



Victorian Certificate of Education 2012

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER

Letter

Figures

Words

VCE VET INTEGRATED TECHNOLOGIES

Written examination

Tuesday 13 November 2012

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

<i>Section</i>	<i>Number of questions</i>	<i>Number of questions to be answered</i>	<i>Number of marks</i>
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 23 pages including a formula sheet on page 23.
- 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

The hydro-electric power station at Lake Eildon's dam has a generating capacity of 150 MW.

The electricity generated there is produced from

- A. heat.
- B. steam.
- C. water.
- D. magnetism.

Question 2

The measured power output of a solar panel has been steadily declining over the last two years.

What is the most likely explanation for this?

- A. The temperature of the solar panel is rising.
- B. The storage batteries are dying.
- C. The warranty has expired.
- D. The glass needs cleaning.

Question 3

An 800 W wind generator produces a maximum AC output voltage of 180 V.

What equipment is required to connect the electrical energy from the wind generator to the 230 VAC 50 Hz mains?

- A. grid-interactive inverter (DC to AC)
- B. AC rectifier connected to a grid-interactive inverter
- C. step-up transformer connected to a grid-interactive inverter
- D. None. It can be directly connected.

Question 4

What is the cell voltage of a standard lithium-ion cell?

- A. 3.7 V
- B. 3.0 V
- C. 1.5 V
- D. 1.2 V

Question 5

A Zener diode can be used in a linear DC power supply to

- A. filter the waveform.
- B. amplify the voltage.
- C. rectify the AC waveform.
- D. regulate the output voltage.

Question 6

What type of transducer converts heat energy into electrical energy?

- A. a nichrome shunt
- B. a thermocouple
- C. a thermistor
- D. a diode

Question 7

An optocoupler is a device that is often connected to the inputs and/or outputs of a microcontroller to

- A. ensure that CMOS voltage levels are TTL compatible.
- B. reduce the need for current-limiting resistors.
- C. provide electrical isolation.
- D. make interfacing easier.

Question 8

An electric hammer drill gets very warm when drilling into a brick wall.

This occurs because

- A. the drill's magnetic field becomes weaker.
- B. the drill is not designed to drill brickwork.
- C. the bit spinning in the wall creates friction.
- D. the resistance of the windings in the motor causes power loss.

Question 9

Courtesy of Clipsal

Why would the Residual Current Device (RCD) shown above be mounted on the mains power switchboard of your home?

- A. to protect all appliances connected to the 230 VAC supply
- B. to prevent the house's wiring from overheating
- C. to protect the people in the house
- D. to measure earth currents

Question 10

Which type of extinguisher is best suited to putting out a fire in electrical equipment?

- A. CO₂
- B. foam
- C. water
- D. wet chemical

Question 11

Under the *Occupational Health and Safety (OH&S) Act*, who is legally responsible for providing a safe working environment?

- A. the employer
- B. the employee
- C. the WorkSafe inspector
- D. the OH&S representative

Question 12

In a personal computer, CMOS memory is

- A. SRAM on the hard drive.
- B. DRAM, where program data is stored.
- C. SRAM, where system settings are stored.
- D. part of cache memory on the motherboard.

Question 13

Which one of the following materials is the best conductor of electricity?

- A. mica
- B. silicon
- C. copper
- D. nichrome

Question 14

A material is defined as a conductor, semiconductor or insulator depending on its atomic structure.

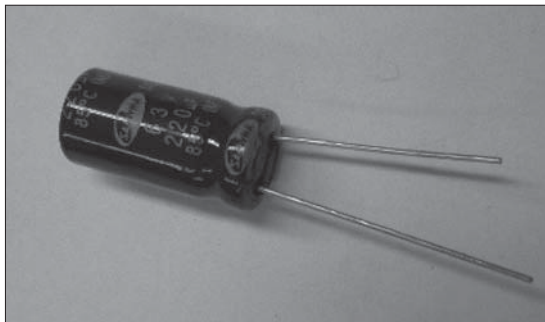
The conductivity of a material is dependent on

- A. the number of electrons in the outer shell.
- B. the number of protons in the outer shell.
- C. the number of atoms in the material.
- D. the atom's atomic weight.

Question 15

Which one of the following devices does the symbol shown above represent?

- A. a NO switch
- B. an SPST switch
- C. a circuit breaker
- D. a residual current device

Question 16

In the electrolytic capacitor shown above, the dielectric material used is

- A. silicon.
- B. an insulator.
- C. a conductor.
- D. a semiconductor.

