SEC37/c2.26m

L-Università ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

SECONDARY EDUCATION CERTIFICATE LEVEL
2026 MAIN SESSION

SUBJECT:	**Engineering Technology**
PAPER NUMBER:	Controlled – Unit 2
DATE:	6th May 2025
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. The use of non-programmable electronic calculators is allowed.

Scenario

Candidates for an electronics technician apprenticeship post were asked to sit for the following test to verify their knowledge and competences.

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

Materials can be categorised into three main groups: conductors, semiconductors, and insulators.

a. Categorise the different materials provided below as conductors or insulators in the appropriate column of Table 1. An example for each category is provided to help you.

Paper	Iron	Rubber	Brass

Table 1: Conductors and Insulators

Conductor	**Insulator**
Copper	Oil

(1)

b. Define the term semi-conductor.

_____

_____

_____

_____ (1)

c. The resistance of a copper wire depends on different parameters. State any **TWO** of these parameters.

_____

_____

_____

_____ (2)

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

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

a. Differentiate between an open and a closed circuit.

_____

_____

_____

_____ (1)

b. In the space provided below draw:

i. A series circuit consisting of a 1.5 V battery and two resistors one of 270 Ω and the other of 620 Ω.

(0.5)

ii. A parallel circuit made up of a 1.5 V battery and a 220 Ω resistor in parallel with a 300Ω resistor.

(0.5)

This question continues on next page.

c. A series-parallel circuit is shown in Figure 1.
Identify **ONE** series and **ONE** parallel circuit combination by referring to the resistors R1, R2 and R3. Write your answers in the space provided below.

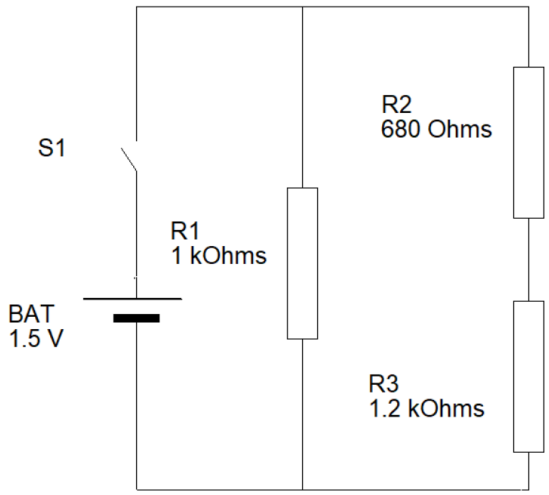

Figure 1: Series-parallel circuit

Series sub-circuit: _____ (1)

Parallel sub-circuit: _____ (1)

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

The power supplied by a battery can be calculated using the equivalent resistance of a circuit.

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

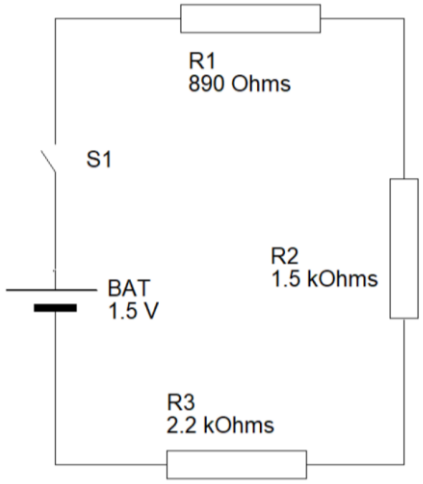

Figure 2: Circuit 1

_____

_____

_____

_____

_____

_____

_____

_____ (2)

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

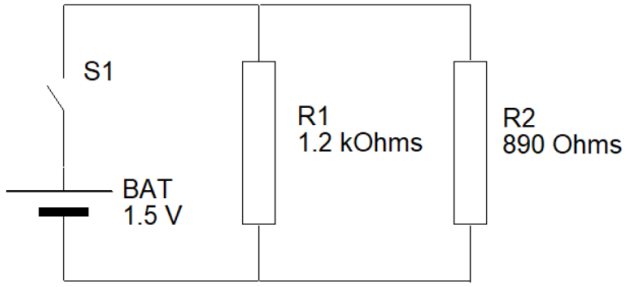

Figure 3: Circuit 2

_____

_____

_____

_____

_____

_____

_____ (2)

This question continues on next page.

