VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

Victorian Certificate of Education 2009

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER

									Letter
Figures									
Words									

VCE VET ELECTROTECHNOLOGY

Written examination

Thursday 5 November 2009

Reading time: 9.00 am to 9.15 am (15 minutes)
Writing time: 9.15 am to 10.45 am (1 hour 30 minutes)

QUESTION AND ANSWER BOOK

Structure of book

Section	*Number of questions*	*Number of questions to be answered*	*Number of marks*
A	20	20	20
B	11	11	80
			Total 100

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers, one scientific calculator.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or white out liquid/tape.

Materials supplied
- Question and answer book of 19 pages including a formula sheet on page 19.
- Answer sheet for multiple-choice questions.

Instructions
- Write your **student number** in the space provided above on this page.
- Check that your **name** and **student number** as printed on your answer sheet for multiple-choice questions are correct, **and** sign your name in the space provided to verify this.
- All written responses must be in English.

At the end of the examination
- Place the answer sheet for multiple-choice questions inside the front cover of this book.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.

SECTION A – Multiple-choice questions

Instructions for Section A

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.
Choose the response that is **correct** or that **best answers** the question.
A correct answer scores 1, an incorrect answer scores 0.
Marks will **not** be deducted for incorrect answers.
No marks will be given if more than one answer is completed for any question.

Question 1

Which one of the following statements is correct in relation to lithium-ion batteries?

A. They cannot be recharged.
B. They can be overheated without damage occurring.
C. They can be damaged when they are completely discharged.
D. They are heavier than lead acid batteries of the same capacity.

Question 2

Four AAA carbon-zinc batteries are connected in series for a torch.
The total voltage applied to the globe is

A. 1.2 V
B. 1.5 V
C. 4.8 V
D. 6 V

Question 3

The primary purpose of a residual current detector (RCD) is to provide

A. short-circuit protection.
B. circuit overload protection.
C. protection from electrical fires.
D. protection against electric shock.

Question 4

A resistor has the following colour bands: red, violet, red, gold.
The value of the resistor in ohms is

A. 27 k 5%
B. 270 k 1%
C. 2 k 7 5%
D. 270 R 2%

Question 5

An electric heater is connected to 240 VAC and draws 6 amps of current.

The power used by the heater is

A. 40 W

B. 144 W

C. 400 W

D. 1440 W

Question 6

Figure 1

The component shown in Figure 1 is

A. a BNC plug.

B. an RCA plug.

C. a DC power plug.

D. a 3.5 mm stereo plug.

Question 7

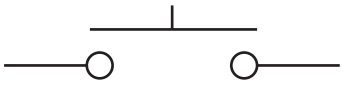


Figure 2

The circuit symbol shown in Figure 2 represents a

A. push button switch.

B. rocker switch.

C. slide switch.

D. DIP switch.

Question 8

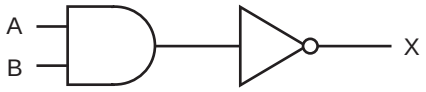
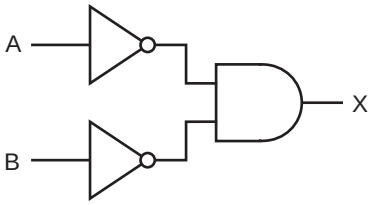


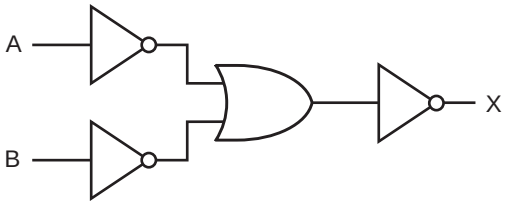
Figure 3

Which one of the following circuits is equivalent to the circuit depicted in Figure 3?

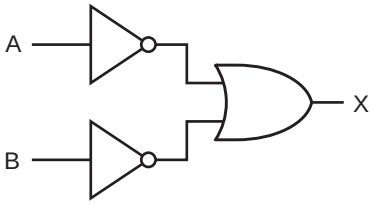
A.



