BOARD OF STUDIES
NEW SOUTH WALES

2009

HIGHER SCHOOL CERTIFICATE EXAMINATION

Electrotechnology

General Instructions

- Reading time – 5 minutes
- Working time – 2 hours
- Write using black or blue pen
- Board-approved calculators may be used
- Write your Centre Number and Student Number at the top of pages 5, 7 and 9

Total marks – 80

Section I Pages 2–4

15 marks

- Attempt Questions 1–15
- Allow about 15 minutes for this section

Section II Pages 5–10

35 marks

- Attempt Questions 16–24
- Allow about 45 minutes for this section

Section III Page 11

30 marks

- Attempt TWO questions from Questions 25–27
- Allow about 1 hour for this section

Section I

15 marks
Attempt Questions 1–15
Allow about 15 minutes for this section

Use the multiple-choice answer sheet for Questions 1–15.

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1 Which organisation enforces OHS legislation in the electrotechnology industry in NSW?

(A) WorkCover NSW

(B) Standards Association

(C) Electrical Trade Union NSW

(D) National Electrical and Communication Association

2 Who is the most appropriate person to remove an isolation tag from a piece of electrical equipment?

(A) The site manager

(B) The site safety officer

(C) The electrical supervisor

(D) The person who applied the tag

3 Who is responsible for creating Material Safety Data Sheets (MSDS)?

(A) The employer

(B) The distributor

(C) The manufacturer

(D) The OHS committee

4 How often must portable electrical power tools be tested and tagged when they are used on construction sites?

(A) Once a day

(B) Once a week

(C) Once a month

(D) Once a year

5 If steel pop rivets are used to join pieces of sheet aluminium, the rivets will

(A) fail.

(B) fracture the aluminium.

(C) pull through the aluminium.

(D) set up corrosion with the aluminium.

6 How can unauthorised reconnection of supply to electrical equipment be avoided?

(A) By isolating and tagging the equipment

(B) By danger tagging a locked-off isolation switch

(C) By connecting the active and earth conductors together

(D) By informing others that you are working on the equipment

7 What is the unit of measurement of electrical energy for domestic tariff?

(A) Ah

(B) kWh

(C) MWh

(D) Wkh

8 What state does a circuit need to be in to measure current?

(A) Dead

(B) Live

(C) Offline

(D) Online

9 Three capacitors of equal value are connected in parallel and charged.

What will the charge on each capacitor be?

(A) Equal to the total charge

(B) One third of the total charge

(C) Three times the total charge

(D) Independent of the total charge

10 A circuit consists of three 60-ohm resistors connected in parallel with each other.

If one resistor becomes open circuit, what is the total resistance, in ohms, of the circuit?

(A) 0

(B) 20

(C) 30

(D) Infinite

11 A circuit consists of two lamps connected in series. It consumes a total of 10 watts.

If one lamp becomes open circuit, what will happen to the power consumption of the circuit?

(A) It will halve.

(B) It will double.

(C) It will decrease to zero.

(D) It will remain unchanged.

12 What is the preferred method of risk control in the workplace in relation to occupational health and safety?

(A) Isolation

(B) Elimination

(C) Substitution

(D) Personal Protective Equipment (PPE)

13 What will the power consumption of a circuit be reduced by if the resistance is tripled?

(A) $\frac{1}{4}$

(B) $\frac{1}{3}$

(C) $\frac{1}{2}$

(D) $\frac{2}{3}$

14 Two cells with unequal output voltage are connected in parallel, but without load.

What will the resulting current be limited by?

(A) The external resistance of the cells

(B) The sum of the voltage of each cell

(C) The difference between the voltage of each cell

(D) The load resistance and the internal resistance of the cells

15 A 20-metre length of conductor has a cross-sectional area (CSA) of 2 mm^2 and a resistance of 2 ohms.

Using the same material, what would be the resistance of a conductor 10 metres in length and having a CSA of 1 mm^2?

(A) 1 ohm

(B) 2 ohms

(C) 4 ohms

(D) 8 ohms

Electrotechnology

Centre Number

Section II

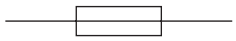
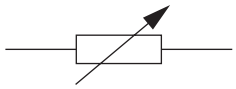
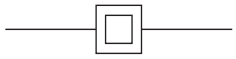
Student Number

35 marks
Attempt Questions 16–24
Allow about 45 minutes for this section

Answer the questions in the spaces provided.

Question 16 (3 marks)

Identify the meaning of each symbol in the table.

