



**L-Università
ta' Malta**

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

**SECONDARY EDUCATION CERTIFICATE LEVEL
2026 MAIN SESSION**

SUBJECT:	Design and Technology
PAPER NUMBER:	I – Level 1-2-3
DATE:	23 rd April 2026
DURATION:	2 hours 5 minutes

Directions to Candidates

Answer **all** questions in **all** sections in the space provided.

Non-programmable calculators are allowed.

Show all the working for mathematical calculations.

Coloured pencils and/or markers may be used for sketches.

Useful Information

Formula:

$$V_{\text{out}} = V_{\text{in}} \left(\frac{R_2}{R_1 + R_2} \right)$$

Section A: Refer to the given Situation and answer ALL the questions.

Situation: Many people living in local urban towns and cities have limited space in their homes. This might discourage the uptake of hobbies, which are important for an individual's wellbeing. A new trend sees consumers highly interested in Do-It-Yourself (DIY) hobbies. Storage and organisation products, which include electronic functions and are easy to store and use, might be attractive products for such consumers.

1. Figure 1 shows a web diagram that will help you explore the context of the given situation.
- a. Complete the web-diagram in Figure 1 by identifying **TWO** more needs which are stated in the situation. An example has already been given. (1)

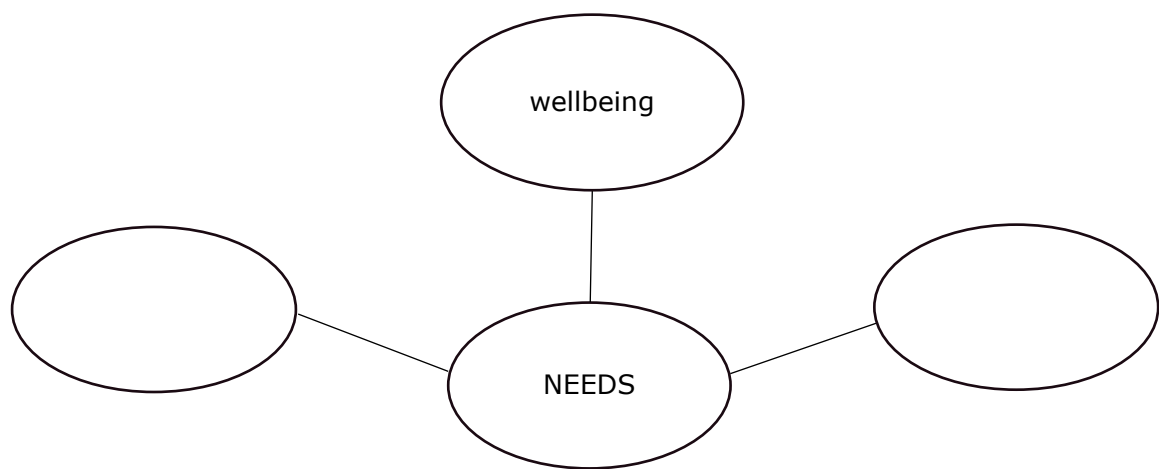


Figure 1

- b. Mention **ONE** DIY hobby which shall be used as the chosen context for the situation above. Describe **ONE** further need of this hobby.

DIY Hobby	
Need	

(1/2)

(1/2)

- c. Describe the role that the design team have within the given design situation.

(1)

- d. Identify **TWO** stakeholders related to the given situation and explain **ONE** need of each stakeholder.

Stakeholder	Need
(1)	(1)
(1)	(1)

(Total: 7 marks)

2. With reference to the hobby mentioned in question 1b:

- a. Identify **TWO** existing products on the market which are used to satisfy the needs of the consumers mentioned in the situation.

(2)

This question continues on next page.

- b. In the spaces provided, sketch in 3D the **TWO** products mentioned in part a. Label important features.

Product 1: _____

(2)

Product 2: _____

(2)

- c. List **ONE** feature of each product that is better when compared to the other product.

	Feature
Product 1	(1)
Product 2	(1)

(Total: 8 marks)

3. Further research is needed before developing a design brief.
- a. Identify and describe **TWO** research tools used for the purpose of data collection keeping in mind the stated stakeholders.

Research Tool	Description
($\frac{1}{2}$)	(1)
($\frac{1}{2}$)	(1)

- b. A variety of tools can be used to record and organise data collected during research. List **TWO** examples of data collection tools used for recording and organising data.

(2)

(Total: 5 marks)

Please turn the page.

-
4. Write a design brief referring to the identified hobby in Question 1 and highlight further needs of the stated stakeholders.

(Total: 2 marks)

5. Write **THREE** design specifications based on further needs identified within the design situation.

(Total: 3 marks)

-
6. Keeping in mind the key specifications written in Question 5.
- a. Communicate **ONE** design idea which satisfies the written design brief and specifications. The design should include an electronic system and branding features.

(4)

This question continues on next page.

-
- b. Discuss the proposed branding feature from the design idea to explain how this feature helps build a strong and recognisable identity for the storage device and the brand it represents.

(2)

(Total: 6 marks)

7. Based on the design idea in Question 6:

- a. Suggest **ONE** possible improvement that could be done for the product to be safer for the user.

(2)

- b. Discuss how an emergent technology such as CAD CAM could be used to make production of the proposed product more effective and explain how this would improve your design.

(3)

- c. State **TWO** pieces of information which should be found on the safety data sheet of the proposed product.

(2)

(Total: 7 marks)

8. Refer back to the design idea in Question 6.
- a. Plan an effective sequence of **FOUR** main steps to manufacture the product, mentioning suitable processes.

Step	Process
1	(1)
2	(1)
3	(1)
4	(1)

- b. State **TWO** traditional and **TWO** digital manufacturing technologies.

Traditional manufacturing technology	Digital manufacturing technology
(½)	(½)
(½)	(½)

- c. Underline the term which mostly fits this definition.
- "Making a limited number of identical products together" is considered as:

Batch production	One-off production	Mass production	Continuous production
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(1)

(Total: 7 marks)***Please turn the page.***

9. Refer again to the design idea in Question 6.

a. Describe the function of the electronic system of the design idea in terms of inputs, processes and outputs in Figure 2.

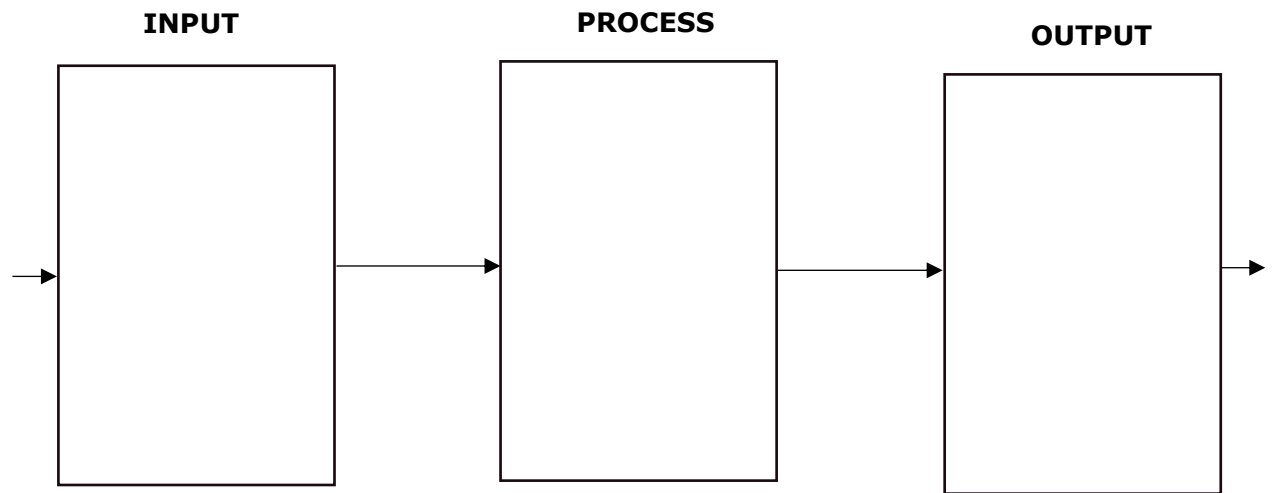


Figure 2

(3)

b. Identify which type of system is shown in Figure 2 by circling the correct answer.

Open loop	Closed loop
-----------	-------------

(1)

c. Give a reason for your answer.

(1)

(Total: 5 marks)

Section B: Answer ALL the questions.

Figure 3 below shows a small domestic greenhouse that is designed to help users grow plants throughout the year. The greenhouse frame is made from aluminium covered with a transparent textile that is resistant to UV light. It uses mechanisms to open ventilation windows and includes sensors that monitor soil moisture, ambient temperature and light levels.



Figure 3

10. Aluminium is a type of non-ferrous metal.

a. List **TWO** other examples of non-ferrous metals.