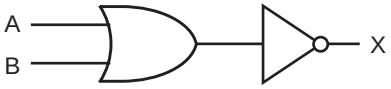
B.



C.



D.



Question 9

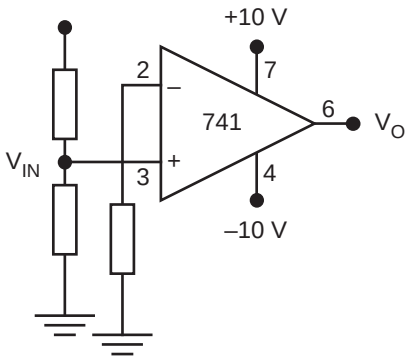


Figure 4

The output signal voltage of the operational amplifier in Figure 4 is 15 Vp-p. The gain of the operational amplifier is 10^6.

The input voltage V_{IN} is

A. 15 mVp-p

B. 15 μVp-p

C. 0.15 Vp-p

D. 1.5 Vp-p

Question 10

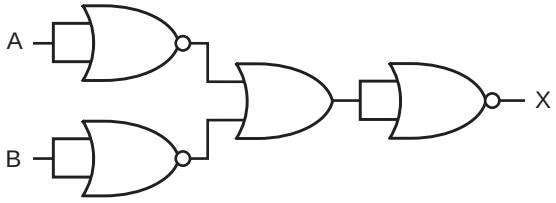


Figure 5

The logic circuit in Figure 5 has the Boolean expression

A. $X = \overline{A} + \overline{B}$

B. $X = \overline{A} \cdot \overline{B}$

C. $X = \overline{\overline{A} + \overline{B}}$

D. $X = \overline{\overline{A} \cdot \overline{B}}$

Question 11

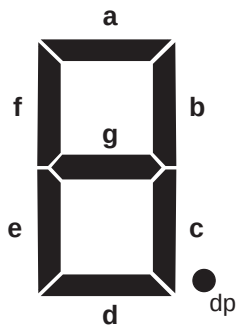


Figure 6

The seven segment display depicted in Figure 6 is active high (common cathode).
In order to display the digit three in decimal, what will be the logical values of segments a, b, c, d, e, f, g?

a, b, c, d, e, f, g

A. 1, 1, 1, 1, 0, 1, 0

B. 1, 1, 1, 1, 0, 0, 1

C. 0, 0, 1, 1, 0, 1, 1

D. 1, 1, 1, 0, 1, 1, 1

Question 12

Transistor Transistor Logic (TTL) circuits are used to

A. protect the circuit against overheating.

B. control the power flow in a circuit.

C. implement logic functions.

D. amplify audio signals.

Question 13

The value of the Binary Coded Decimal (BCD) number 0110 0011 1000 1001 in decimal is

A. 7

B. 6389

C. 7490

D. 25481

Question 14

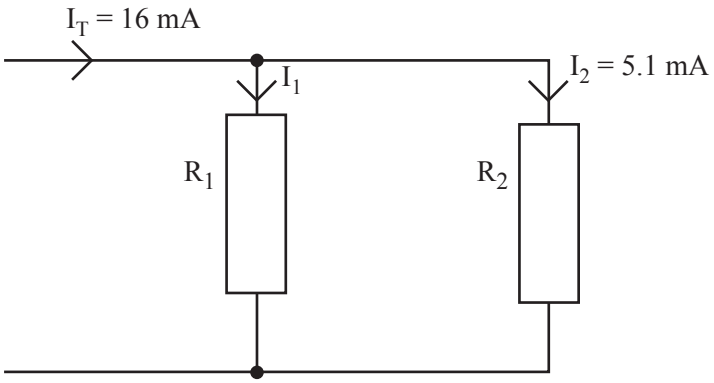


Figure 7

For the circuit in Figure 7, what is the current I_1 when I_T = 16 mA?

A. 21.1 mA

B. 10.9 mA

C. 5.1 mA

D. 3.7 mA

Question 15

Which one of the following is an application for an inductor in an electrical circuit?

