



L-Università  
ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE  
EXAMINATIONS BOARD

**SECONDARY EDUCATION CERTIFICATE LEVEL  
2024 MAIN SESSION**

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SUBJECT:	<b>Engineering Technology</b>
PAPER NUMBER:	Controlled – Unit 2
DATE:	11 <sup>th</sup> May 2023
TIME:	10:00 a.m. to 11:35 a.m.

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**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 teacher and the school technicians are required to construct and test a number of circuits using different materials and components.

**Question 1**

**K-1 (4 marks)**

All materials can be grouped into 3 categories: conductors, semi-conductors and insulators depending on the electrical properties they exhibit.

a) Categorise the set of materials provided below as either conductors or insulators based on their electrical properties in the respective column in Table 1. An example from each category is included in the table for assistance.

Brass	Glass	Aluminium	Plastic
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Table 1: Conductors and Insulators

<b>Conductor</b>	<b>Insulator</b>
Steel	Wood

(1)

b) Define the term semi-conductor.

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(1)

c) The resistance of a copper wire can be affected by three different parameters. State any **TWO** of these parameters.

Parameter 1: \_\_\_\_\_

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(1)

Parameter 2: \_\_\_\_\_

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(1)

**Question 2**

**K-3 (4 marks)**

- An electrical circuit can be either closed or open.
- An electrical circuit can be either series, parallel or a combination of the two.

a) Differentiate between an open circuit and a closed circuit. The answer must focus on the differences between the two circuits.

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(1)

b) In the space provided below draw:

i) A series circuit made up of a 1.5 V battery and 2x 100  $\Omega$  resistors in series.

ii) A parallel circuit made up of a 1.5 V battery and a 100  $\Omega$  resistor in parallel with a 56 $\Omega$  resistor.

(1)

***This question continues on next page.***

c) Figure 1 shows a series-parallel circuit.  
 From this circuit identify **ONE** series and **ONE** parallel circuit by referring to the resistors R1, R2, R3 and R4 resistors. Write your answers in the space provided below.

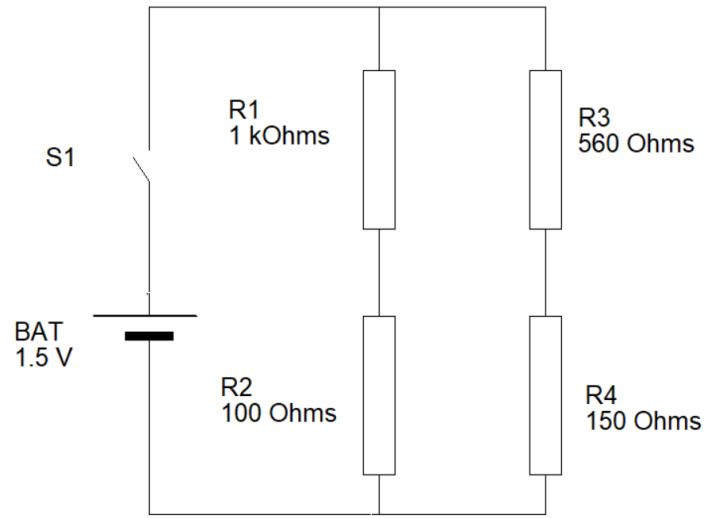


Figure 1: Series-parallel circuit

Series sub-circuit: \_\_\_\_\_ (1)

Parallel sub-circuit: \_\_\_\_\_ (1)

**Question 3**

**C-2 (6 marks)**

To determine the power supplied by a battery the equivalent resistance of a circuit is necessary.

a) Find the total resistance of the circuit shown in Figure 2. Show all your working.

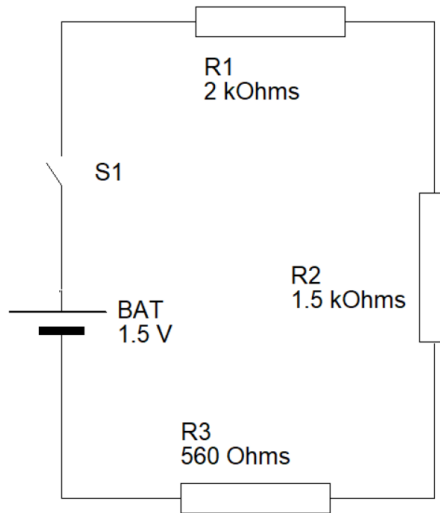


Figure 2: Circuit 1

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(2)

b) Find the total resistance of the circuit shown in Figure 3 below. Show all your working.