_____ (1)

b. Give **TWO** physical and **TWO** mechanical properties of aluminium.

Physical Properties	Mechanical Properties
(1/2)	(1/2)
(1/2)	(1/2)

This question continues on next page.

- c. Give **TWO** reasons why aluminium is a suitable material for the greenhouse frame.

_____ (2)

- d. List **ONE** PPE used when working with aluminium.

_____ (1)

(Total: 6 marks)

11. The planters in the greenhouse are made out of timber which shall be exposed to moisture and soil.

- a. Mention **ONE** suitable natural wood that could be used for the planters.

_____ (1)

- b. Describe **ONE** reason for your answer to part a.

_____ (1)

- c. Give **TWO** reasons for using natural wood instead of plastic for the planters.

_____ (2)

- d. Describe how a varnish finish can be applied to the wood to increase its durability.

_____ (1)

- e. Write down **FOUR** steps making up an effective sequence of work required in producing the planters, referring to suitable manufacturing processes.

Step 1: _____
_____ (1)

Step 2: _____
_____ (1)

Step 3: _____
_____ (1)

Step 4: _____
_____ (1)

(Total: 9 marks)

12. UV resistant transparent textile can be used for covering the greenhouse.

- a. Identify **ONE** reason why the greenhouse is covered with a transparent textile instead of an opaque material.

_____ (1)

- b. Give **ONE** reason why a UV resistant textile is a better option than a PMMA sheet in terms of physical or mechanical properties for the greenhouse.

_____ (1)

- c. Give **ONE** reason why a designer might choose a synthetic textile over a natural fibre for covering the greenhouse.

_____ (1)

(Total: 3 marks)

13. A number of tools can be used to assemble the greenhouse structure.

- a. List **ONE** measuring tool and **ONE** cutting tool and their purpose.

	Name of Tool	Purpose/Use
Measuring Tool	(1/2)	(1/2)
Cutting Tool	(1/2)	(1/2)

This question continues on next page.

- b. Figure 4 shows a cordless drill. Use the terms in the word bank to label the operational and safety parts of this tool.

chuck	battery	motor	speed control trigger
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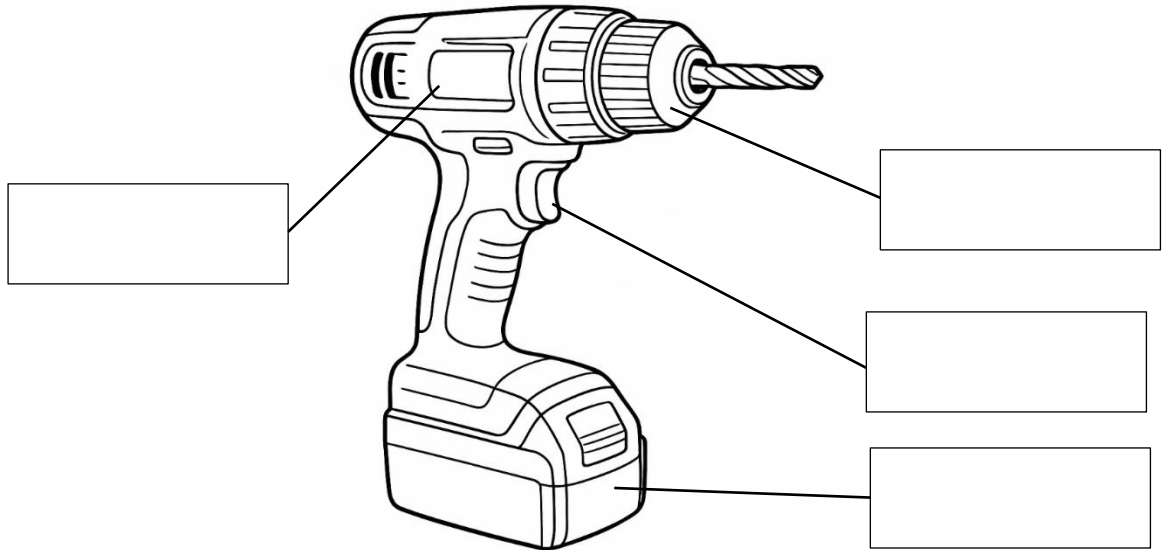


Figure 4

(2)

(Total: 4 marks)

14. Different mechanisms can be used to open and close the ventilation window of the greenhouse.

- a. The mechanism shown in Figure 5 is one possible solution.

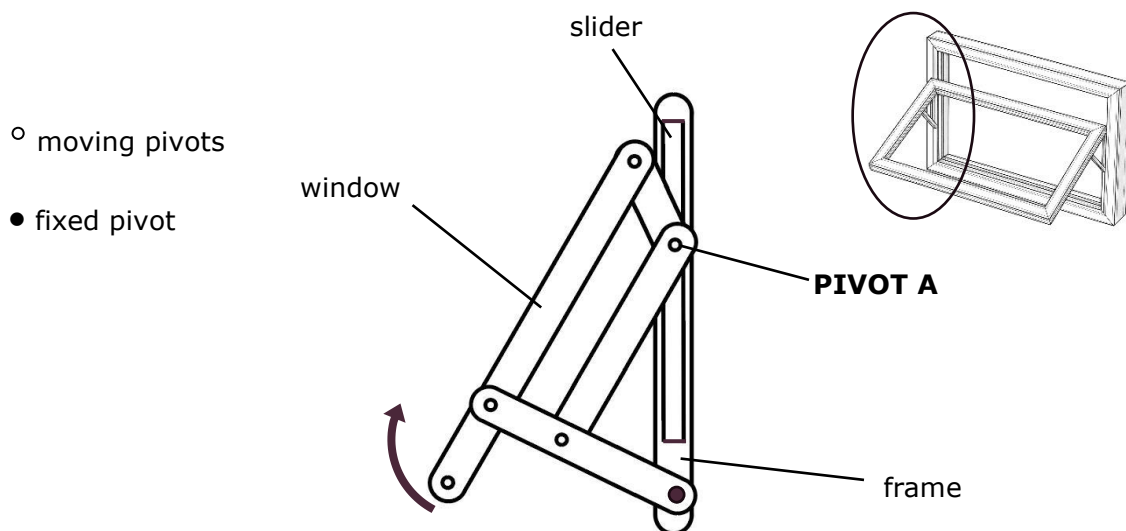


Figure 5

- i. Name the type of linkage shown in Figure 5.

(1)

- ii. On Figure 5, add an arrow to describe how pivot A moves when the window is opened.

(1)

- b. Figure 6 shows another solution using a pulley system. In the space provided, redesign the pulley mechanism to show how to reduce the effort done by the user. (3)