A. DC current blocking

B. switching DC current

C. amplifying small signals

D. surge current suppression

Question 16

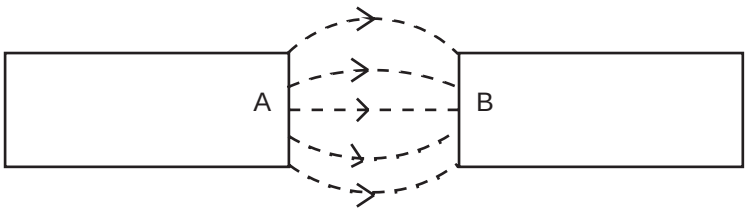


Figure 8

The polarities of the magnets in Figure 8 are

A. A is north B is south

B. A is south B is north

C. A is positive B is negative

D. A is negative B is positive

Question 17

The silicon steel laminations used in the construction of transformer cores

A. reduce the load current on the secondary winding.

B. regulate the frequency to the primary winding.

C. stabilise the secondary voltage.

D. reduce eddy currents.

Question 18

A transformer with a secondary winding with fewer turns than its primary winding is referred to as a

A. shell-type transformer.

B. step-down transformer.

C. voltage reducer transformer.

D. core-type laminated transformer.

Question 19

A capacitor consists of

A. a single plate and a dielectric.

B. parallel plates and a dielectric.

C. parallel plates and a conductor.

D. semiconductor plates and an electrolyte.

Question 20

The wireless adaptor on a PC shows the following information when using the ***ipconfig /all*** command.

Ethernet adapter Wireless Network Connection:

Connection-specific DNS Suffix:
Description: Intel(R) Wireless WiFi Link 4965AGN
Physical Address: 00-1D-E0-B7-18-D1
Dhcp Enabled: Yes
Autoconfiguration Enabled: Yes
IP Address: 192.168.0.2
Subnet Mask: 255.255.255.0

The 'physical address', known as the MAC address, is shown in hexadecimal.

How many binary bits are required to represent this address?

A. 48

B. 12

C. 9

D. 4

END OF SECTION A
TURN OVER

SECTION B

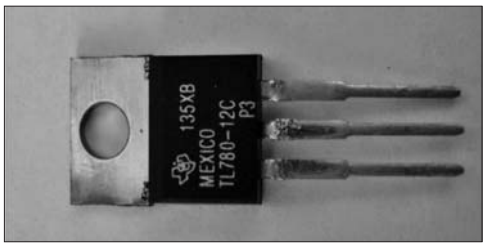
Instructions for Section B

Answer **all** questions in the spaces provided.
State all formulas and calculations.
All units must be specified in the answers.

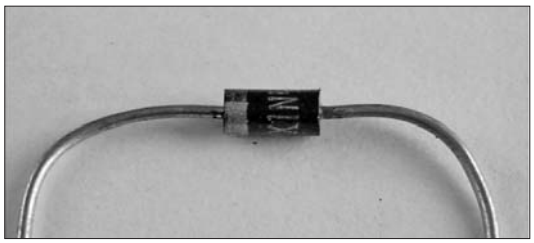
Question 1

In the table below, correctly place the corresponding letters from the pictures against the named component.

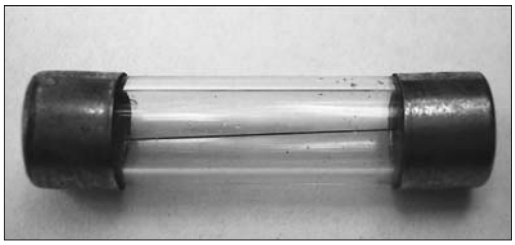
A.



B.

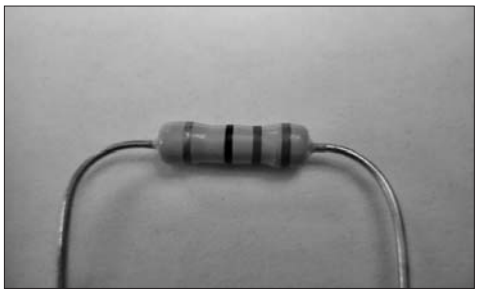


C.

