .....

(ii) Complete the following in relation to the tests using test instruments:

### Test No.1

(1) Type of test (1 mark)

\_\_\_\_\_

(2) Instrument used (1 mark)

\_\_\_\_\_

(3) Acceptable test result (1 mark)

\_\_\_\_\_

Ref: .....

**(turn over)**

## Question 14 continued

### Test No.2

(1) Type of test (1 mark)

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(2) Instrument used (1 mark)

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(3) Acceptable test result (1 mark)

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Ref: .....

(b) What action would you take if the electrical appliance fails one of the tests stated in (a)(ii). (2 marks)

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

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

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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

## For Examiner's Use Only

Questions Answered	Marks	
<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>		