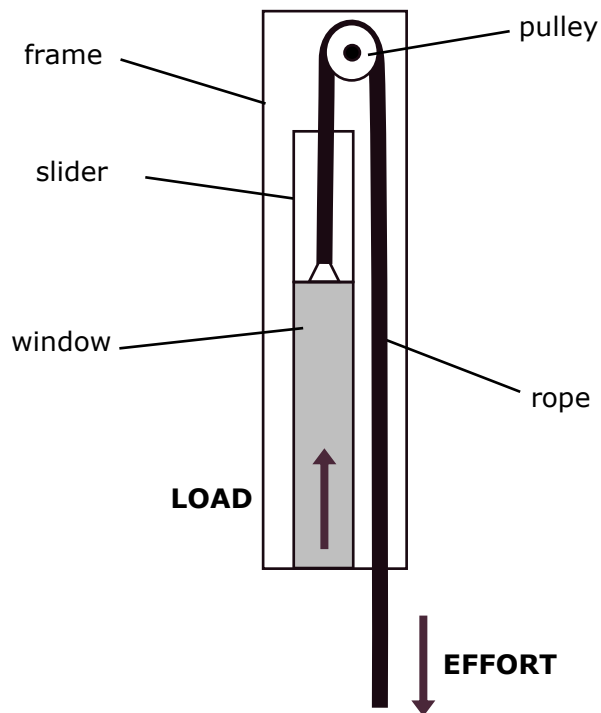
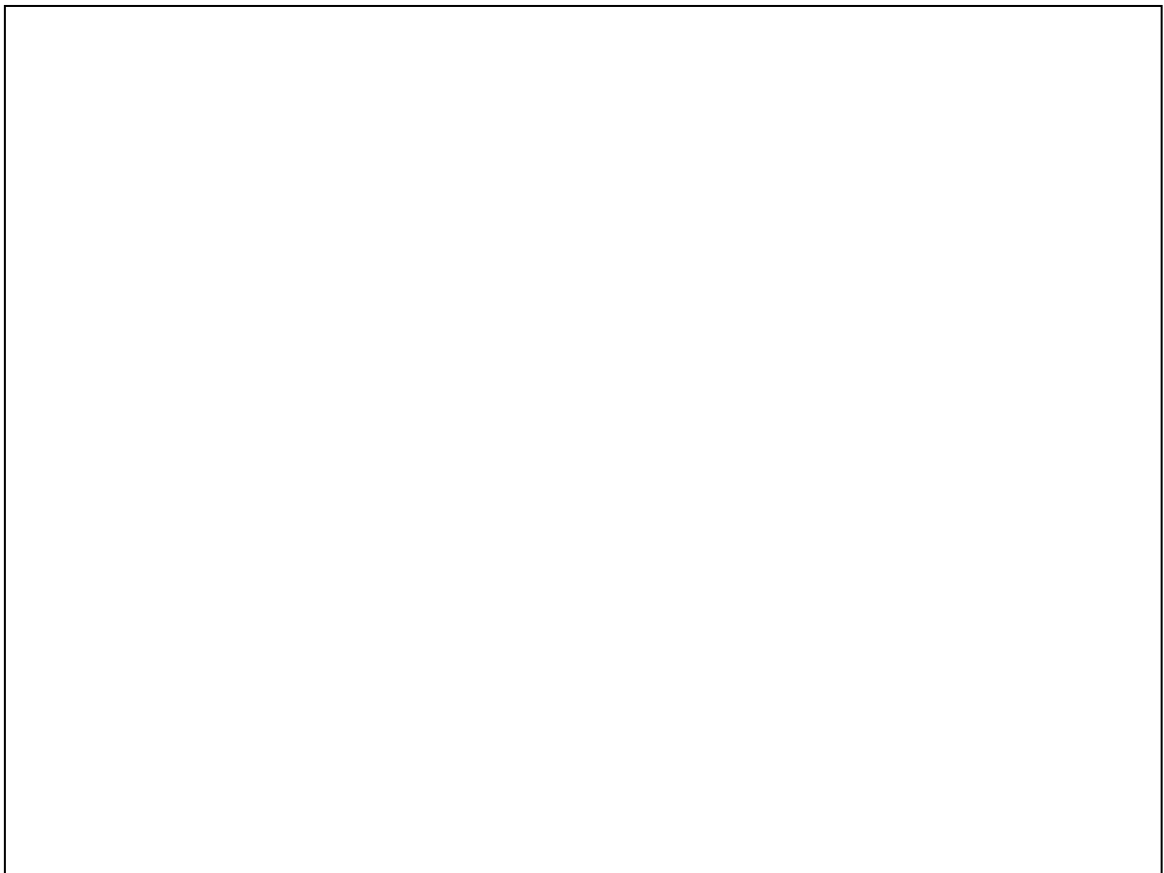


Figure 6



(Total: 5 marks)
Please turn the page.

15. The watering system of the greenhouse shall be automated by the use of sensors and a microcontroller.
- a. List **ONE** advantage and **ONE** disadvantage of using a microcontroller in a system when compared to discrete electronics.

Advantage	(1)
Disadvantage	(1)

- b. State **ONE** way how the automatic watering system of the greenhouse improves the environmental value of the design.

_____ (1)

(Total: 3 marks)

16. Figure 7 shows the circuit which controls the watering system of the greenhouse.

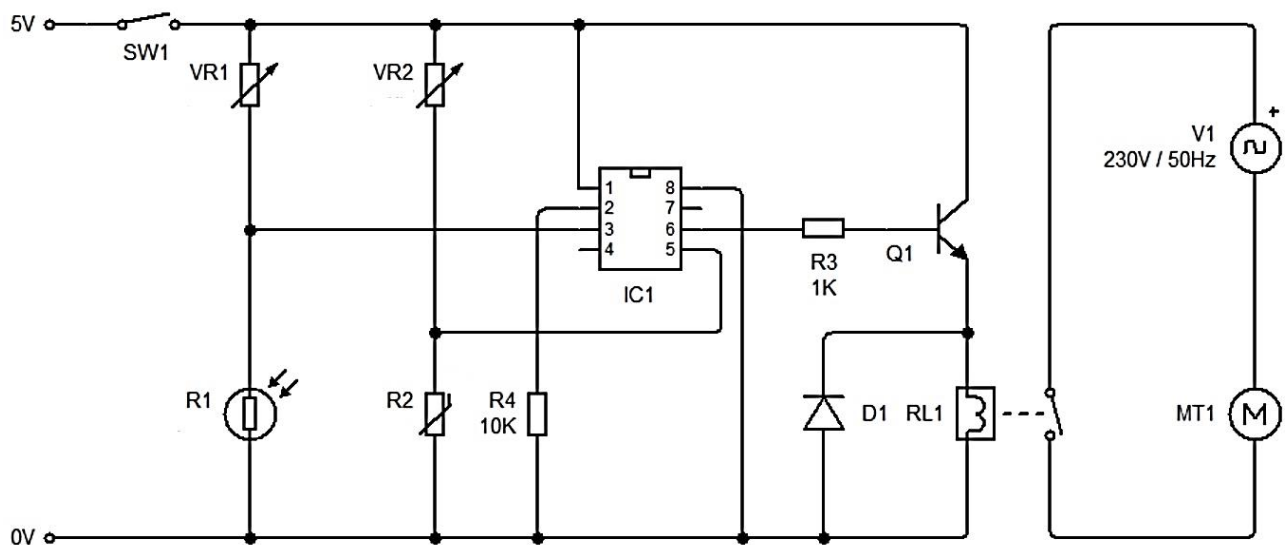


Figure 7

- a. Identify the names of the following electronic components.

Component	Name
VR1	
Q1	
R2	
D1	

(4)

- b. Identify the label of the component which controls the power supply of the microcontroller circuit.

_____ (1)

- c. A particular electronic component is used to allow the low-power microcontroller to control a higher-power device.

i. On Figure 7, circle this electronic component. (1)

ii. Write the name of this electronic component.

_____ (1)

- iii. This component is available in different current and voltage ratings. Give the SI units for:

Current: _____ (1)

Voltage: _____ (1)

- d. Describe the function of component D1 in the circuit shown in Figure 7.

_____ (2)

This question continues on next page.

- e. This question focuses on the voltage divider made up of VR1 and R1. Assume that the value of VR1 is 10 K and the value of R1 is 1 K.
- i. Calculate the output voltage of the potential divider.

(2)

- ii. Explain how the output voltage of the potential divider is affected when the value of VR1 is changed from 10 K to 100 K, assuming that R1 keeps a value of 1 K.

(2)

- f. A switch can be added to the high-voltage circuit to switch the water pump off in case of an emergency. In the space provided, redesign the high-voltage circuit to show how such modification could be done.

(2)

(Total: 17 marks)

-
17. Refer to the 5 'S' Approach (Sort, Set in Order, Shine, Standardise, Sustain) to illustrate **THREE** good workshop practice procedures which should be followed when manufacturing the greenhouse in the school workshop.

(Total: 3 marks)

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**SECONDARY EDUCATION CERTIFICATE LEVEL
2026 MAIN SESSION**

SUBJECT:	Design and Technology
PAPER NUMBER:	II – Level 1-2
DATE:	23 rd April 2026
DURATION:	2 hours 5 minutes

Directions to Candidates

Answer **all** questions in **all** sections in the space provided.

Non-programmable calculators are allowed.

Show all the working for mathematical calculations.

Coloured pencils and/or markers may be used for sketches.

Useful Information

Formula:

$$\text{Velocity gear ratio} = \frac{\text{Driver teeth or diameter}}{\text{Driven teeth or diameter}}$$

Section A: Answer all questions. This section carries 30 marks.

1. Underline the correct answer from the selection given.

In which section of the design process does a designer:

a. interview individuals to collect data:

- i. explore;
- ii. design;
- iii. make.

b. sketch several initial ideas that satisfy the specifications:

- i. design;
- ii. make;
- iii. evaluate.

c. test the function of the final prototype:

- i. explore;
- ii. make;
- iii. evaluate.

d. produce a working prototype:

- i. explore;
- ii. make;
- iii. evaluate.

(Total: 2 marks)

2. Fill in the blanks.

a. When using a sanding machine the following PPEs should be worn: _____
and _____.

b. CNC milling is a type of _____ manufacturing while FDM 3D printing is a
type of _____ manufacturing.

(Total: 4 marks)

3. Identify which sustainability concept from reduce, reuse or recycle is being applied in the scenarios in Table 1.

Table 1

Scenario	Reduce / Reuse / Recycle
Jamie blends shredded paper with water, pours it into a mesh-screen frame, and leaves it to dry in the sun. A few hours later, he peels off a fresh sheet of handmade paper.	
Carlos has an old glass jar that once held sauce. Instead of throwing it away, he washes it thoroughly and uses it to store homemade granola in his kitchen.	
Liam prepares to 3D-print a phone stand and changes the infill from 50% to 15% in his slicer software while keeping it strong enough.	