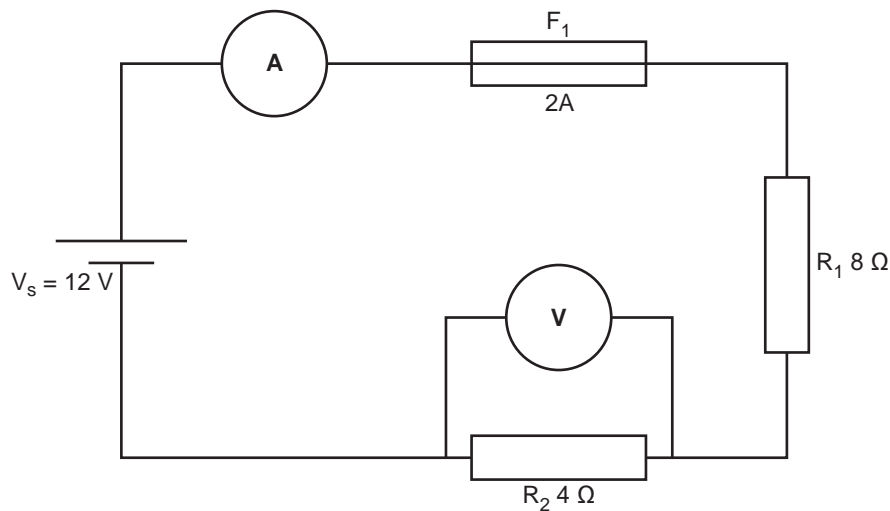
Question 17

You are connecting your laptop to a small computer network that uses a wireless router. Running the 'ipconfig' command reveals the information shown below.

Ethernet adapter Wireless Network Connection 2:
 Connection-specific DNS Suffix . :
 IP Address.....: 192.168.0.4
 Subnet Mask.....: 255.255.255.0
 Default Gateway.....: 192.168.0.1

Browsing the default gateway address displays

- A. the ISP webserver.
- B. the wireless router login.
- C. the DHCP network configuration.
- D. an error message from the ISP proxy.

Question 18

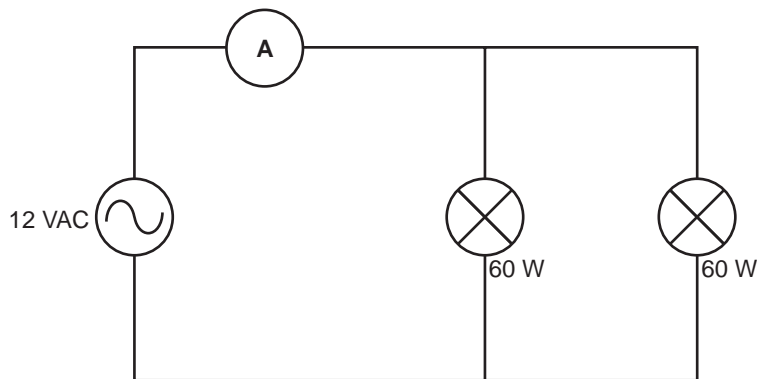
In the diagram above, if R_2 becomes an open circuit

- A. the voltage (V) across R_2 will be zero.
- B. the voltage across R_1 will be 12 V .
- C. the fuse F_1 will be an open circuit.
- D. the current (A) will be zero.

Question 19

The piezo speaker shown above

- A. requires an AC audio signal to produce sound.
- B. produces sound only at the piezo material's resonance.
- C. converts electrical signals to sound using electromagnetism.
- D. requires a DC audio signal to expand and contract its piezo crystal in order to produce sound.

Question 20

The diagram above shows two quartz halogen lamps connected to a 12 VAC supply.

What is the current flowing through the ammeter?

- A. 720 A
- B. 10 A
- C. 5 A
- D. 1.44 A

SECTION B

Instructions for Section B

Answer **all** questions in the spaces provided.

State all formulas and calculations.

All units must be specified in correct engineering notations in the answers.

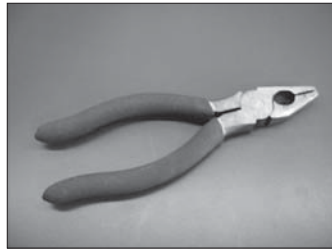
Question 1

Complete the table on page 9 with the corresponding photo (A.–J.) of hand and power tools, then briefly describe what each tool is used for.

A.



B.



C.



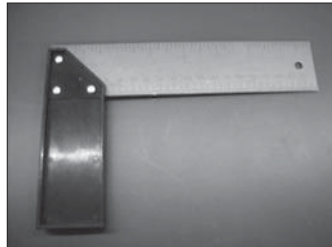
D.



E.



F.



G.



H.



I.



J.