	Symbol	*Meaning*	
(a)			**1**
(b)			**1**
(c)			**1**

Question 17 (2 marks)

(a) Write an equation for Ohm's Law. **1**

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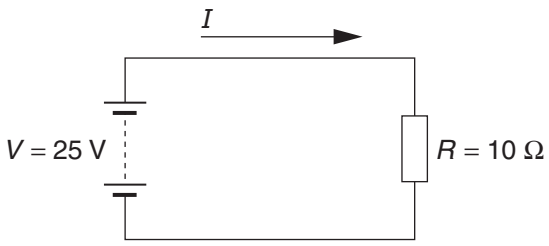
(b) Calculate the current in the electrical circuit shown. **1**



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Question 18 (5 marks)

Resistor Colour Code Chart

Colour	*Value*	*Multiplying factor*	*Tolerance*
Black	0	1	–
Brown	1	10	1%
Red	2	100	2%
Orange	3	1 000	–
Yellow	4	10 000	–
Green	5	100 000	0.5%
Blue	6	1 000 000	0.25%
Violet	7	–	0.1%
Grey	8	–	–
White	9	–	–
Gold	–	0.1	5%
Silver	–	0.01	10%

(a) Use the Resistor Colour Code Chart to find the colour code of the resistor. **2**

Value	*Tolerance*	*Band 1*	*Band 2*	*Band 3*	*Band 4*
680	1%				

(b) Determine the maximum value of the following resistor, showing all working. **3**

Band 1	*Band 2*	*Band 3*	*Band 4*
Red	Black	Blue	Gold

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Electrotechnology

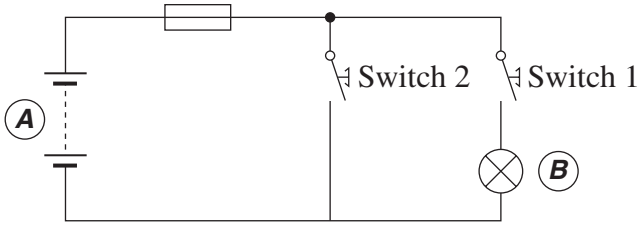
Centre Number

Section II (continued)

Student Number

Question 19 (7 marks)

An electrical circuit is shown.



(a) Identify the components (A) and (B).

		Component	
(i)	(A)		**1**
(ii)	(B)		**1**

(b) Describe what will happen if Switch 1 is closed. **2**

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(c) Describe what will happen if Switch 1 remains closed and Switch 2 is also closed. **3**

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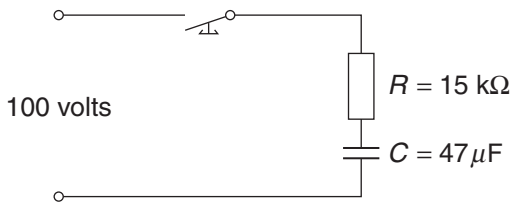
Question 20 (5 marks)

An electrical circuit is shown.



Calculate, showing all working:

(a) the time constant for the circuit; **2**

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(b) the maximum circuit current; **1**

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(c) the value of resistance to be added to change the time constant to one second. **2**

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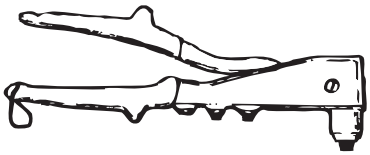
Question 21 (4 marks)

Identify the following tools and give an appropriate electrotechnological application for each one.

(a)  Tool: **2**

Application: .....

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(b)  Tool: **2**

Application: .....

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Question 22 (3 marks)

In large scale electricity generation, mechanical energy is converted to electrical energy.

(a) Explain this conversion process. **1**

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(b) Identify TWO renewable generation technologies that use this process. **2**

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Question 23 (3 marks)

Describe the process you should use to measure a resistor with a nominal value of 1KΩ, using an analogue ohmmeter. **3**

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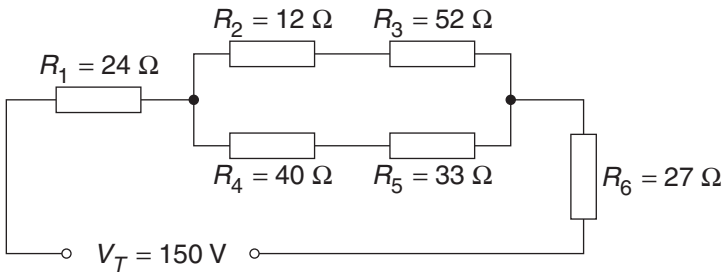
Question 24 (3 marks)

Calculate the total resistance of the electrical circuit shown. Show all your working in the space provided. **3**



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Electrotechnology

Section III

30 marks
Attempt TWO questions from Questions 25–27
Allow about 1 hour for this section

Answer each question in a SEPARATE writing booklet. Extra writing booklets are available.

In your answers you will be assessed on how well you:

- demonstrate relevant knowledge and understanding
- communicate ideas and information, using precise industry terminology and appropriate workplace examples
- organise information in a well-reasoned and cohesive response
- solve proposed issues or problems

Question 25 (15 marks)

A single-phase 230-volt motor needs to be isolated in order to carry out minor service work.

Describe the process of isolation, identifying each step and justifying where appropriate. In your answer, refer to the safe use of equipment.

Question 26 (15 marks)

You are required to drill and tap an M10 hole to a depth of 15 mm in a mild-steel bar which is 50 mm thick.

Describe the process of drilling and tapping, identifying each step and justifying where appropriate. In your answer, refer to the safe use of tools required.

Question 27 (15 marks)

You are responding to a service call from an irate customer. One section of the customer's business premises has lost power and this is affecting production.

Describe and explain the processes you would use to resolve both the customer service issue and the loss of supply issue.

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