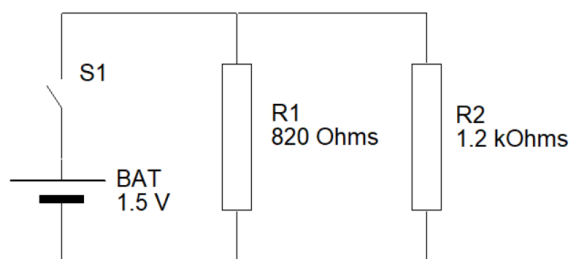


Figure 3: Circuit 2

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(2)

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

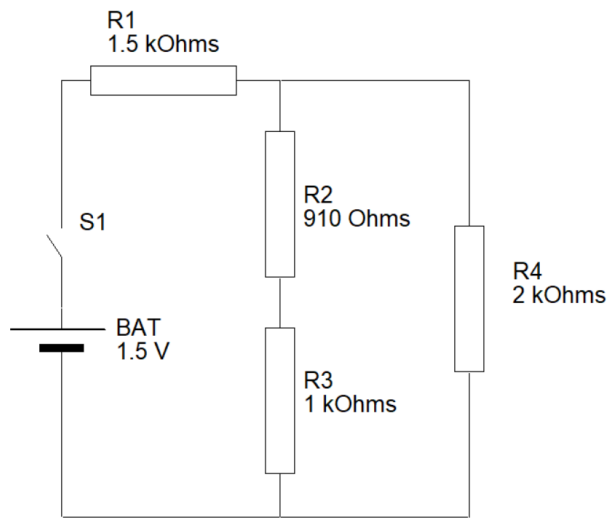


Figure 4: Circuit 3

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(2)

**Question 4**

**C-3 (6 marks)**

Capacitors are connected in series or in parallel to achieve the required capacitance in a circuit.

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

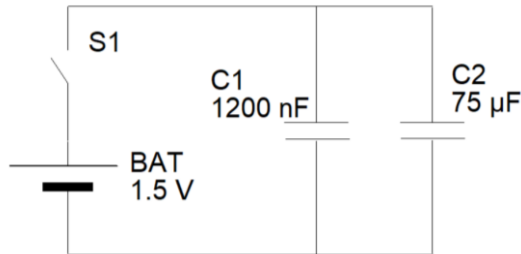


Figure 5: Circuit 4

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(2)

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

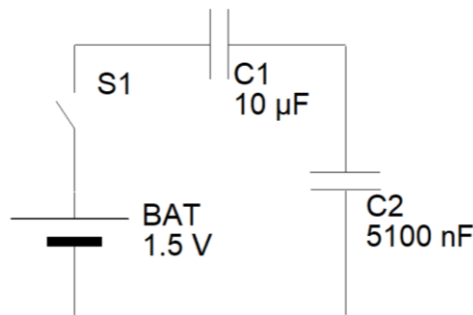


Figure 6: Circuit 5

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(2)

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c) Find the value of resistor R1 in the circuit shown in Figure 7 to obtain a time constant of 0.01 s. Show all your working.

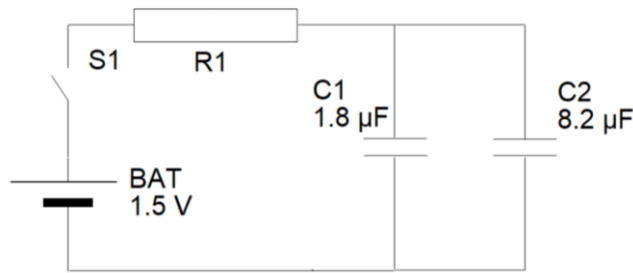


Figure 7: Circuit 6

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(2)



**Question 5**

**K-6 (4 marks)**

Signals display the value of a parameter as a function of time.

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

Table 2: Different types of Signals

	Signal	Name
i)		<hr/> <p style="text-align: right;">(0.5)</p>
ii)		<hr/> <p style="text-align: right;">(0.5)</p>

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



b) Define the **TWO** parameters of a sine wave signal and state their respective SI unit.

i) Parameter 1: \_\_\_\_\_

SI Unit of Parameter 1: \_\_\_\_\_

(0.5)

ii) Parameter 2: \_\_\_\_\_

SI Unit of Parameter 2: \_\_\_\_\_

(0.5)

c) Label important features of the oscilloscope given in Figure 8.