Tool	Photo	What it is used for
tap		
scriber		
pop riveter		
pedestal drill		
needle-nose pliers		
engineer's square		
portable drill		
oddleg callipers		

8 marks

Question 2

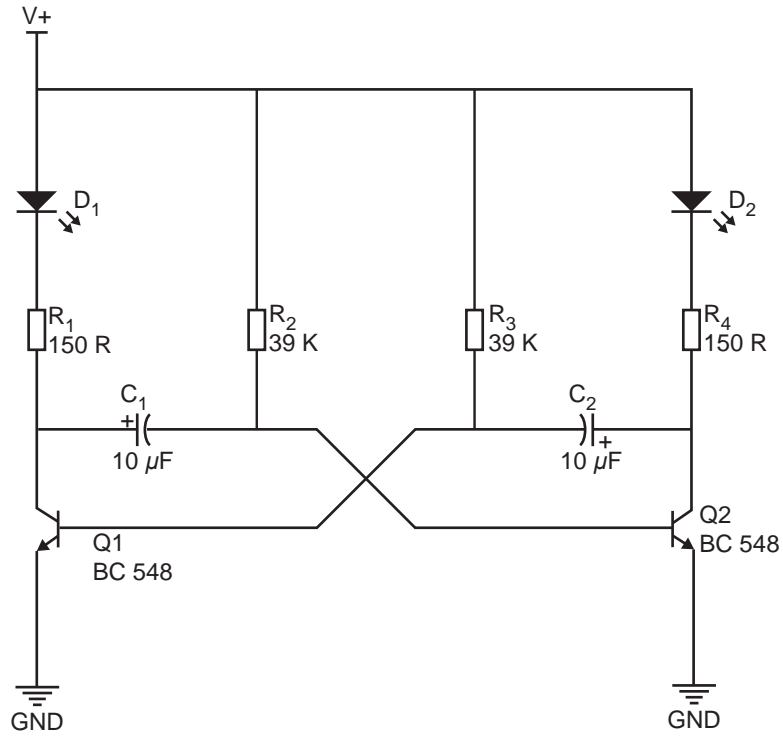


Figure 1

Figure 1 shows a schematic diagram. The partially completed Printed Circuit Board (PCB) artwork for this schematic diagram is shown in Figure 2.

Complete Figure 2 by drawing the missing six PCB tracks.

