

**B O A R D O F S T U D I E S**  
NEW SOUTH WALES

**2009**

**HIGHER SCHOOL CERTIFICATE  
SPECIMEN 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 page 9 and 13

**Total marks – 80**

**Section I** Pages 2–5

**15 marks**

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

**Section II** Pages 9–16

**35 marks**

- Attempt Questions 16–25
- Allow about 45 minutes for this section

**Section III** Page 17

**30 marks**

- Attempt TWO questions from Questions 26–28
- 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.

---

- 1 A particular copper conductor has a resistance of 2 ohms ( ).  
What will the resistance of this copper conductor be if its length is halved?
- (A)  $\frac{1}{2}$   
(B) 1  
(C) 2  
(D) 4
- 2 What type of drill bit is most appropriate when drilling into a brick wall?
- (A) Auger  
(B) Forstner  
(C) Masonry  
(D) Spur point
- 3 Which of the following noise levels is the threshold above which hearing protection must be worn?
- (A) 65 dB  
(B) 75 dB  
(C) 85 dB  
(D) 95 dB
- 4 In first aid, what do the letters DRABCD stand for?
- (A) Danger, Resuscitation, Airway, Breathing, CPR, Defibrillator  
(B) Danger, Response, Airway, Breathing, CPR, Defibrillator  
(C) Danger, Response, Airway, Bleeding, CPR, Defibrillator  
(D) Danger, Response, Airway, Breathing, CPR, Dial for help

- 5** What is the SI unit of electrical power?
- (A) Ampere
  - (B) Newton
  - (C) Ohm
  - (D) Watt
- 6** Why are hand taps normally used in sets of three?
- (A) It provides spares if you should break a tap.
  - (B) It allows tapping of the hole in a range of sizes.
  - (C) It reduces the amount of material each tap removes.
  - (D) It enables progressive tapping to the bottom of a blind hole.
- 7** When an apparatus is being dismantled, why are the individual components tagged or marked?
- (A) To ensure that there are no missing parts
  - (B) To ensure correct and efficient reassembly
  - (C) To ensure that the person dismantling the apparatus knows the correct part number
  - (D) To ensure that the person dismantling the apparatus knows the name of each component
- 8** Resistors *A* and *B* are connected in parallel. Resistor *A* has half the resistance of resistor *B*.
- What would be the current flowing through resistor *B*?
- (A) One third of the supply current
  - (B) One half of the supply current
  - (C) Two thirds of the supply current
  - (D) Twice as much as the current flowing in resistor *A*

- 9** The total equivalent capacitance of capacitors connected in parallel is equal to the
- (A) lowest individual capacitance.
  - (B) sum of the individual capacitances.
  - (C) product of the individual capacitances.
  - (D) sum of the reciprocals of the individual capacitances.
- 10** Which of the following current effects is used in the operation of most electrical machines?
- (A) Chemical
  - (B) Heating
  - (C) Magnetic
  - (D) Physiological
- 11** What would be the effect on power consumption if the electromotive force to a circuit is doubled?
- (A) It would be unchanged.
  - (B) It would be halved.
  - (C) It would be doubled.
  - (D) It would be quadrupled.
- 12** Why is electrical equipment required to be installed in a safe manner and in accordance with manufacturer's instructions?
- (A) To remove the need for inspection and testing
  - (B) In order to meet WorkCover compensation policy
  - (C) In order to meet AS3000-2001 wiring rules requirements
  - (D) To ensure the integrity of the installation against mechanical or electrical failure