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

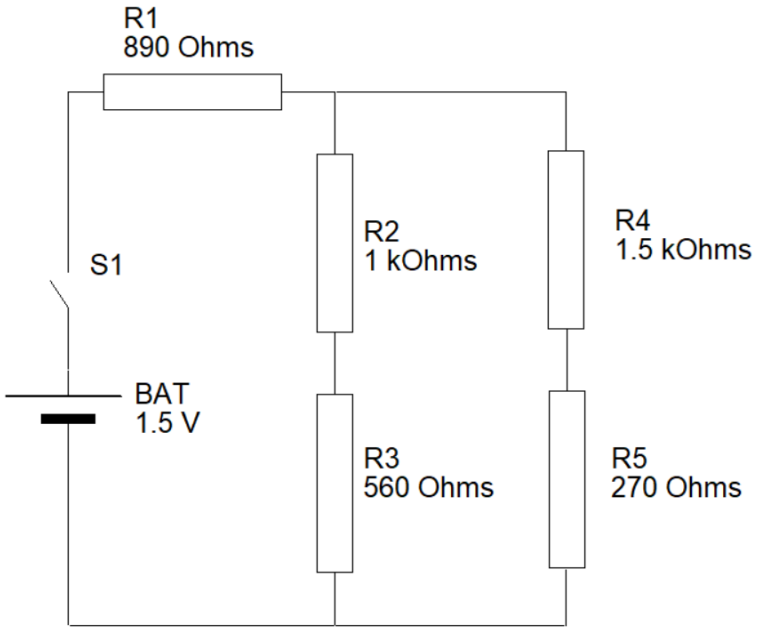

Figure 4: Circuit 3

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ (2)

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

The required equivalent capacitance is necessary to determine the total charge supplied by the battery.

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

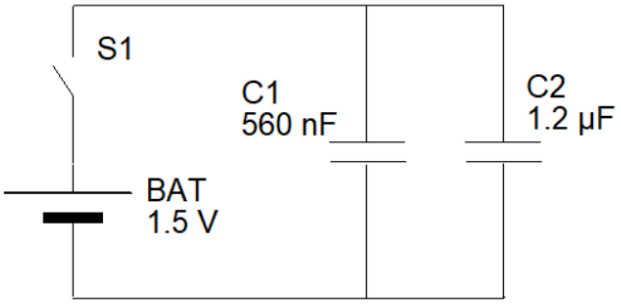

Figure 5: Circuit 4

_____

_____

_____

_____ (2)

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

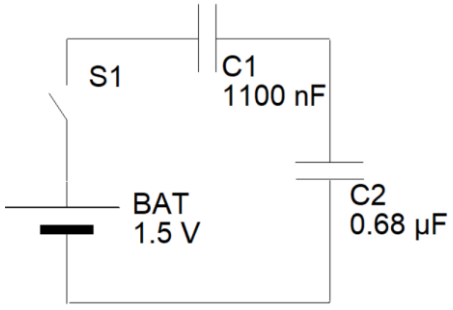

Figure 6: Circuit 5

_____

_____

_____

_____

_____

_____

_____ (2)

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c. For the RC circuit shown in Figure 7, find the resistance value of resistor R1 to achieve a time constant of 5.28s.