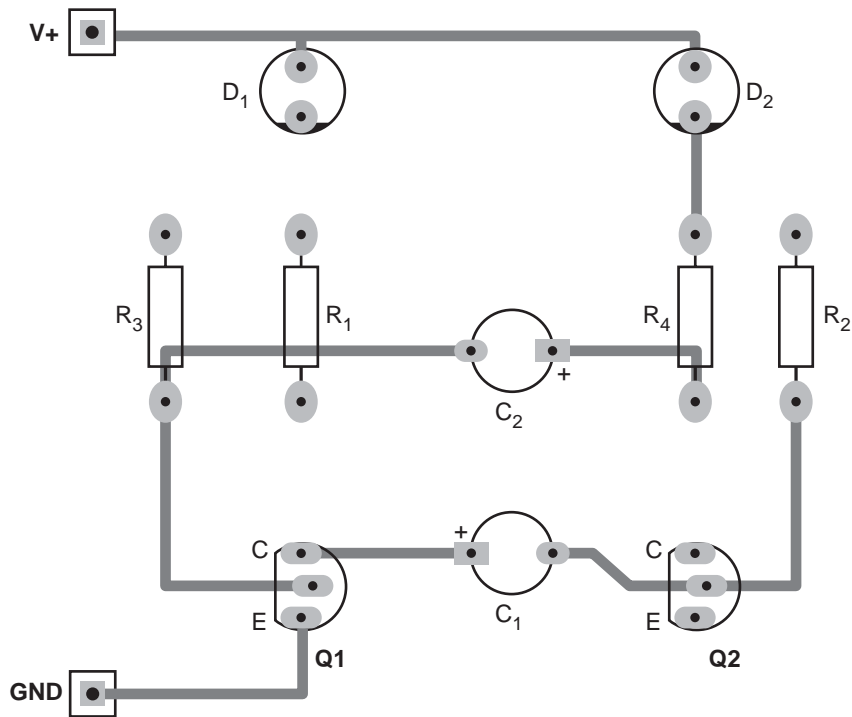


Figure 2

6 marks

CONTINUES OVER PAGE

Question 3

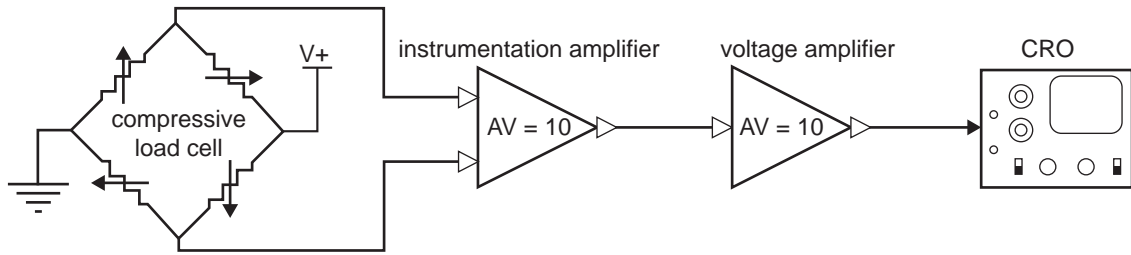


Figure 3

Figure 3 shows a compressive load cell and an amplifier connected to an oscilloscope (CRO). A weight of 10 kg is dropped onto the compressive load cell and the output recorded on the oscilloscope is shown in Figure 4 below.

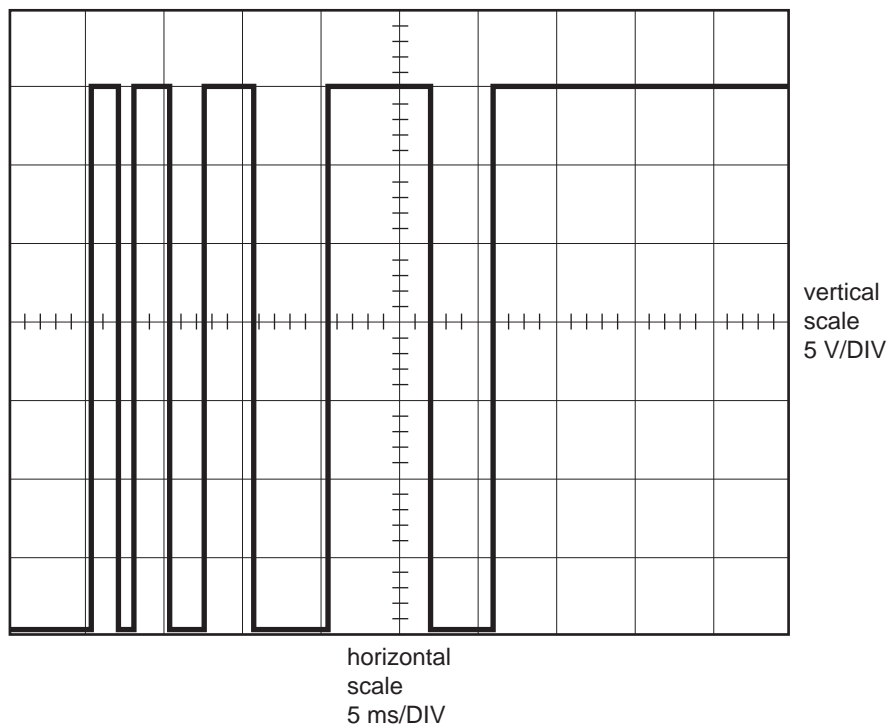


Figure 4

- a. If each amplifier has a voltage gain of 10, what is the peak output voltage of the load cell?

3 marks

- b. How long does it take for the output voltage to stabilise?

2 marks

- c. Why does the output of the load cell pulsate when a load is dropped onto it?

1 mark

Figure 5 shows the load cell's output voltage for a given load.