(Total: 3 marks)

4. Use lines to match the properties with the materials stated in Table 2.

Table 2

MDF		Could come in a variety of vibrant colours.
Stainless-steel		Very lightweight so it used to make the body of airplanes.
PMMA		A good thermal conductor so it is good for the making of pots and pans.
Aluminium		Dense and commonly used for DIY flat pack furniture.

(Total: 2 marks)

5. Identify **ONE** standard form of supply for the materials stated in Table 3.

Table 3

Name of Material	Standard form of material
Pine	
Plywood	
PLA	
Gold	

(Total: 4 marks)

6. Complete Table 4 with the relevant information about tools and their uses.

Table 4

Name of tool/machine/equipment	Use of tool
	Used to fasten two pieces of material together by pop rivets
file	
	A precision measuring tool used to measure thicknesses, lengths, depths, and diameters with high accuracy.
safety ruler	

(Total: 3 marks)

7. Figure 1 shows a mug that has a star printed on it using thermo-chromic ink.

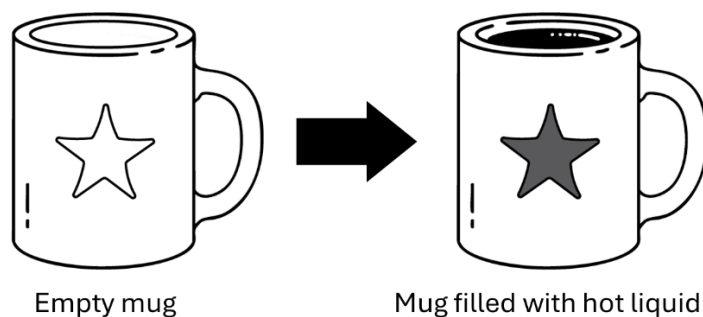


Figure 1

- a. Describe the main property of this smart material.

Thermo-chromic ink can _____
 _____ (2)

- b. Give another example of a smart material and describe its main property.

Example: _____ (1)

Property: _____ (1)

(Total: 4 marks)

8. Figure 2 shows a sketch of a packaged mug.



Figure 2

Complete the centre and folding lines on the development of the mug packaging shown in Figure 3.

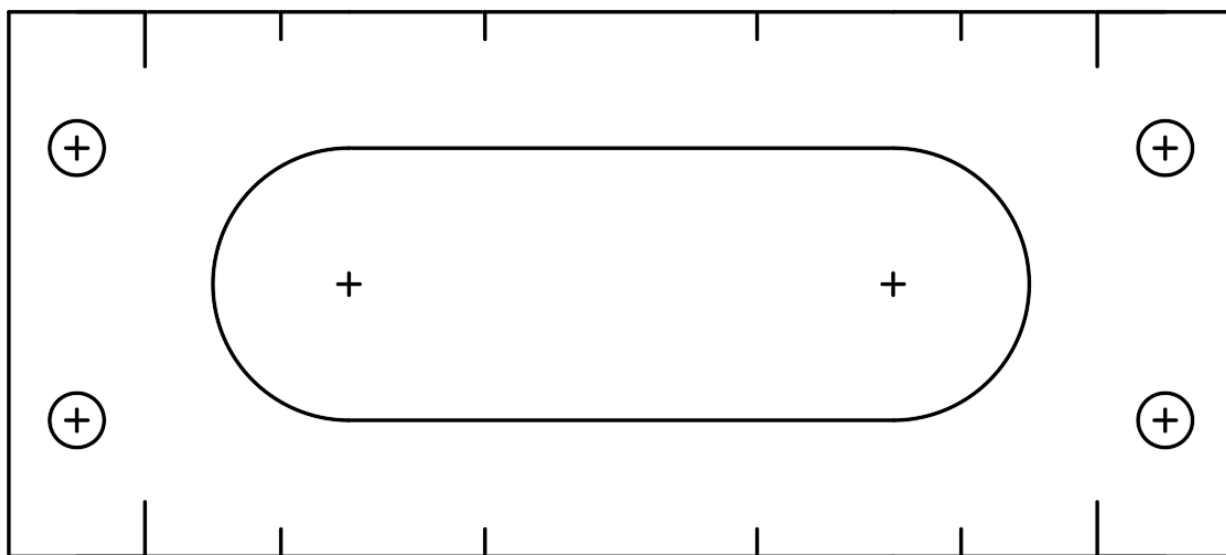


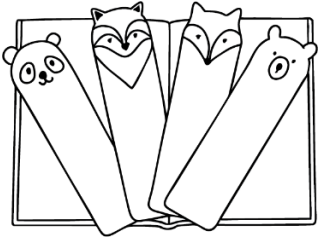
Figure 3

(Total: 2 marks)

Please turn the page.

9. Identify whether the following items were made through the utilisation of traditional or digital manufacturing methods.

Table 5

Item manufactured	Traditional or Digital manufacturing
 Laser engraved wooden bookmarks	
 3D printed name keychains	
 Cosmetic bag sewn using a sewing machine (Source: https://www.vecteezy.com/vector-art/49982255-beauty-essentials-makeup-bag-line-art)	
 A shelving unit where the shelves were cut using a scroll saw	

(Total: 2 marks)

10. Figure 4 shows two views of a pencil holder.

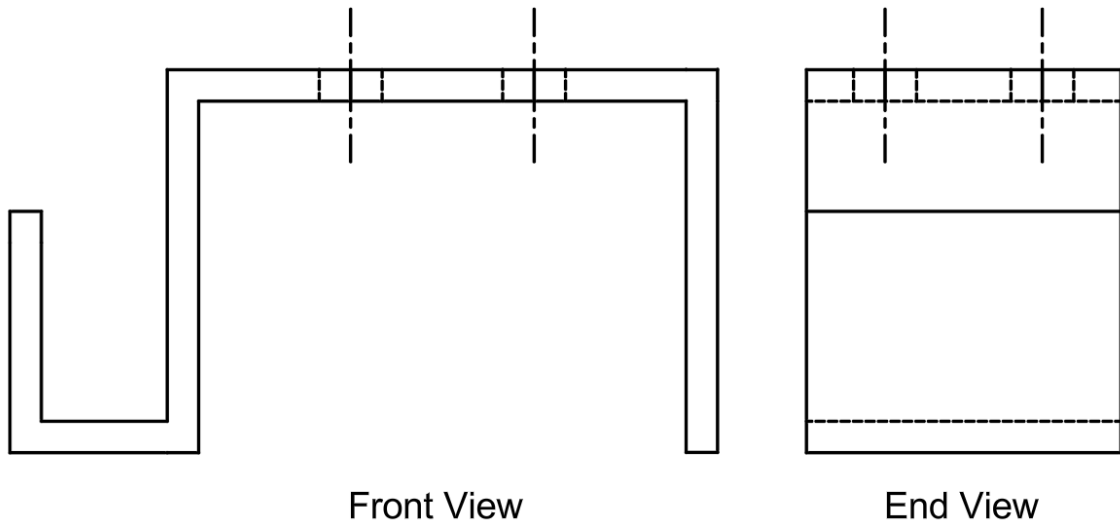
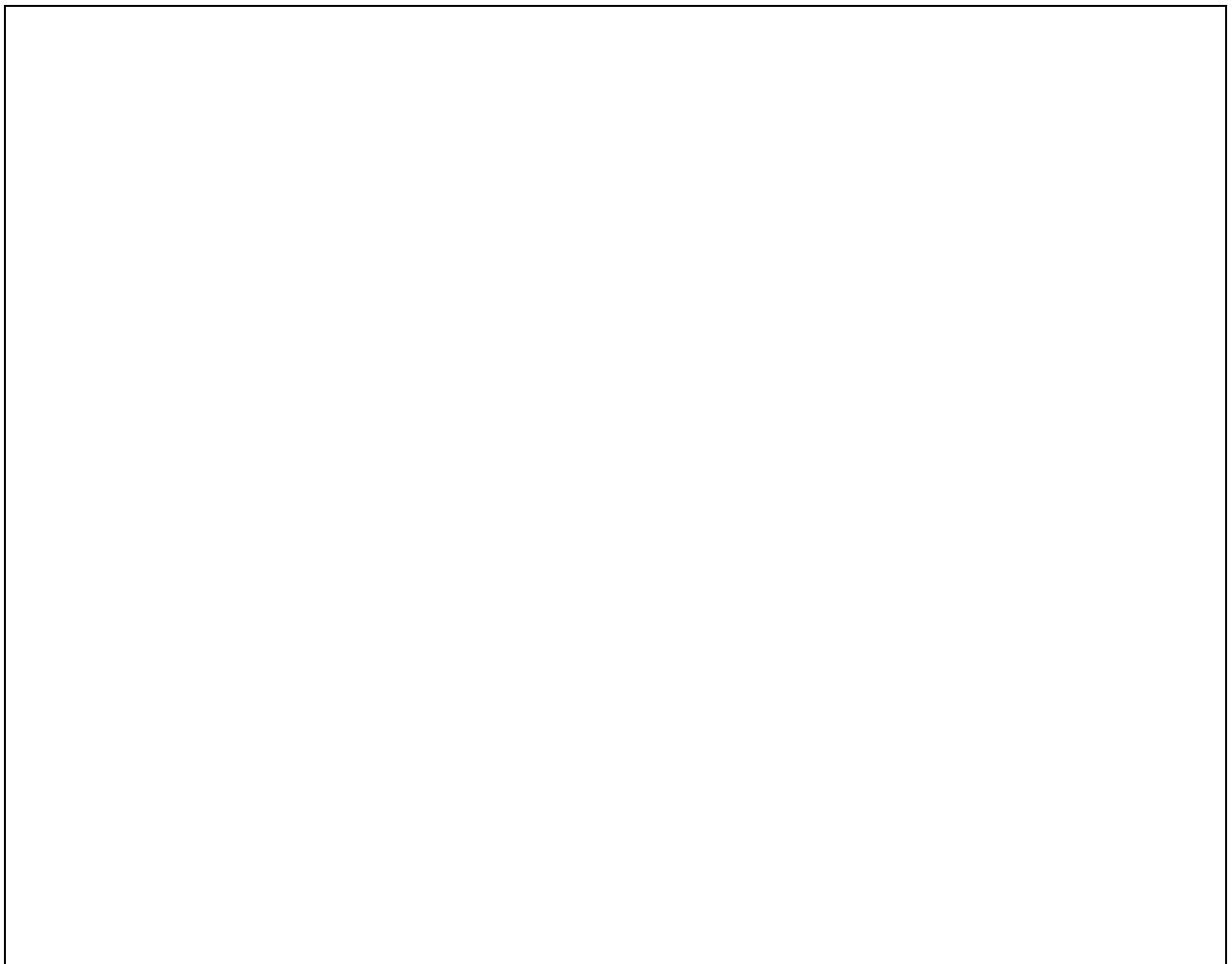