- 13** Which of the following would normally be included in a Material Safety Data Sheet?
- (A) Chemical analysis report
  - (B) International protection rating
  - (C) Name and contact details of manufacturer or importer
  - (D) A list of local and interstate retailers and commercial providers
- 14** Which of the following happens if a short circuit occurs?
- (A) Resistance decreases and current decreases
  - (B) Resistance decreases and current increases
  - (C) Resistance increases and current decreases
  - (D) Resistance increases and current increases
- 15** An employee in an electrical contracting company has an angry customer on the telephone who is unhappy with recent work that has been completed by the company's electrician. The customer details poor workmanship, including damage to the client's house and waste left onsite on completion of the work.
- Which of the following is the most appropriate initial response from the employee to the customer?
- (A) An undertaking to make good any damage to the customer's house and compensation for the waste left onsite
  - (B) An undertaking to reimburse to the customer the fee that has been paid for the electrical work done
  - (C) An acknowledgement of the valid nature of the complaint and an undertaking to bring the customer's concerns to the attention of senior management of the company
  - (D) An assurance that the customer's complaint will be brought to the immediate attention of a senior company employee and an undertaking to have the senior company employee get back to the customer as soon as possible

BLANK PAGE

BLANK PAGE

BLANK PAGE

# Electrotechnology

--	--	--	--	--

Centre Number

## Section II

--	--	--	--	--	--	--	--	--

Student Number

35 marks

Attempt Questions 16–25

Allow about 45 minutes for this section

Answer the questions in the spaces provided.

**Marks**

### Question 16 (4 marks)

(a) What is the difference between a cell and a battery?

**2**

.....

.....

.....

.....

(b) What is the difference between a primary cell and a secondary cell?

**2**

.....

.....

.....

.....

### Question 17 (2 marks)

(a) What is an open circuit?

**1**

.....

.....

(b) What is a closed circuit?

**1**

.....

.....

**Question 18** (2 marks)

In the table below draw the SI symbol for the corresponding component.

2

<i>Component</i>	<i>Symbol</i>
Fuse	
Circuit breaker	

**Question 19** (2 marks)**Resistor Colour Code Chart**

2

<i>Colour</i>	<i>Resistance value</i>	<i>Multiplying factor</i>	<i>Tolerance (%)</i>
Black	0	1	–
Brown	1	10	1%
Red	2	100	2%
Orange	3	1000	–
Yellow	4	10000	–
Green	5	100000	0.5%
Blue	6	1000000	0.25%
Violet	7	–	0.1%
Grey	8	–	–
White	9	–	–
Gold	–	0.1	5%
Silver	–	0.01	10%

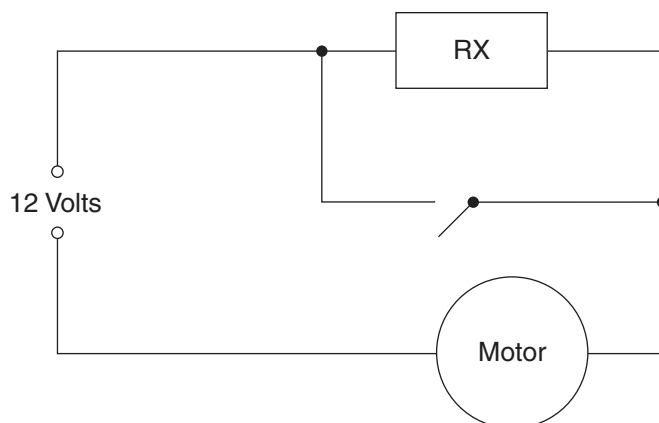
Complete the table below by decoding the resistance value and tolerance from the colour code in the *Resistor Colour Code Chart*.

<i>Band 1</i>	<i>Band 2</i>	<i>Band 3</i>	<i>Band 4</i>	<i>Resistance value</i>	<i>Tolerance (%)</i>
Brown	Grey	Gold	Gold		

**Question 20** (2 marks)

Calculate the resistance of RX if it allows the motor to operate at 6 volts and take 7.5 amperes.

2



.....

.....

.....

.....

**Question 21** (2 marks)

A cable with a cross-sectional area of  $1 \text{ mm}^2$  has a resistance of 20 ohms.

2

What would be the resistance of a similar cable of the same length if it had a cross-sectional area of  $1.5 \text{ mm}^2$ ?