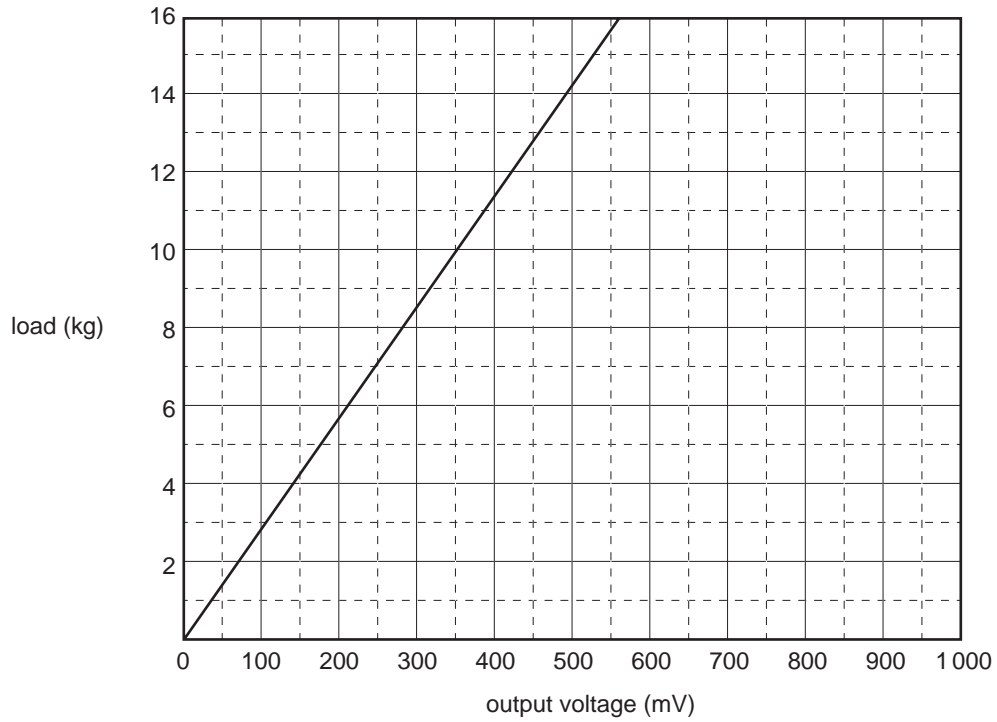


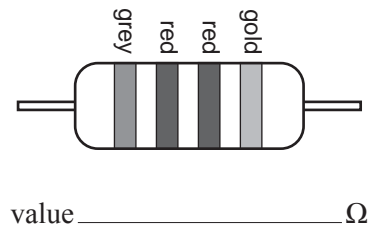
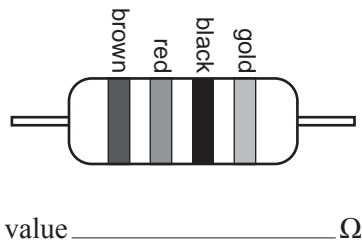
Figure 5

- d. If a load of 15 kg were placed on the compressive load cell, what voltage would be read on the CRO?

2 marks

Question 4

- a. Using the colour code chart provided in the formula sheet, determine the value of the following resistors.



2 marks

- b. The following resistors were measured and found to have the values listed in the table below. State whether each resistor is within tolerance.

Resistor	Measured value	Within tolerance? (Y/N)
12 k Ω 5%	11.56 k Ω	
82 k Ω 2%	80302 Ω	
180 Ω 5%	187.8 Ω	

3 marks

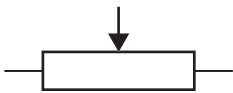
- c. Which physical properties of a resistor determine its power rating?

1 mark

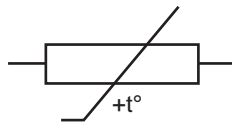
Question 5

Match the symbols A.–F. to the components listed in the table below. Write the letter for the correct symbol in the table.

A.



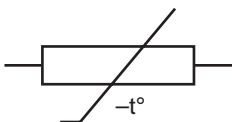
B.



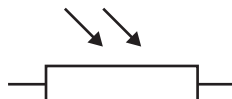
C.



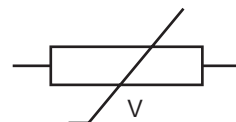
D.



E.



F.



Component	Symbol	Component	Symbol
voltage-dependent resistor (VDR)		fixed resistor	
light-dependent resistor (LDR)		thermistor (PTC)	

4 marks

Question 6

Refer to the series circuit at Figure 6.

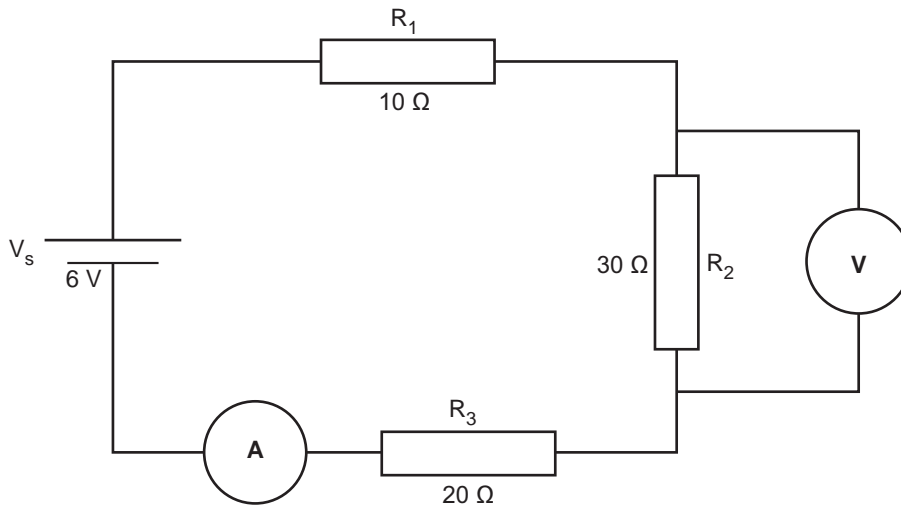


Figure 6

- a. On the circuit above, show the direction of a conventional current. 1 mark
- b. On the circuit above, show the meter polarity for the voltmeter and the ammeter. 2 marks
- c. Calculate the values displayed by the ammeter and the voltmeter.

ammeter _____

voltmeter _____

4 marks

- d. Calculate the total power dissipated by the circuit.