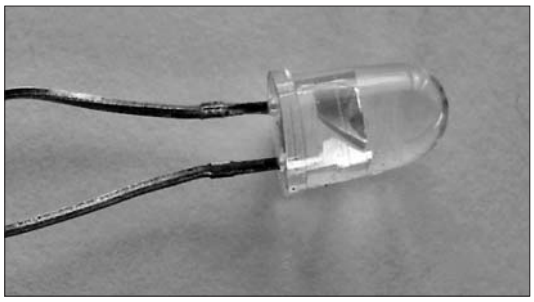


D.

E.



F.



G.

H.

Component	Letter
Fuse	
Power transistor	
Potentiometer	

Component	Letter
Diode	
Integrated circuit	
High-power resistor	

6 marks

Question 2

A transducer can be referred to as a device that converts one form of energy into another form.

In the table below, fill in the missing information.

Transducer	Energy input	Energy output
Microphone	Sound-wave pressure	
LED		Light
Piezo sparker		High-voltage spark
	Light energy	Variable resistance
Solar cell		

6 marks

Question 3

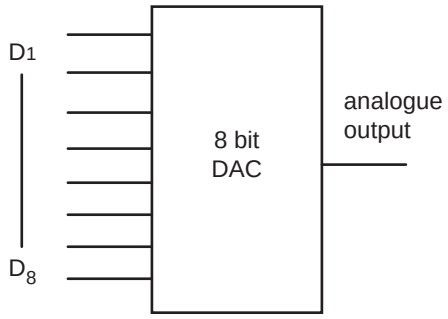


Figure 1

The 8 bit Digital to Analogue Converter (DAC) shown in Figure 1 is used to convert digital data into an analogue voltage.

a. Determine the total number of different analogue output levels that the 8 bit DAC could produce.

_____

1 mark

b. If the output voltage varies between 0 to 5 volts, calculate the minimum output voltage increment for a change in the digital input value.

_____

2 marks

c. Give **three** examples of systems or devices that use a DAC.

_____

_____

_____

3 marks

Question 4

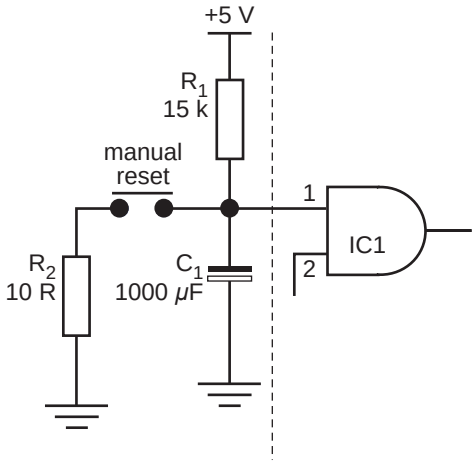


Figure 2

The circuit in Figure 2 shows a reset circuit for an alarm system. The circuit provides a delay, allowing sufficient time to exit after the reset button has been pushed.

a. When the reset button is pushed, calculate the time constant for the discharge of C_1.

2 marks

b. Calculate the amount of time required for C_1 to discharge after the reset button has been pushed.

2 marks

c. When the reset button is released, calculate the time constant for the charging of C_1.

2 marks

Question 5

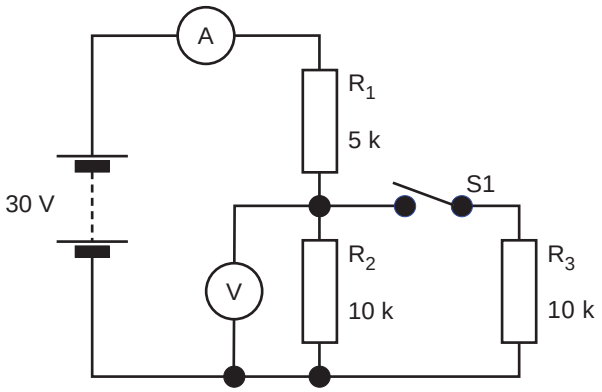


Figure 3

a. In the circuit in Figure 3 the switch (S1) is initially open. Assuming that the ammeter and voltmeter are ideal and have no effect on the circuit, calculate the expected readings on the ammeter (A) and voltmeter (V).

