SEC37/c2.23m

L-Università ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

SECONDARY EDUCATION CERTIFICATE LEVEL
2023 MAIN SESSION

SUBJECT:	**Engineering Technology**
PAPER NUMBER:	Controlled – Unit 2
DATE:	17th May 2022
TIME:	10:00 a.m. to 11:35 a.m.

THIS PAPER SHOULD BE RETURNED TO THE INVIGILATOR AFTER THE EXAMINATION.

Name of candidate _____

I.D. number _____

School _____

Class _____

Answer **ALL** questions in the space provided.

Scenario

A technician is required to assemble and test simple circuits built on various prototype boards.

Question 1 **K-1 (4 marks)**

A material is classified as conductor, semi-conductor or insulator. This depends on the electrical properties the material demonstrates.

a) Categorise the following materials as insulators or conductors by writing the material under the appropriate column in Table 1. The answers for the first two materials are given in the table.

~~Rubber~~, ~~Iron~~, Gold, Paper, Wood, Steel

Table 1 – Conductors and Insulators

Conductor	Insulator
Iron	*Rubber*

(1)

b) Define the term semi-conductor.

_____

_____

_____

_____ (1)

c) State **TWO** parameters affecting the resistance of a copper wire.

Parameter 1: _____

_____

_____ (1)

Parameter 2: _____

_____

_____ (1)

Question 2 **K-3 (4 marks)**

An electrical circuit provides a path around which electricity can flow.

a) Differentiate between an open circuit and a closed circuit. In your answer write what are the differences.

_____

_____

_____

_____ (1)

b) Draw the schematic circuit shown in Figure 2 in the space provided.

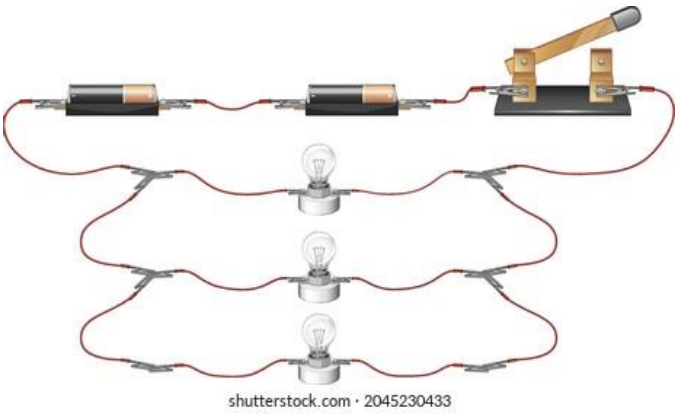


Figure 2 – Series-parallel circuit 1
(Source: https://www.shutterstock.com)

(1)

This question continues on next page.

c) Identify **ONE** series and **ONE** parallel sub-circuits from the circuit shown in Figure 3 below. Write your answer in the space provided including references to B1, S1, S2, L1 and L2.

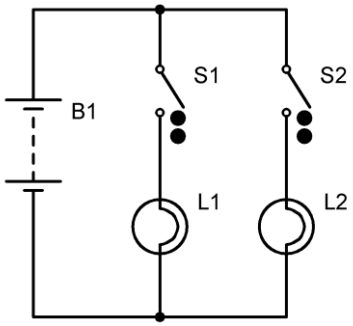


Figure 3 – Series-parallel circuit 2

Series circuit: _____ (1)

Parallel circuit: _____ (1)

Question 3 **C-2 (6 marks)**

Resistors can be connected in various series and parallel combinations to form resistive circuits.

a) Find the total resistance of the circuit shown in figure 4 below. Show all your working.