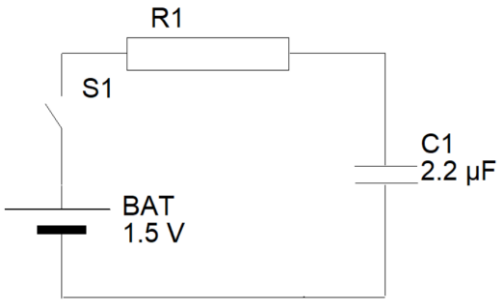


Figure 7: Circuit 6

_____

_____

_____

_____

_____

_____

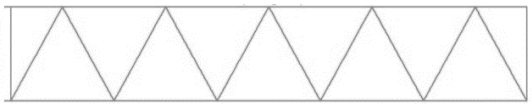
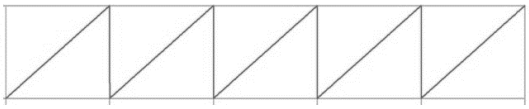
_____ (2)

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

A signal waveform defines the changes of a parameter as a function of time.

a. Identify the **TWO** different signals tabulated in Table 2.

Table 2: Different types of Signals

	Signal	Name
i.		_____ (0.5)
ii.		_____ (0.5)

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

b. Define **TWO** parameters of a sine wave signal, and their SI units.

Parameter 1: _____

SI Unit of Parameter 1: _____ (0.5)

Parameter 2: _____

SI Unit of Parameter 2: _____ (0.5)

This question continues on next page.

c. Label the important features of the oscilloscope shown in Figure 8.

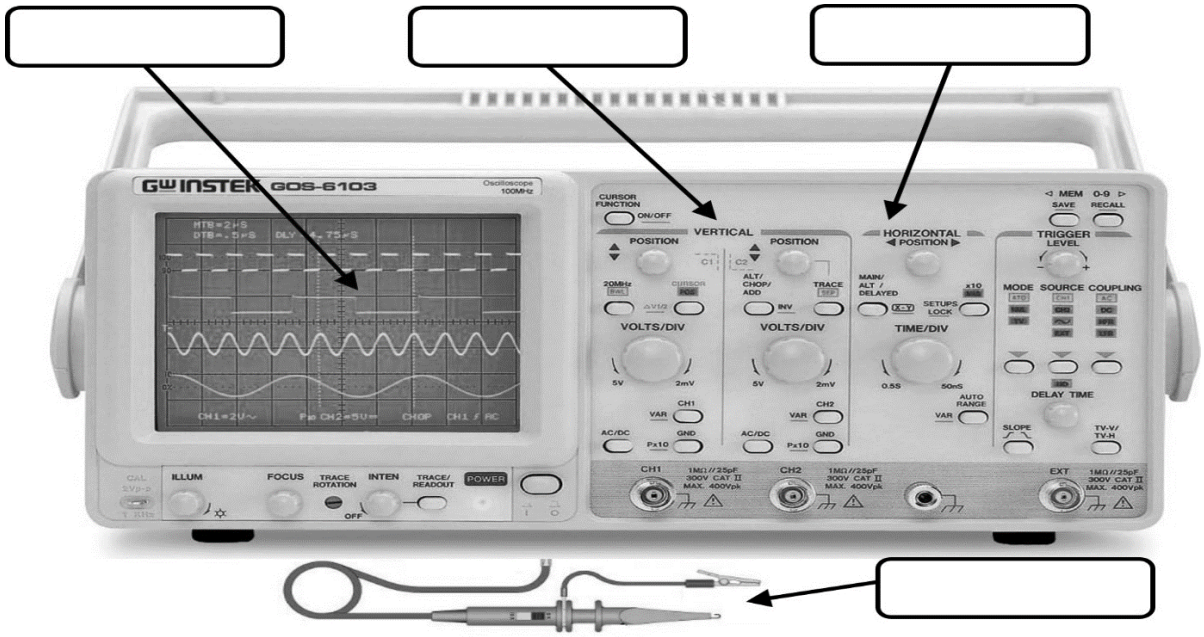


Figure 8: Oscilloscope
(Source: https://www.techedu.org/)

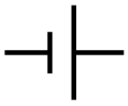
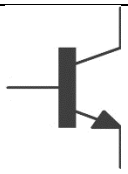
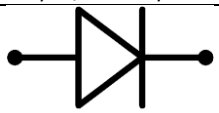
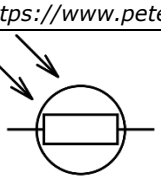
(2)

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

Electronic components can be represented using standardised symbols.

a. Identify all the electronic symbols illustrated in Table 3.