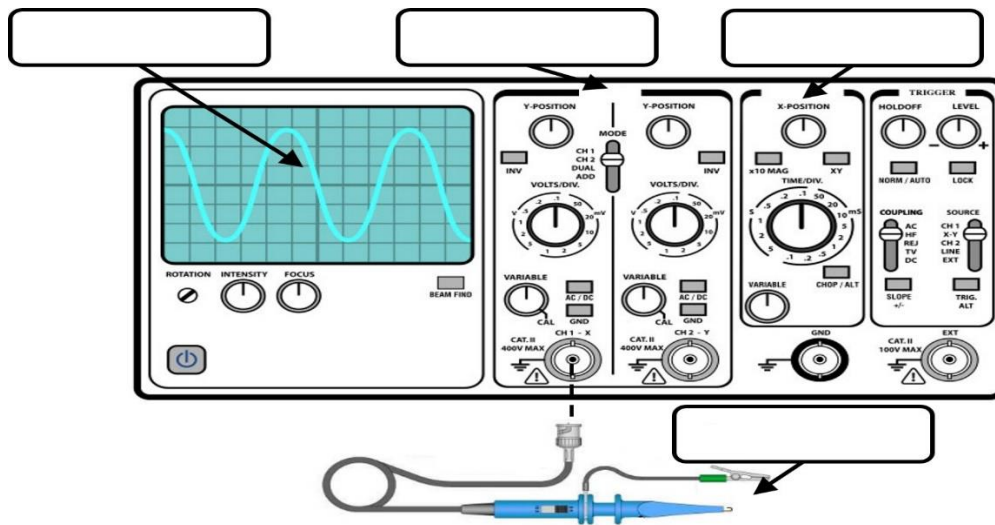


Figure 8: Oscilloscope

(Source: <https://www.wellpcb.com/> and <https://www.shutterstock.com>)

(2)

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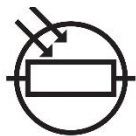

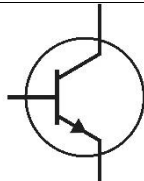
**Question 6**

**K-9 (4 marks)**

Standard symbols are used to represent electronic components in a circuit.

a) Identify the electronic symbols illustrated in Table 3.

Table 3: Electronic Symbols.

	<b>Electronic Symbol</b>	<b>Name</b>
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 connecting a line between them.

Amps

Voltage

Farads

Resistance

Volts

Current




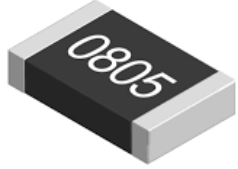
Ohms

Capacitance

(1)

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

Table 4: Component Packaging.

	<b>Component</b>	<b>Packaging 1</b>	<b>Packaging 2</b>
i)	Capacitor	 Axial / Radial	 Axial / Radial
ii)	Resistor	 Through hole / Surface mount	 Through hole / Surface mount

(Source: <https://gmelectronic.com/>), (Source: <https://amplifiedparts.com/>),  
 (Source: <https://www.il.farnell.com>), (Source: <https://www.no.rs-online.com>)

(2)

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**Question 7**

**K-10 (4 marks)**

The use of tools is essential in the construction of electronic circuits.

a) Complete Table 5 below by labelling the four different tools used for electronic circuit construction.

Table 5: Tools

	<b>Tool</b>	<b>Name</b>
i)	 <p>(Source: <a href="https://www.botland.store.com/">https://www.botland.store.com/</a>)</p>	_____ (0.25)
ii)	 <p>(Source: <a href="https://www.amazon.co.uk/">https://www.amazon.co.uk/</a>)</p>	_____ (0.25)
iii)	 <p>(Source: <a href="https://www.my.rs-online.com/">https://www.my.rs-online.com/</a>)</p>	_____ (0.25)
iv)	 <p>(Source: <a href="https://www.rs-online.vn/">https://www.rs-online.vn/</a>)</p>	_____ (0.25)

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**Question 8**

**C-5 (6 marks)**

- During the process of PCB manufacturing a number of hazards can lead to injury.
- Therefore different safety precautions should be taken during PCB manufacturing.

a) Identify the correct 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 for hazardous scenarios.

	Scenario	Warning Sign
i)	A liquid that can create oxidation of a PCB board	 <p style="text-align: right;">(1)</p>
ii)	A liquid used during the etching process is hazardous to the environment	 <p style="text-align: right;">(1)</p>

(Source: <https://www.vectorstock.com/>)

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

Airborne fragments Inhaling dangerous fumes	Chemical spill Lifting heavy loads	Falling objects Cuts
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Hazard 1: \_\_\_\_\_ (0.5)

Hazard 2: \_\_\_\_\_ (0.5)

Hazard 3: \_\_\_\_\_ (0.5)

Hazard 4: \_\_\_\_\_ (0.5)

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

Work in a well ventilated area	Keep the work area safe and clean
Wear appropriate PPE	Store chemicals within 1 metre from the etching station
Use chemicals according to its Data Safety Sheet	Work in a group of at least 3 persons

Minimize risk 1: \_\_\_\_\_ (0.5)

Minimize risk 2: \_\_\_\_\_ (0.5)

Minimize risk 3: \_\_\_\_\_ (0.5)

Minimize risk 4: \_\_\_\_\_ (0.5)

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