A reading _____

V reading _____

4 marks

b. Calculate the readings on the ammeter (A) and voltmeter (V) when the switch is closed.

A reading _____

V reading _____

4 marks

Question 6

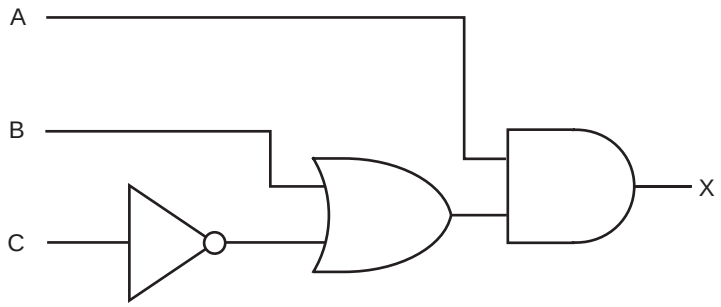


Figure 4

For the logic circuit shown in Figure 4

a. fill in the truth table below

A	B	C	X
0	0	0	0
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	1

6 marks

b. write the Boolean expression.

_____

2 marks

Question 7

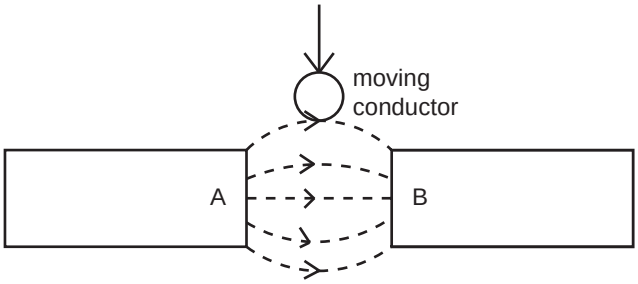


Figure 5

Refer to Figure 5.

a. The value of the voltage induced in a conductor which is moved in a magnetic field depends on four factors.

List two of these factors, and explain the effect of each.

Factor 1 _____

Effect _____

_____

_____

Factor 2 _____

Effect _____

_____

_____

4 marks

b. What would be the effect on the induced voltage if the conductor were moved in the opposite direction?

_____

_____

1 mark

Question 8

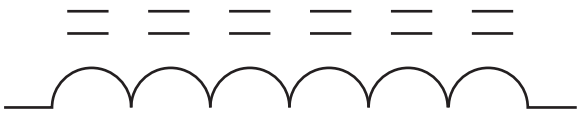


Figure 6

a. What type of core material is indicated for the coil in Figure 6?

_____

1 mark

b. Explain the term 'mutual inductance', giving an example of a device which uses this effect.

Mutual inductance _____

_____

Device _____

2 marks

c. What type of core material is suitable for an inductor used in low-frequency, high-current applications?

_____

1 mark

d. The tuning coil for a radio receiver is an example of a practical application for an inductor. List one more practical application for an inductor.

_____

_____

1 mark

e. The winding on the high-voltage side of a transformer (primary) contains 1660 turns. The low-voltage winding (secondary) contains 138 turns. If the primary voltage is 240 volts and the secondary current is 10 amperes, calculate the secondary voltage and the primary current.

Secondary voltage _____

Primary current _____

4 marks

Question 9

A personal computer system motherboard is shown in Figure 7. In the table below, place an appropriate letter in the 'Component letter' column to correctly identify the component or connector listed.