Figure 4

In the space provided, sketch a 3D pictorial view of the pencil holder. Do **not** include the holes on the top of the holder.



(Total: 2 marks)

Please turn the page.

11. Figure 5 shows a concept design of a radio which shall be manufactured using a laser cutter.

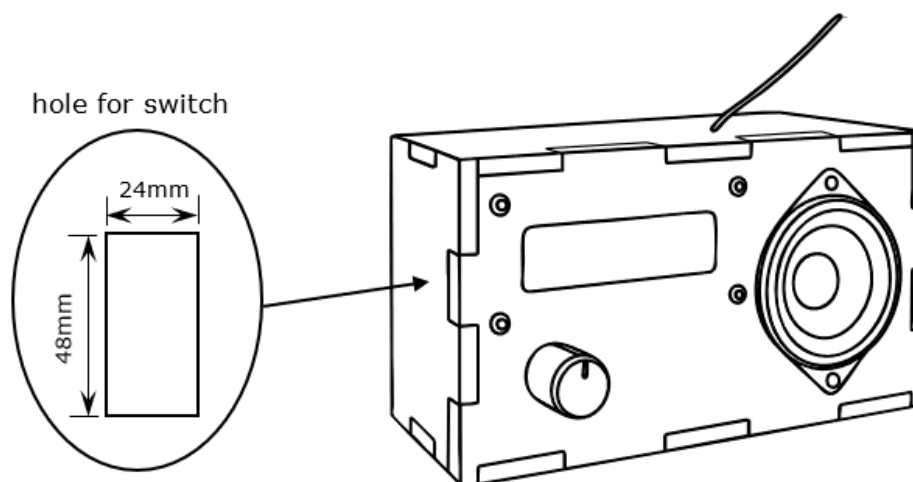


Figure 5

- a. The material used was translucent and smooth. Underline the material which satisfies these properties. (1)

MDF	Plywood	PMMA	Melamine resin
-----	---------	------	----------------

- b. A power switch that goes on and off is going to be installed inside the hole on the side of the radio. On Table 6, circle the name of switch, A or B, which should be installed. (1)

Table 6

Switch Name	Working drawings of switches	Description
Switch A		Pole / Throw: SPST Action: OFF-ON
Switch B		SPDT (Single Pole Change Over) Action: ON-OFF-ON

(Source: <https://www.fabian.com.mt/en/products/webshop/21948/switch-toggle-miniature-spdt-on-off-on.htm>)

(Total: 2 marks)

Section B: Answer all questions. This section carries 70 marks.**Read carefully the following theme and situation.****Theme:** Safety and Cleanliness at Home

Situation: Keeping a house tidy, clean and safe can be a difficult task for families with children under the age of seven. Such children naturally imitate behaviours of others, enjoy being given simple chores, and learn through play. Therefore, a small, playful device can encourage children to participate in simple cleaning chores such as tidying toys, wiping spills or sorting laundry. The device should make imitation natural, safe and rewarding for both child and caregiver while fitting into everyday home routines.

12. Identify **ONE** need for each of the following stakeholders within the design situation.

Caregivers: _____
_____ (1)

Children: _____
_____ (1)

(Total: 2 marks)

Please turn the page.

13. The caregivers were given a questionnaire to investigate what features they would like to see in the device which are targeted for children.

Table 7 shows the recorded results to questions asked:

Table 7

Question	Options	Percentage Response
A. What colours would you prefer such device to be?	cool colours	30
	warm colours	70
B. Would you prefer such a device to have mostly electronic or mechanical functions?	mechanical	25
	electronic	75
C. Would you prefer the device to be lightweight or heavyweight?	heavyweight	10
	lightweight	90

Fill in Table 8 by choosing **TWO** of the presented questions. Use **ONE** adequate infographic for **each** to communicate the recorded data effectively. State the name of the tool used.

Table 8

Question chosen		
Infographic		
Name of infographic		

(Total: 6 marks)

-
14. Identify **TWO** specifications stated within the design situation and the recorded data from the questionnaire. The first specification is given as an example.

Specification 1: The device must include a functional system (mechanical and/or electronic).

Specification 2: _____

_____ (1)

Specification 3: _____

_____ (1)

(Total: 2 marks)

15. Create a suitable design brief by referring to the data identified in the situation and the specifications.

Design and make a _____

(Total: 4 marks)

Please turn the page.

16. Sketch **TWO** design ideas that satisfy the written specifications and design brief in Questions 14 and 15. Each sketch should include colour, annotations and dimensions.

Idea 1:

(4)

Idea 2:

(4)

(Total: 8 marks)

Please turn the page.

17. Choose **ONE** design idea and describe the system in terms of inputs and outputs.

Chosen Design Idea: ____

Inputs: _____

_____ (1)

Outputs: _____

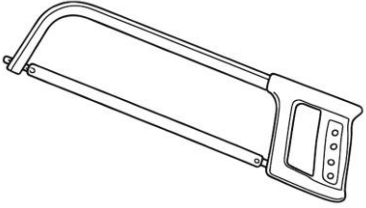
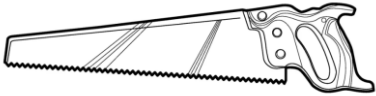
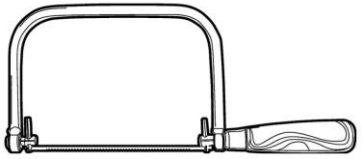
_____ (1)

(Total: 2 marks)

18. A 20 mm diameter PVC tube needs to be cut to length.

a. Label the following cutting tools.

Table 9

	 (Source: https://tinyurl.com/mthjbjes)	 (Source: https://tinyurl.com/mthjbjes)
Tool A: _____	Tool B: _____	Tool C: _____

(3)

b. Select the tool from Table 9 which is most suitable to cut a PVC tube to the proper length. Underline the correct answer. (1)

- i. Tool A
- ii. Tool B
- iii. Tool C

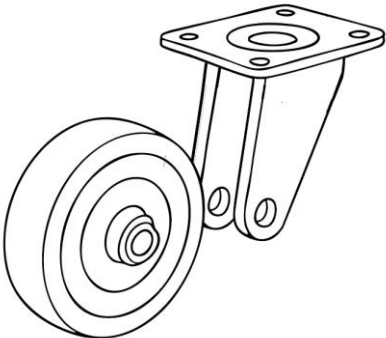
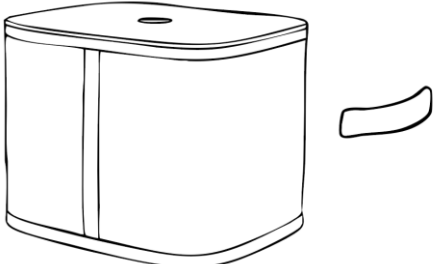
c. A piece of leftover PVC tube is 300 mm long. Mention **ONE** way how this leftover piece could be used instead of throwing it away.