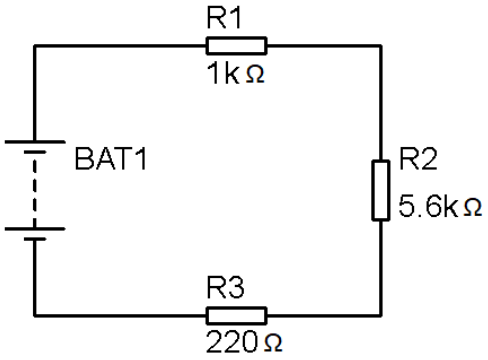


Figure 4 – Circuit 1

_____

_____

_____

_____

_____

_____

_____ (2)

b) Find the total resistance of the circuit shown in Figure 5 below. Show all your working.

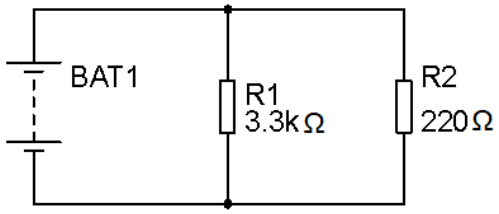


Figure 5 – Circuit 2

_____

_____

_____

_____

_____

_____ (2)

c) Find the total resistance of the circuit shown in Figure 6 below. Show all your working.

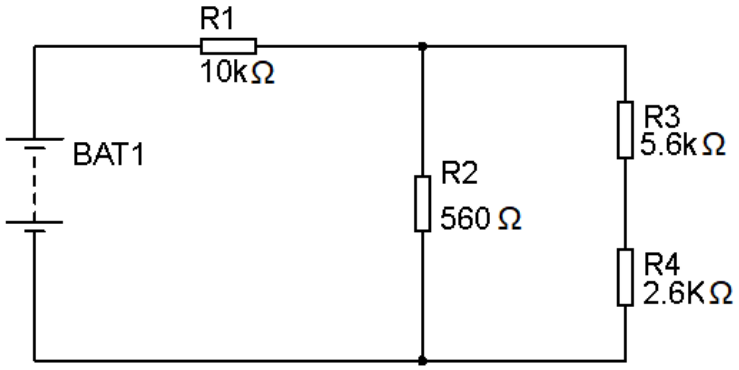


Figure 6 – Circuit 3

_____

_____

_____

_____

_____

_____

_____

_____ (2)

Please turn the page.

Question 4 **C-3 (6 marks)**

Capacitors can be connected in various series and parallel combinations to form capacitive circuits.

a) Find the total capacitance of the circuit shown in Figure 7 below. Show all your working.

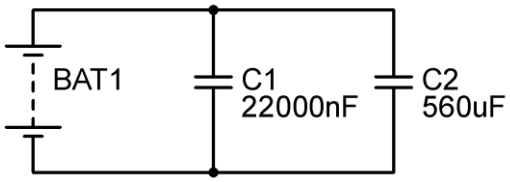


Figure 7 – Circuit 4

_____

_____

_____

_____

_____

_____ (2)

b) Find the total capacitance of the circuit shown in Figure 8 below. Show all your working.

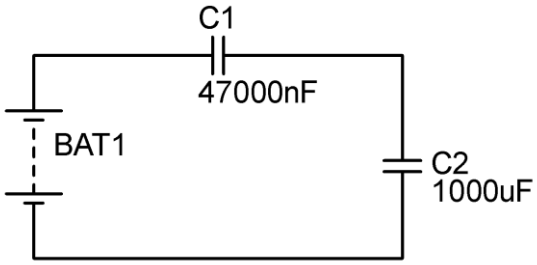


Figure 8 – Circuit 5

_____

_____

_____

_____

_____

_____ (2)

c) Find the value of resistor R1 in the circuit shown in Figure 9, to obtain a time constant of 0.2s. Show all your working.