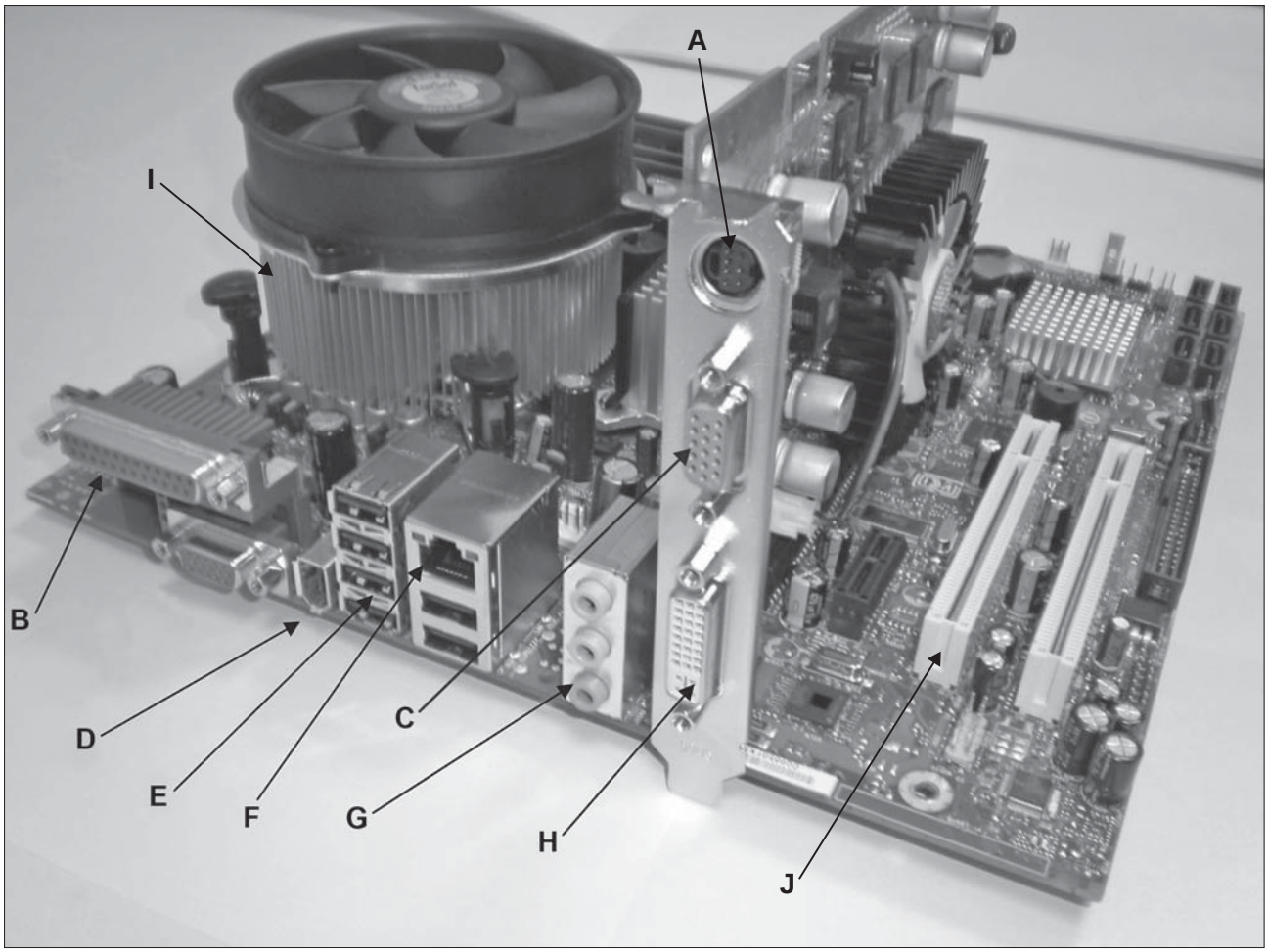


Figure 7

Letter	Component or connector	Letter	Component or connector
	Digital video output		CPU heatsink
	Firewire IEEE1394 interface		Analogue video connector
	USB interface		Parallel port
	Audio input / output connection		Network interface connector

8 marks

Question 10

Figure 8 shows a soldering bench with tools and equipment required for soldering and testing.

Figure 8

a. Identify two of the tools required for soldering and describe their usage.