_____ (1)

(Total: 5 marks)

19. Table 10 shows a number of disassembled items related to housekeeping. Complete the table by sketching how these items look when assembled with the stated fasteners.

Table 10

Disassembled items	Fastener	Assembled items with fasteners
 detached wheel of bucket	nut and bolt	
 textile bin with detached handle	rivets	

(2)

(2)

(Total: 4 marks)
Please turn the page.

20. A family bought an automated cleaning robot as seen in Figure 6. This cleaning robot includes a function which makes the robot turn whenever it senses darkness in a specific area.

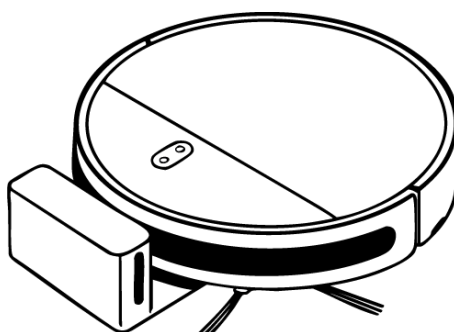


Figure 6

Figure 7 shows the circuit of the robot that activates this function via two motors and a microcontroller (IC1).

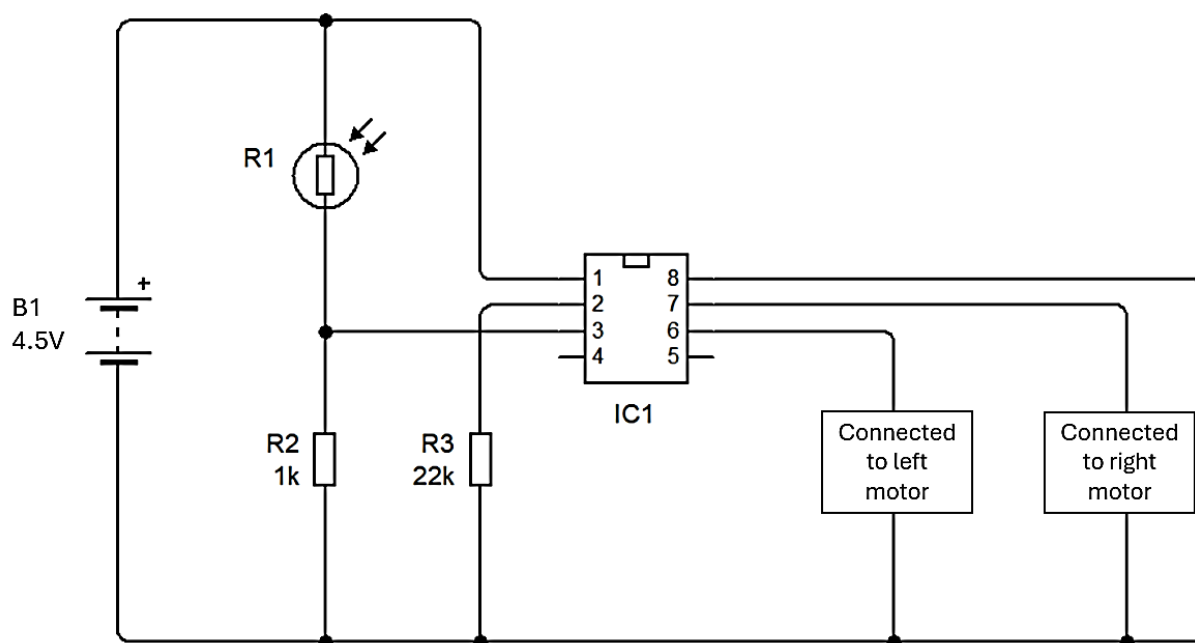


Figure 7

- a. Give the name of the following components.

B1: _____

R1: _____

R2: _____

(3)

b. Transistors are connected to the motors on Pinouts 6 and 7 of IC1.

i. Draw the symbol of each component.

Name of component	Component symbol
Transistor	
Motor	

(2)

ii. Describe **ONE** function of a transistor.

(1)

(Total: 6 marks)

21. Figure 8 shows the datasheet of microcontroller IC1.

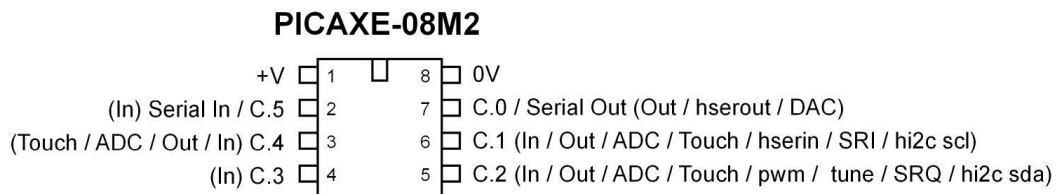


Figure 8

a. Complete Table 11 by stating the name of the pinout where the stated components are connected. In the same table, indicate whether the pinouts are inputs or outputs.

Table 11

Component	Pinout Number	Pinout Name	Input or Output
R1 and R2	3		
Left Motor	6		
Right Motor	7		

(3)

This question continues on next page.

b. Figure 9 explains how the cleaning robot moves whenever it senses darkness.

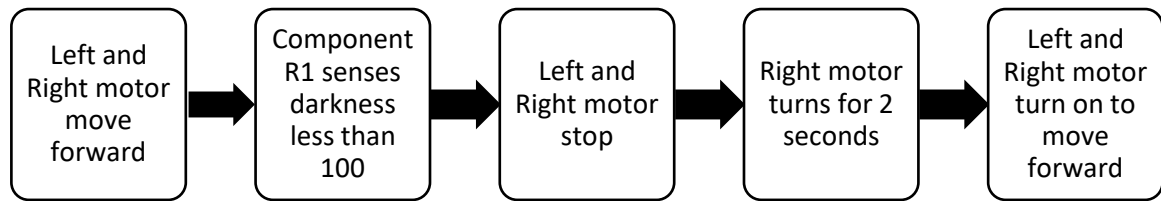


Figure 9

Figure 10 shows an incomplete flowchart with the program that controls the cleaning robot according to the sequence presented in Figure 9. Complete Figure 10 by adding the missing symbols and commands.

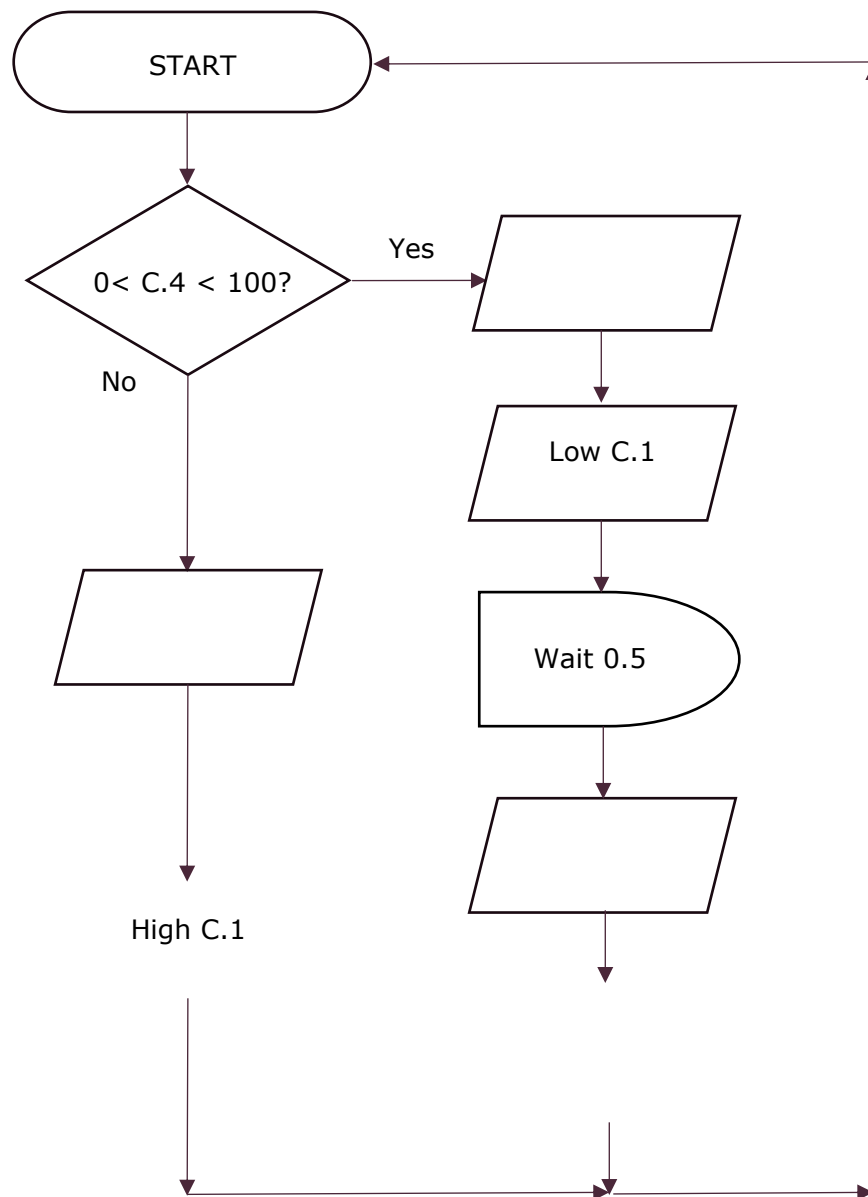


Figure 10

(6)
(Total: 9 marks)

22. The circuit of the cleaning robot was put together through the process of soldering.
- a. Identify **FOUR** hand tools utilised during the soldering process.