.....

.....

.....

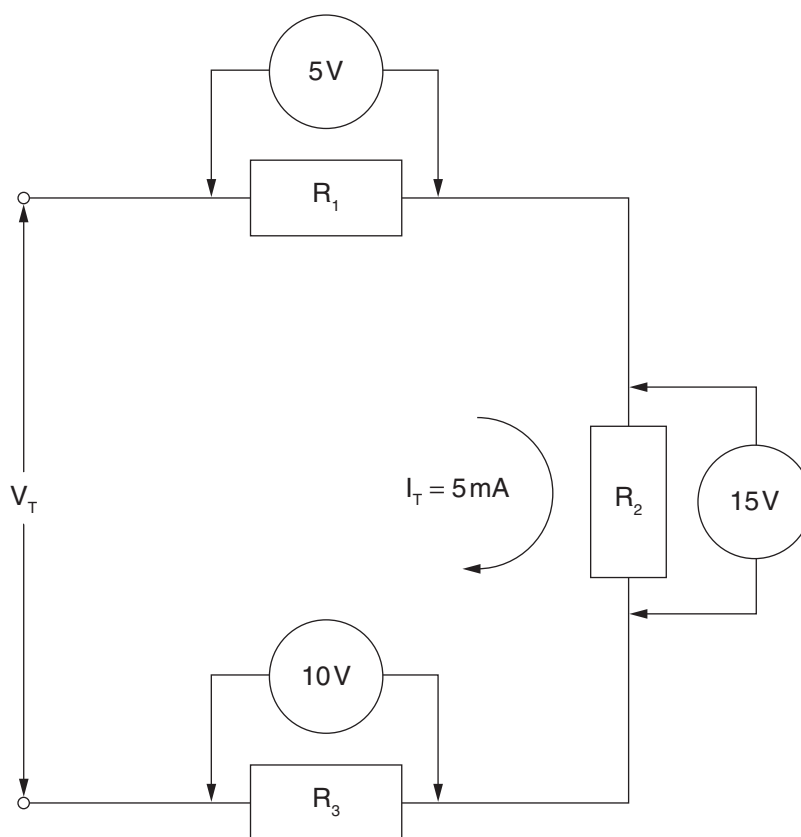
.....

.....

**Question 22** (3 marks)

Calculate the total resistance of the circuit shown below.

**3**



.....

.....

.....

.....

.....

--	--	--	--	--

Centre Number

Section II (continued)