Table 3: Electronic Symbols.

	Electronic Symbol	Name
i.	 *(Source: https://www.iso.org/)*	_____ (0.25)
ii.	 *(Source: https:/learn.sparkfun.com/)*	_____ (0.25)
iii.	 *(Source: https://www.petervis.com/)*	_____ (0.25)
iv.	 *(Source: https://electronics.stackexchange.com/)*	_____ (0.25)

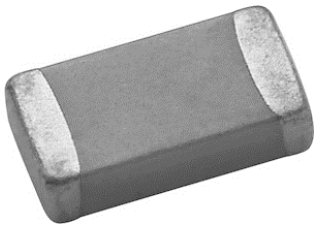
b. Match the given SI units on the left to their respective parameters on the right by connecting a line between them.

Farads	Resistance
Watts	Capacitance
Volts	Voltage
Ohms	Power

(1)

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

Table 4: Component Packaging.

	Component	**Packaging 1**	**Packaging 2**
i.	Resistor	 Radial / Axial	 Radial / Axial
ii.	Capacitor	 Through hole / Surface mount	 Through hole / Surface mount

(Sources: https:/forum.digikey.com, https://www.ie.farnell.com, https://www.vishay.com/, https://www.flyrobo.in)

(2)

Please turn the page.

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

Specialised and well-kept tools are essential to construct good quality electronic circuits.

a. Label the different tools used in the construction of electronic circuits shown in Table 5.

Table 5: Tools

	Tool	Name
i.	 *(Source: https://www.gedore.com/)*	_____ (0.25)
ii.	 *(Source: https://www.toptul.com/)*	_____ (0.25)
iii.	 *(Source: https:// mecha-tronx.com/)*	_____ (0.25)
iv.	 *(Source: https:// au.rs-online.com/)*	_____ (0.25)

b. Identify the missing **FOUR** steps in the correct order to use a soldering iron effectively. The final step has already been provided.

Step 1: _____

_____ (0.25)

Step 2: _____

_____ (0.25)

Step 3: _____

_____ (0.25)

Step 4: _____

_____ (0.25)

Step 5: Allow the solder joint to solidify appropriately.

c. PCB circuit construction requires different tools with different functions.
Outline the functions of the following **TWO** tools used in a circuit construction.

De-Soldering Pump	Track Cutter

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ (2)

Please turn the page.

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

The PCB manufacturing process present a number of hazards which are mitigated with different safety precautions.

a. Identify the appropriate warning sign for each of the hazardous scenarios listed in Table 6. Draw a circle around the correct sign.

Table 6: Warning signs for hazardous scenarios.

	Scenario	**Warning Sign**
i.	A liquid used during the etching process that creates oxidisation	 (1)
ii.	A liquid used during the etching process that is hazardous to the environment	 (1)

(Source: https://www.vectorstock.com/, https://depositphotos.com/, https://www.vecteezy.com/)

b. Identify **FOUR** hazards from the ones provided below that might be present when manufacturing a PCB.

Inhaling dangerous fumes	Cuts	Inadequate lighting
Low solder iron tip temperature	Chemical spill	Airborne fragments

Hazard 1: _____ (0.5)

Hazard 2: _____ (0.5)

Hazard 3: _____ (0.5)

Hazard 4: _____ (0.5)

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

Use of sub-standard material	Safe waste disposal
Safe handling of chemicals	Overlooking PCB design rules
Regular equipment maintenance	Wear appropriate PPE

Minimize risk 1: _____ (0.5)

Minimize risk 2: _____ (0.5)

Minimize risk 3: _____ (0.5)

Minimize risk 4: _____ (0.5)

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