_____ (4)

- b. Describe the process of soldering of a component on a stripboard/Veroboard.

_____ (4)

- c. Figure 11 shows a worker in a closed area soldering certain components on the circuit board for the robot cleaner. Identify **TWO** health and safety hazards within this image.



Figure 11

Hazard 1: _____ (1)

Hazard 2: _____ (1)

(Total: 10 marks)

23. It is recommended that the casing of the cleaning robot is to be manufactured by vacuum forming and not by 3D printing. Describe why vacuum forming is a better option than 3D printing in relation to production.

(Total: 2 marks)

Please turn the page.

24. The cleaning brushes of the robot are connected to a d.c. motor with the gears as shown in Figure 12.

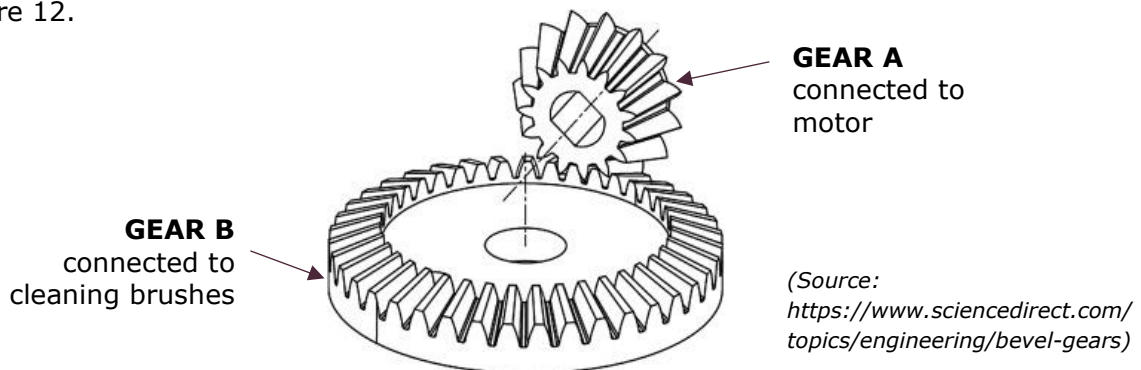


Figure 12

- a. Identify the type of gear shown in Figure 12.

_____ (1)

- b. Label the driver and the driven gear on Figure 12.

(2)

- c. Assume that Gear A has 12 teeth and Gear B has 24 teeth.

- i. Calculate the velocity gear ratio for this gearing system.

(3)

- ii. State whether Gear B is rotating slower or faster than Gear A.

_____ (1)

- d. The brushes of the cleaning robot are attached with screws. State which tool should be used to remove the brushes and replace them with new ones.

_____ (1)

(Total: 8 marks)

25. The company that manufactures the cleaning robot shown in Figure 6 decided to do some modifications to the robot's design to improve functionality. Suggest **TWO** improvements that could be done.

(Total: 2 marks)



L-Università
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MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

**SECONDARY EDUCATION CERTIFICATE LEVEL
2026 MAIN SESSION**

SUBJECT:	Design and Technology
PAPER NUMBER:	II – Level 2-3
DATE:	23 rd April 2026
DURATION:	2 hours 5 minutes

Directions to Candidates

Answer **all** questions in **all** sections in the space provided.

Non-programmable calculators are allowed.

Show all the working for mathematical calculations.

Coloured pencils and/or markers may be used for sketches.

Useful Information

Formula:

$$V = I \times R$$

Section A: Answer all questions. This Section carries 30 marks.

1. Figure 1 shows part of a transistor datasheet accessed from the website:
<https://datasheet4u.com/>

Absolute Maximum Ratings

Description	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	40	V
Collector-Base Voltage	V_{CBO}	60	
Emitter-Base Voltage	V_{EBO}	6.0	
Collector Current Continuous	I_C	200	mA

Figure 1

- a. From the given information, write down the value and unit of the emitter-base voltage.

_____ (2)

- b. State what is the reference source of this datasheet.

_____ (1)

(Total: 3 marks)

2. A gaming chair should hold up to 150 kg.
 Devise an appropriate test to determine the validity of this claim.

(Total: 2 marks)

3. Apply hidden and centre lines on the sketch in Figure 2.

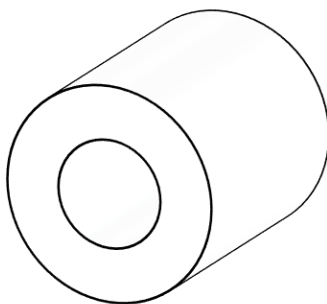


Figure 2

(Total: 2 marks)

4. Describe the following scales of production:

a. One-off production:

_____ (1)

b. Mass production:

_____ (1)

(Total: 2 marks)

5. Fill in the missing information in Table 1.

Table 1

Name	Type	Class	Origin
Walnut			Organic
Silk			Organic

(Total: 2 marks)

6. Certain PPE should be used when using particular tools, equipment or machines. Mention **ONE** tool, equipment or machine related to each of PPE mentioned in Table 2.

Table 2

PPE	Tool/equipment/machine
Dust mask	
Apron	
Heat resistant gloves	
Safety goggles	

(Total: 2 marks)

7. Describe the main reason why copper and GRP are used to manufacture PCBs.

Copper: _____ (1)

Plastic: _____ (1)

(Total: 2 marks)

Please turn the page.

8. Describe the purpose of the flat edge of a round LED as seen in Figure 3.

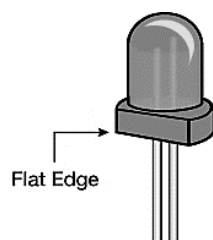


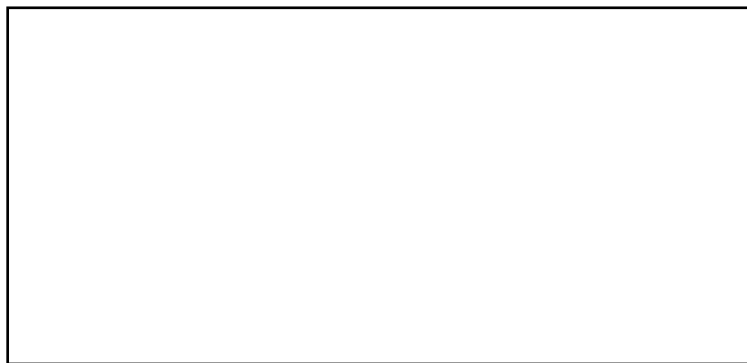
Figure 3

(Total: 1 mark)

9. Table 3 shows the truth table of a particular logic gate. In the space provided, design a simple circuit using **TWO** switches to obtain the desired outputs as shown in the truth table.

Table 3

INPUTS		OUTPUT
0	0	0
0	1	0
1	0	0
1	1	1



(Total: 2 marks)

10. Describe why a resistor is connected in series to the transistor in the system shown in the Figure 4.

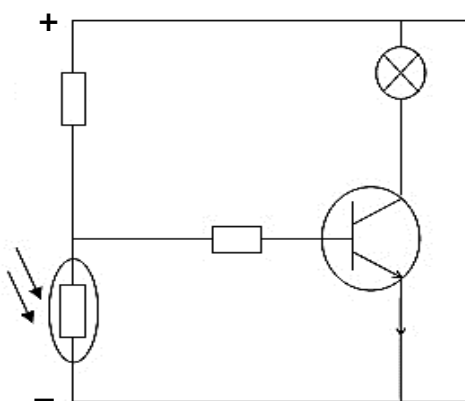


Figure 4

(Total: 2 marks)

11. A particular electronic system is made up with the following components:

- push-to-make switch;
- signal lamp;
- buzzer.

Use these components to complete the circuit diagram in Figure 5 to design a system which turns on the lamp and buzzer when the switch is pressed. Note that the outputs should be connected in parallel.