2 marks

Question 7

Refer to the circuit shown at Figure 7.

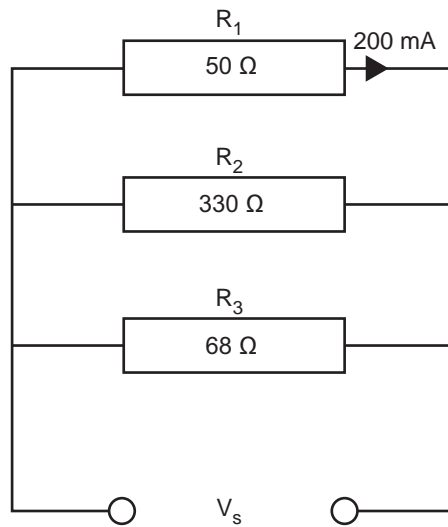


Figure 7

- a. Calculate the supply voltage V_s .

2 marks

- b. Calculate the total resistance in the circuit.

2 marks

- c. What is the minimum power rating of resistor R_3 required to ensure it does not overheat?

2 marks

- d. How will the voltage across R_1 be affected if the resistance of R_2 falls by half?

1 mark

Question 8

Refer to the circuit at Figure 8.

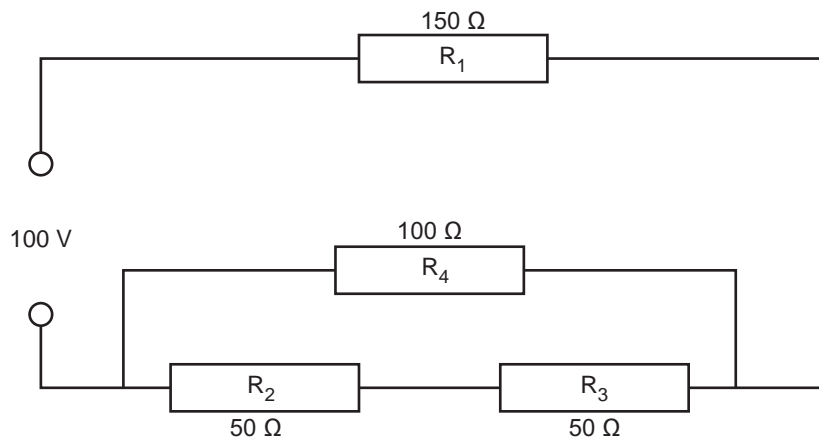


Figure 8

- a. Calculate the total resistance in the circuit.

2 marks

- b. Calculate the total current flowing from the supply.

2 marks

- c. Find the current flowing through resistor R_4 .

2 marks

- d. Find the voltage drop across R_3 .

2 marks

Question 9

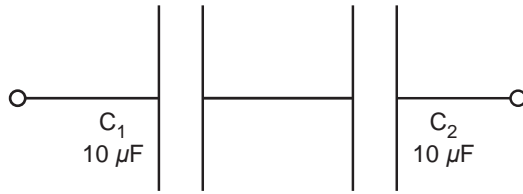


Figure 9

- a. Find the total capacitance of the circuit in Figure 9.

2 marks

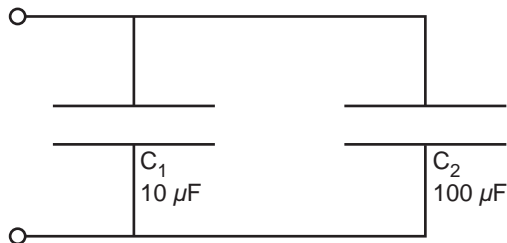


Figure 10

- b. Find the total capacitance of the circuit in Figure 10.

2 marks

- c. Why might capacitors be placed in series?

1 mark

- d. Figure 11 shows capacitor C_1 and resistor R_1 acting as a power-on reset circuit for a microcontroller system.