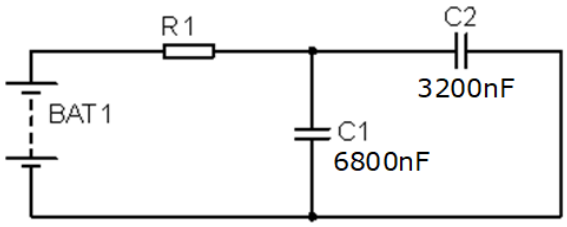


Figure 9 – Circuit 6

_____

_____

_____

_____

_____

_____

_____

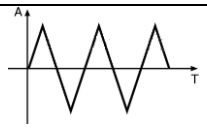
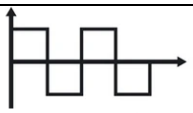
_____ (2)

Question 5 **K-6 (4 marks)**

A signal shows the value of any quantity as a function of time.

a) Identify the different types of signals given in Table 2.

Table 2 – Different types of Signals

	Signal	Name
i)		
ii)		
iii)		
iv)		

(Source: https://www.shutterstock.com) (1)

This question continues on next page.

b) Define the **TWO** parameters of the signal shown in Figure 10 and identified as (i) and (ii). Name the parameters in the space provided and define their SI units.

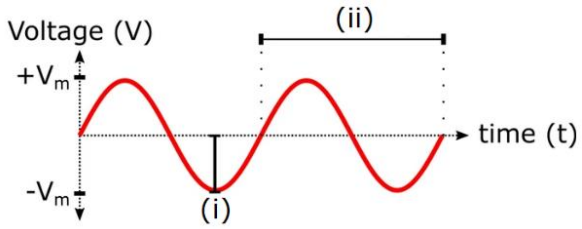


Figure 10 – Signal Parameters
(Source: https://www.shutterstock.com)

i) Parameter (i): _____

SI Unit of Parameter (i): _____ (0.5)

ii) Parameter (ii): _____

SI Unit of Parameter (ii): _____ (0.5)

c) Label important features of the oscilloscope given in Figure 11.

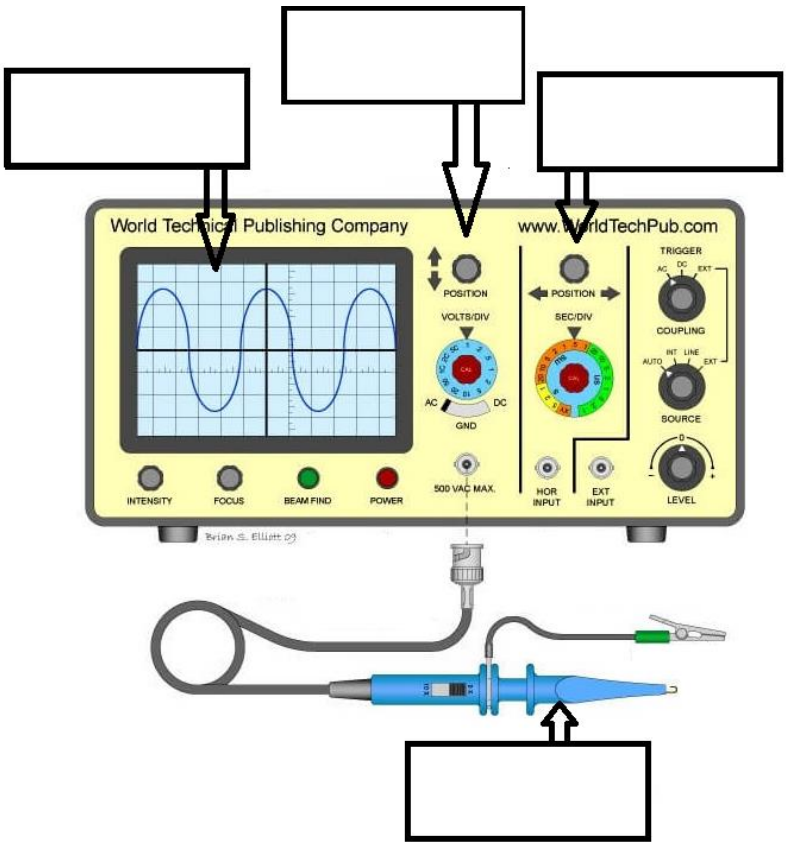


Figure 11 – Oscilloscope
Source: https://www.shutterstock.com

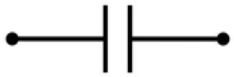
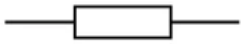
(2)

Question 6 **K-9 (4 marks)**

Components are represented in circuit diagrams using standard symbols.

a) Identify the electronic symbols by completing Table 3 below.