Tool	Usage

4 marks

b. Describe two risks associated with soldering a printed circuit board, and describe what control measures you might employ to minimise each risk.

Risk	Control measures

4 marks

Question 11

A microcontroller unit requires a power supply voltage of 5 V DC 1 amp. You have a 9-volt AC 1 amp adaptor and you wish to convert the 9 V AC to DC. Figure 9 is a circuit diagram of a power supply required to produce the 5 volts. The load resistor R_{load} represents the microcontroller system.

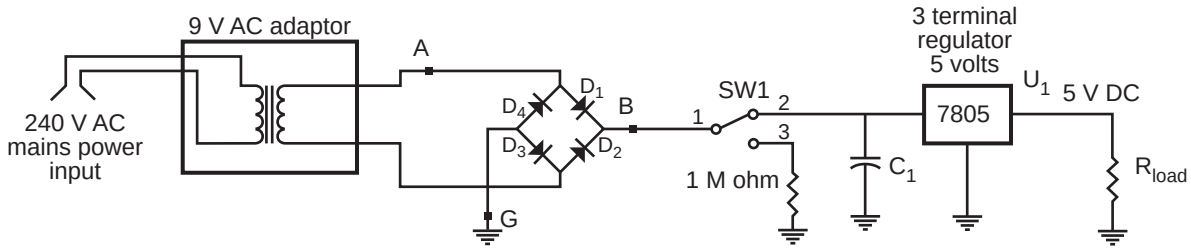


Figure 9

a. What is the function of diodes D_1–D_4?

1 mark

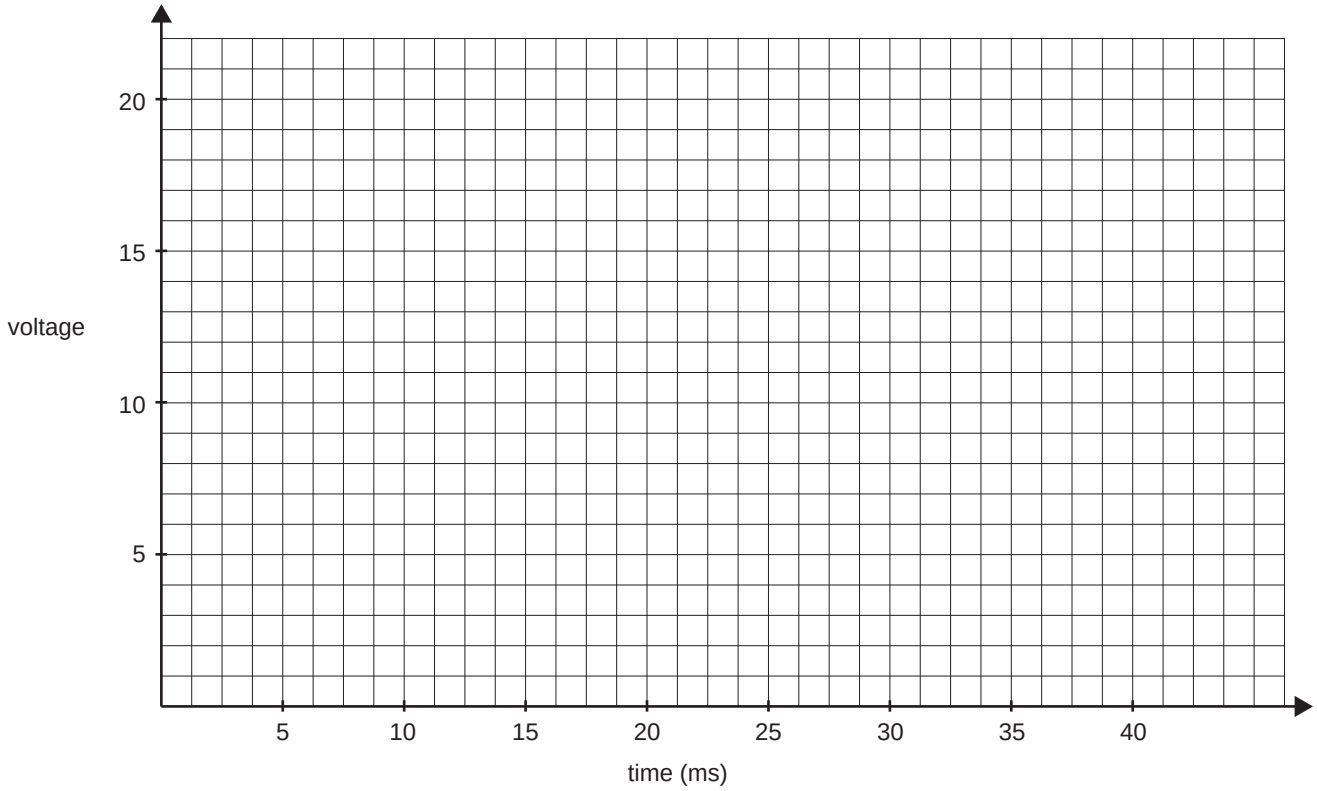
b. What is the function of capacitor C_1?