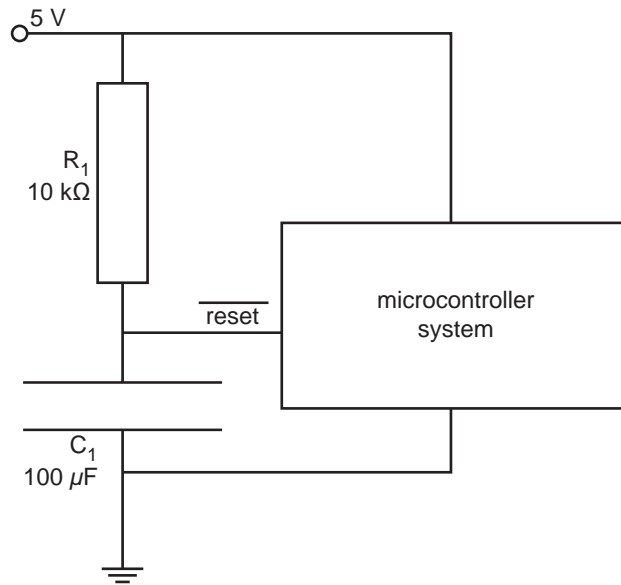


Figure 11

- i. When power is applied, the microcontroller is held in 'reset' until the capacitor charges to one time constant. Calculate the time it takes for the capacitor to charge to one time constant.

- ii. How long will it take for the capacitor to be fully charged?

2 + 1 = 3 marks

Question 10

Figure 12 shows a block diagram of a small yacht’s power system. The system consists of a 12 V 30 W solar panel, regulator, 100 A.h Absorbent Glass Mat (AGM) 12 V battery, and a load consisting of depth sounder, VHF radio, audio system and lighting system.

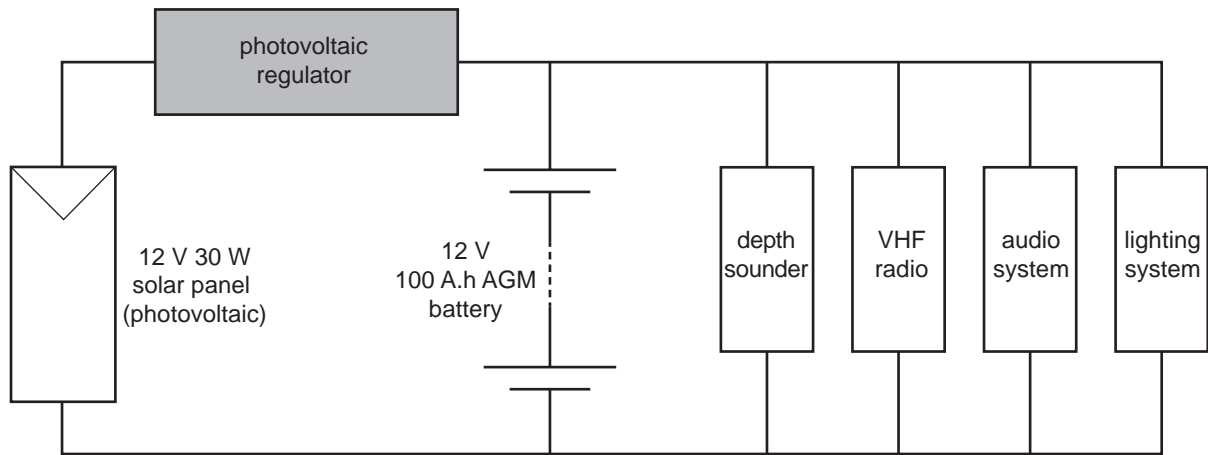


Figure 12

In sunny conditions, the solar panel supplies 30 W to the regulator.

- a. If the regulator is 90% efficient, what is the output power of the regulator?

1 mark

- b. With a regulator output of 12 V, how much current can be supplied to the load and battery?

2 marks

- c. The regulator is operating at 90% efficiency.

If the panel supplies 30 W at an average of 8 hours per day, what is the daily ampere hour output of the regulator?

2 marks

- d.** If the average daily load consumption is 28 A.h and the AGM battery can safely discharge to 50% of its capacity, calculate how many days the yacht's power system will operate before battery charging is required. Note that the panel supplies power to the load as stated in **part c.**

3 marks

Question 11

- a. Figure 13 shows the rear view of a motherboard for a personal computer (PC).
In the table below, match the connectors on the motherboard with those listed.