Table 3 – Electronic Symbols.

	Electronic Symbol	Name
i)		_____ (0.25)
ii)		_____ (0.25)
iii)		_____ (0.25)
iv)		_____ (0.25)

(Source: https://www.shutterstock.com)

b) Match the following SI units to their respective parameters by drawing a line between them.

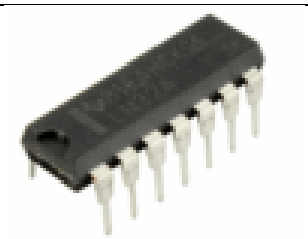
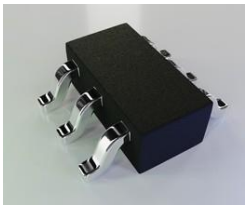
i) Ohms	Power
ii) Watts	Resistance
iii) Amps	Voltage
iv) Volts	Current

(1)

This question continues on next page.

c) Table 4 below shows different packaging for IC and transistor. Identify each of the given packaging, by underlining the correct answer.

Table 4 – Component Packaging.

	Component	Packaging 1	Packaging 2
i)	Operation amplifier IC	 Dual in-line / Single in-line	 Dual in-line / Single in-line
ii)	Transistor	 Through hole / Surface mount	 Through hole / Surface mount

(Source: https://wmelectronics.co.uk/), (Source: https://techmechrobo.com/), (Source: https://www.shutterstock.com), (Source: https://www.indiamart.com)

(2)

Question 7 **K-10 (4 marks)**

Different tools are required to construct electronic circuits.

a) Label the following tools by completing Table 5 below.

Table 5 – Tools.

	Tool	Name
i)		_____ (0.25)

ii)		_____ (0.25)
iii)		_____ (0.25)
iv)		_____ (0.25)

(Source: https://www.reichelt.com/), (Source: https://malta.desertcart.com/), (Source: https://www.shutterstock.com)

b) Identify **FIVE** steps which are required to use a soldering iron effectively.

Step 1: _____

_____ (0.2)

Step 2: _____

_____ (0.2)

Step 3: _____

_____ (0.2)

Step 4: _____

_____ (0.2)

Step 5: _____

_____ (0.2)

This question continues on next page.

c) Outline the function of each of the following tools used to construct a circuit on a veroboard.

Third hand	Track cutter

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ (2)

Question 8 **C-5 (6 marks)**

Safety precautions should be taken when manufacturing a PCB.

a) Identify the appropriate warning sign for each of the hazardous scenarios given in Table 6 below. Mark the answer by drawing a circle around the correct warning sign.

Table 6 – Warning signs Hazardous Scenarios.

	Scenario	Warning Sign
i)	Storage facility of gas under pressure	 (1)
ii)	Near a gas cylinder which is highly flammable	 (1)

(Source: https://www.istockphoto.com/photos/warning-symbol)

b) Identify **FOUR** hazards that might be present when manufacturing a PCB.

burns	chemical spill	dropping heavy objects on foot	
inhaling dangerous fumes	cuts	working at height	

Hazard 1: _____ (0.5)

Hazard 2: _____ (0.5)

Hazard 3: _____ (0.5)

Hazard 4: _____ (0.5)

This question continues on next page.

c) Identify **FOUR** ways to eliminate or minimize the risks involved when manufacturing a PCB.

use safe work practice adopt the correct lifting technique to prevent back injury work in a well-ventilated area make use of adequate PPE use firefighting equipment use tools according to their instructions

Minimize risk 1: _____ (0.5)

Minimize risk 2: _____ (0.5)

Minimize risk 3: _____ (0.5)

Minimize risk 4: _____ (0.5)

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