1 mark

c. The AC power adaptor supplies 9 V AC (RMS) to the power supply circuit. Referring to the formula sheet, what is the peak voltage of the AC waveform at point A. Show your working.

3 marks

d. On the graph below, draw the expected voltage waveform at point B when the switch SW1 contacts 1 and 3 are closed. (The 1 M ohm resistor is connected to point B only.) Assume that each diode has a forward voltage of 0.6 V. Note the AC adaptor is 9 V AC @ 50 Hz.



3 marks

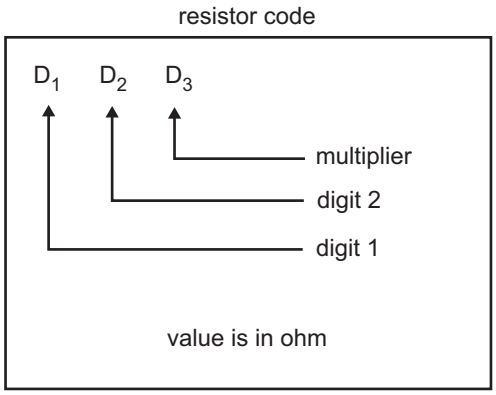
e. With switch SW1 contacts 1 and 2 closed, assuming the load resistance (R_{load}) is 15 ohms, how much current is flowing through the load?

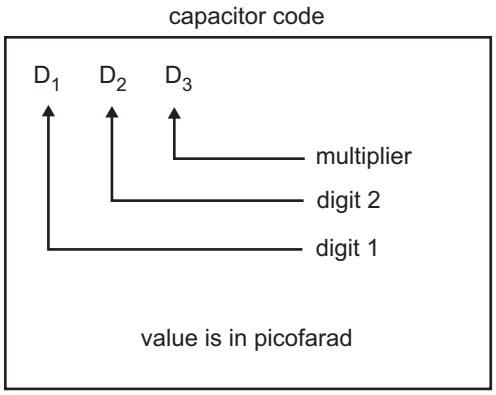
Show your working.

2 marks

END OF SECTION B

Formula sheet





$R_T = R_1 + R_2 + R_3$

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$V = I \times R$

$P = V \times I$

$Q = C \times V$

$V_{PK} = \sqrt{2} \times V_{RMS}$

$$\text{Turns ratio} = \frac{N1}{N2}$$

$$\frac{V_{primary}}{V_{secondary}} = \frac{N_{primary}}{N_{secondary}} = \frac{I_{secondary}}{I_{primary}}$$

$V_{REG} = V_{IN} - V_{OUT}$

Time constant $\tau = R \times C$

$$\text{Time constant } \tau = \frac{L}{R}$$

$$f = \frac{1}{T}$$

$$V_{STEP} = \frac{V_{max}}{2^n - 1}$$

Resistor colour code

0 black
1 brown
2 red
3 orange
4 yellow
5 green
6 blue
7 violet
8 grey
9 white

END OF QUESTION AND ANSWER BOOK


Victoria
The Place To Be