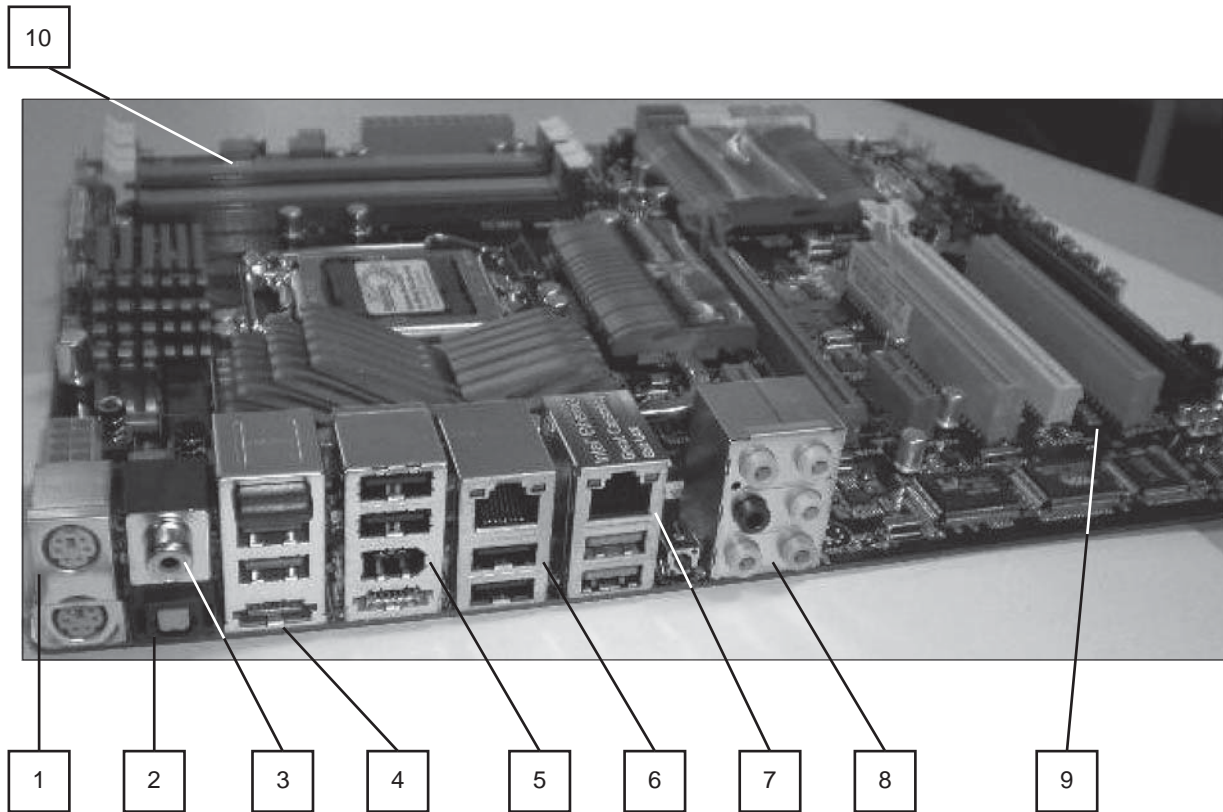


Figure 13

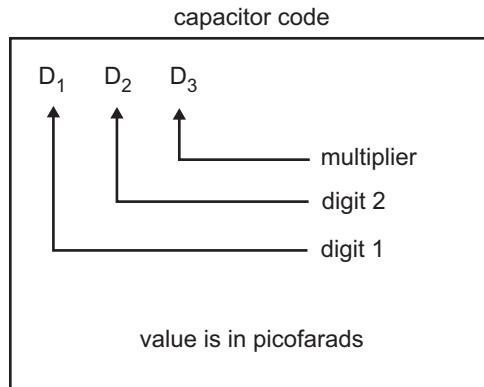
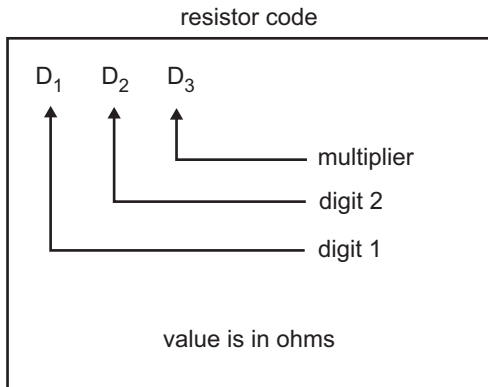
Connection	Number	Connection	Number
PS2 mouse		IEEE1394 serial	
LAN		USB	
PCI bus		audio	

6 marks

- b. Name **two** protective items that should be used when handling a PC motherboard.

2 marks

Formula sheet



$$R_T = R_1 + R_2 + R_3$$

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

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

$$R = \frac{\rho l}{A}$$

$$V = I \times R$$

$$P = V \times I$$

$$V_X = V_S \left(\frac{R_X}{R_T} \right)$$

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

$$\text{turns ratio} = \frac{N_1}{N_2}$$

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

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

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

$$\tau = C \times R$$

$$C = \frac{\epsilon A}{d}$$

$$C_T = C_1 + C_2 + C_3$$

$$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$

$$Q = V \times C$$

$$W = \frac{1}{2} CV^2$$

$$W = P t$$

Resistor colour code

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

$$\text{efficiency \%} = \frac{\text{output}}{\text{input}} \times 100$$