--	--	--	--	--	--	--	--	--

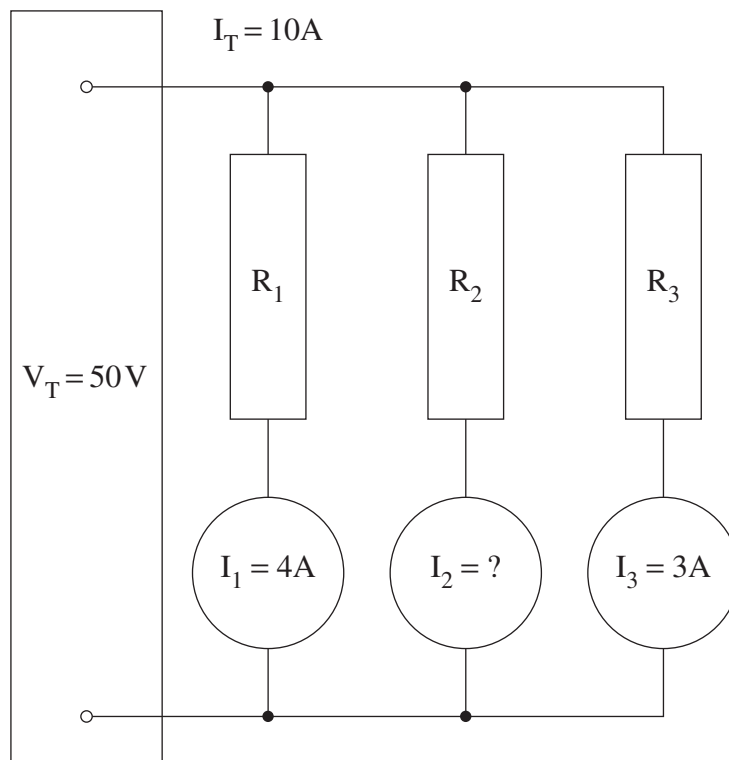
Student Number

Marks

Question 23 (2 marks)

Calculate the value of  $R_2$  in the circuit shown below.

2



.....

.....

.....

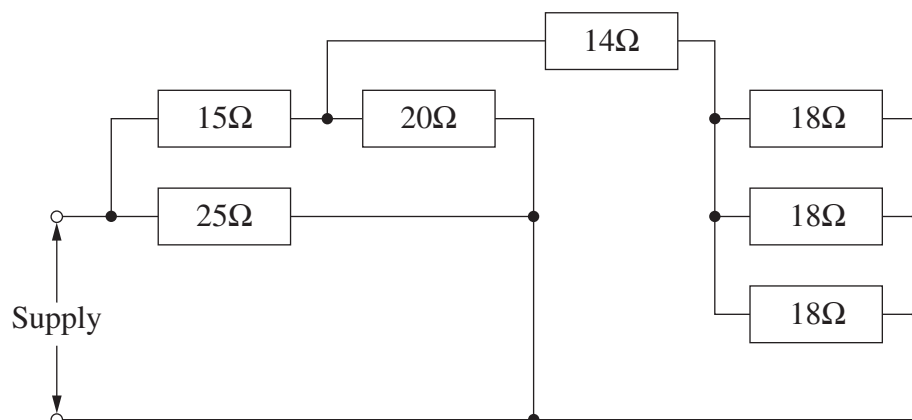
.....

.....

**Question 24** (4 marks)

A circuit is shown.

4



Determine the resistance of the whole circuit measured at the supply terminals.

.....

.....

.....

.....

**Question 25** (12 marks)

You are an electrical contractor who has been called to a factory to fix a large exhaust fan that is tripping its overload.

- (a) What safety precautions should be completed before you examine the exhaust fan? **2**

.....  
.....  
.....  
.....  
.....  
.....

- (b) Upon closer examination you discover that the fan drive motor has seized. **2**  
Describe the process you would follow before you disconnect the fan drive motor.

.....  
.....  
.....  
.....  
.....  
.....

- (c) The fan drive motor needs to be removed so that it can be repaired. It weighs 30 kg, is covered in grease, and the lighting in the factory is very poor. **3**  
What risk control measures should be put in place to remove the fan drive motor?

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....

**Question 25 continues on page 16**

Question 25 (continued)

- (d) What procedure would you follow in order to dismantle and then reassemble the fan drive motor? In your answer, include the tools necessary for each step in the procedure. 5

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

**End of Question 25**

# Electrotechnology

## Section III

**30 marks**

**Attempt TWO questions from Questions 26–28**

**Allow about 1 hour for this section**

Answer this question in a 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 26 (15 marks)

Describe the aspects of customer service that an electrical contractor should consider in order to provide a high-quality customer service.

### Question 27 (15 marks)

You are investigating damaged cabling to a hydraulic motor in close proximity to an electric arc furnace. Before any repairs are to be attempted, you need to manage all risks.

Describe how you would manage this situation in relation to the hierarchy of risk control measures.

### Question 28 (15 marks)

A circuit is to be installed to provide electrical power to a motor-operated machine in a factory. Part of the circuit is to be installed in PVC conduit along a brick wall. Two 4-metre lengths of conduit are to be securely fixed to the wall at a height of 3 metres.

Propose a written job procedure to install the conduit.

**End of paper**

BLANK PAGE