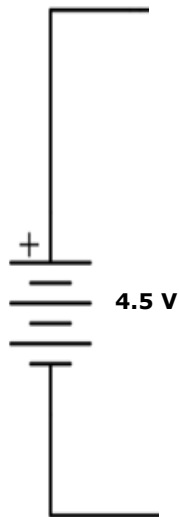


Figure 5

(Total: 3 marks)

12. CAD software is used to produce digital 3D forms. Describe the process used to add height or depth to flat 2D shapes in a CAD software.

(Total: 2 marks)

13. Discuss the suitability of using a digital printer when producing decals.

(Total: 2 marks)

Please turn the page.

14. Give a reason why a hacksaw is the most appropriate tool to use when cutting a piece of mild steel rod.

(Total: 1 mark)

15. Explain the importance of being ethical when referencing data sources.

(Total: 2 marks)

Section B: Answer all questions. This section carries 70 marks.

READ the following theme and situation carefully before answering this section.

Theme: Cleanliness and Safety at Home

Situation: Keeping a house tidy, clean and safe can be a difficult task for families with children under the age of seven. Such children naturally imitate behaviours of others, enjoy being given simple chores, and learn through play. Therefore, a small, playful device can encourage children to participate in simple cleaning chores such as tidying toys, wiping spills or sorting laundry. The device should make imitation natural, safe and rewarding for both child and caregiver while fitting into everyday home routines.

16. Refer to the situation above to answer the following questions.
- a. Complete the web diagram in Figure 6 to explore further needs related to house cleaning routines which are not stated in the situation. One example has been provided. (1)

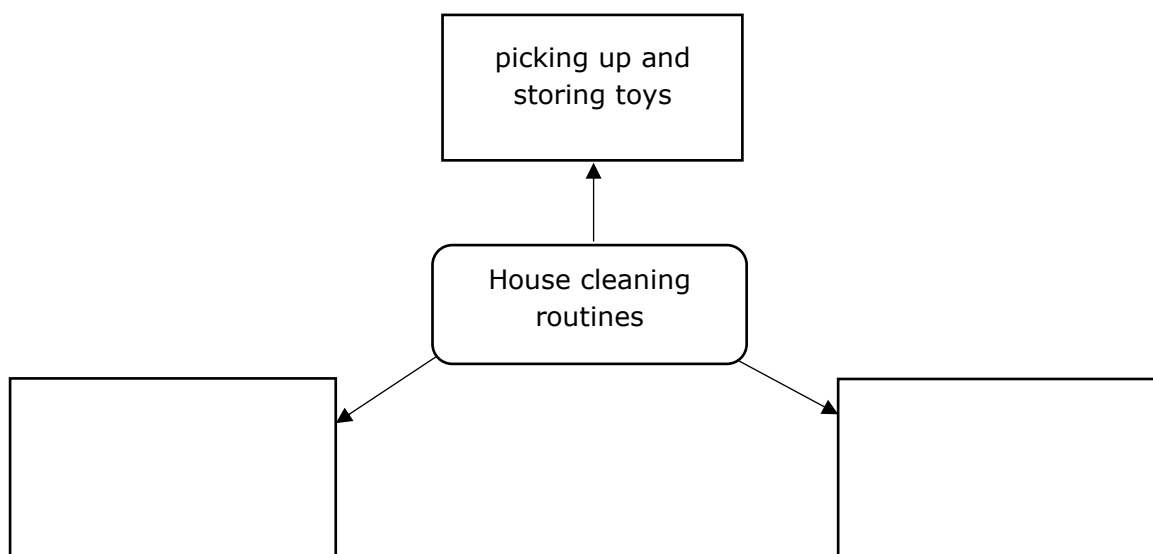


Figure 6

b. Describe **ONE** role of the following stakeholders within the design situation.

i. Manufacturer: _____ (1)

ii. Children: _____ (1)

c. It was concluded that the new device should focus on the need to involve kids in picking up toys which are lying around and storing them. Write a suitable and marketable design brief mentioning the stakeholders' needs.

_____ (3)

d. Write **ONE** specification referring to each of the following product aspects.

i. Safety:

_____ (1)

ii. Durability:

_____ (1)

iii. Interactivity:

_____ (1)

(Total: 9 marks)

Please turn the page.

17. Table 4 shows the number of hours a typical family spends doing different house cleaning routines per week. Use an adequate tool to communicate the information given in the space provided. Include colour and a legend to communicate the information more effectively.

Table 4

House Cleaning Routines	Average Time Spent (per week)
Floor Cleaning	5 hours
Laundry	3 hours
Dishwashing	4 hours
Gardening	2 hours

(Total: 4 marks)

18. Refer to the design brief and specifications stated in Question 16.
- a. In the space provided, sketch **TWO** design ideas which satisfy the stated design brief and specifications. Include dimensions and annotations in your sketches.

IDEA 1

(5)

This question continues on next page.

IDEA 2

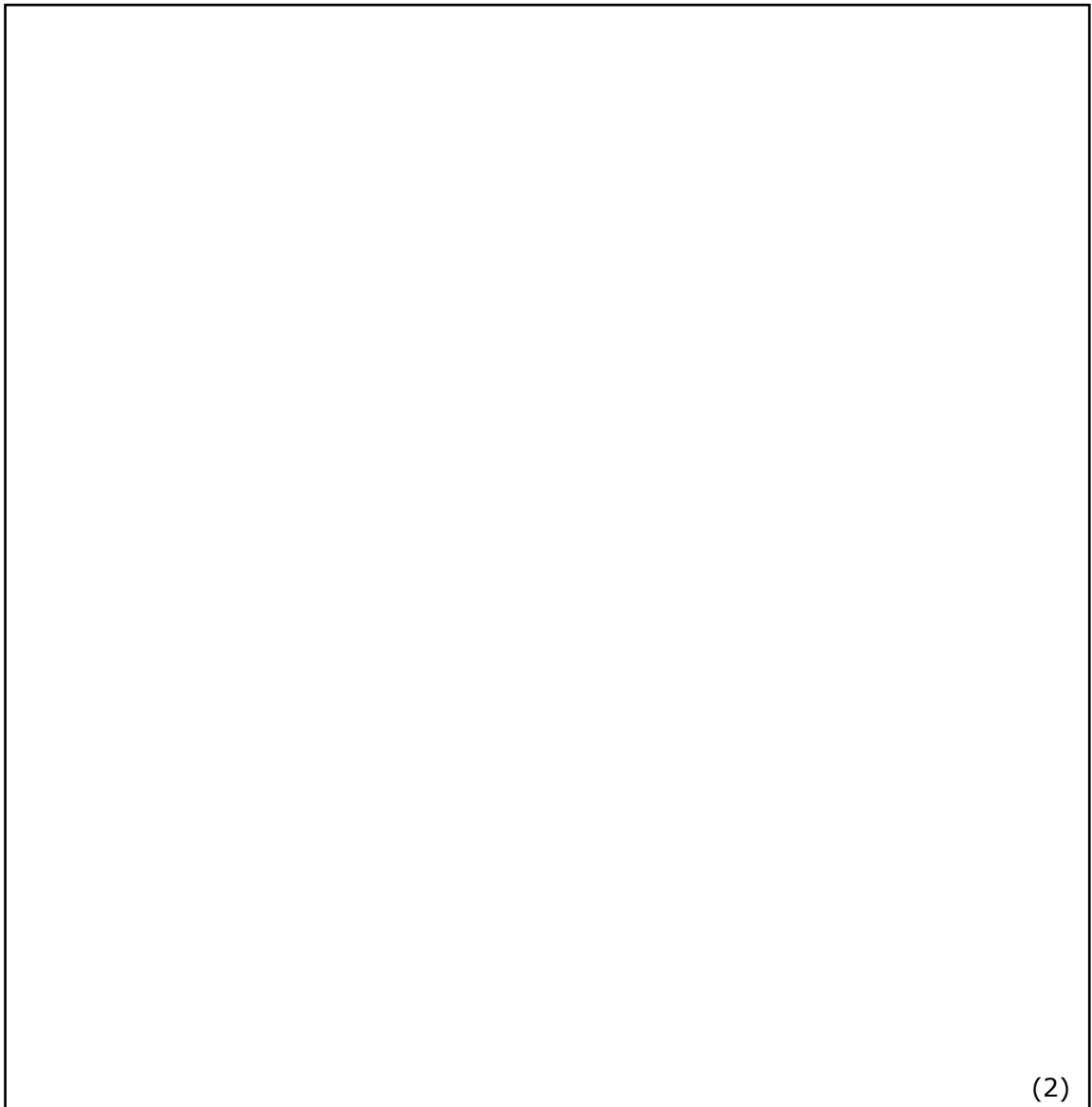
(5)

-
- b. Evaluate **each** design idea against the needs of one of the stakeholders:

Idea 1: _____
_____ (1)

Idea 2: _____
_____ (1)

- c. Choose **ONE** of the design ideas on which to apply aesthetic features related to branding.
i. Draw sketches of the chosen idea to show these added aesthetic features.



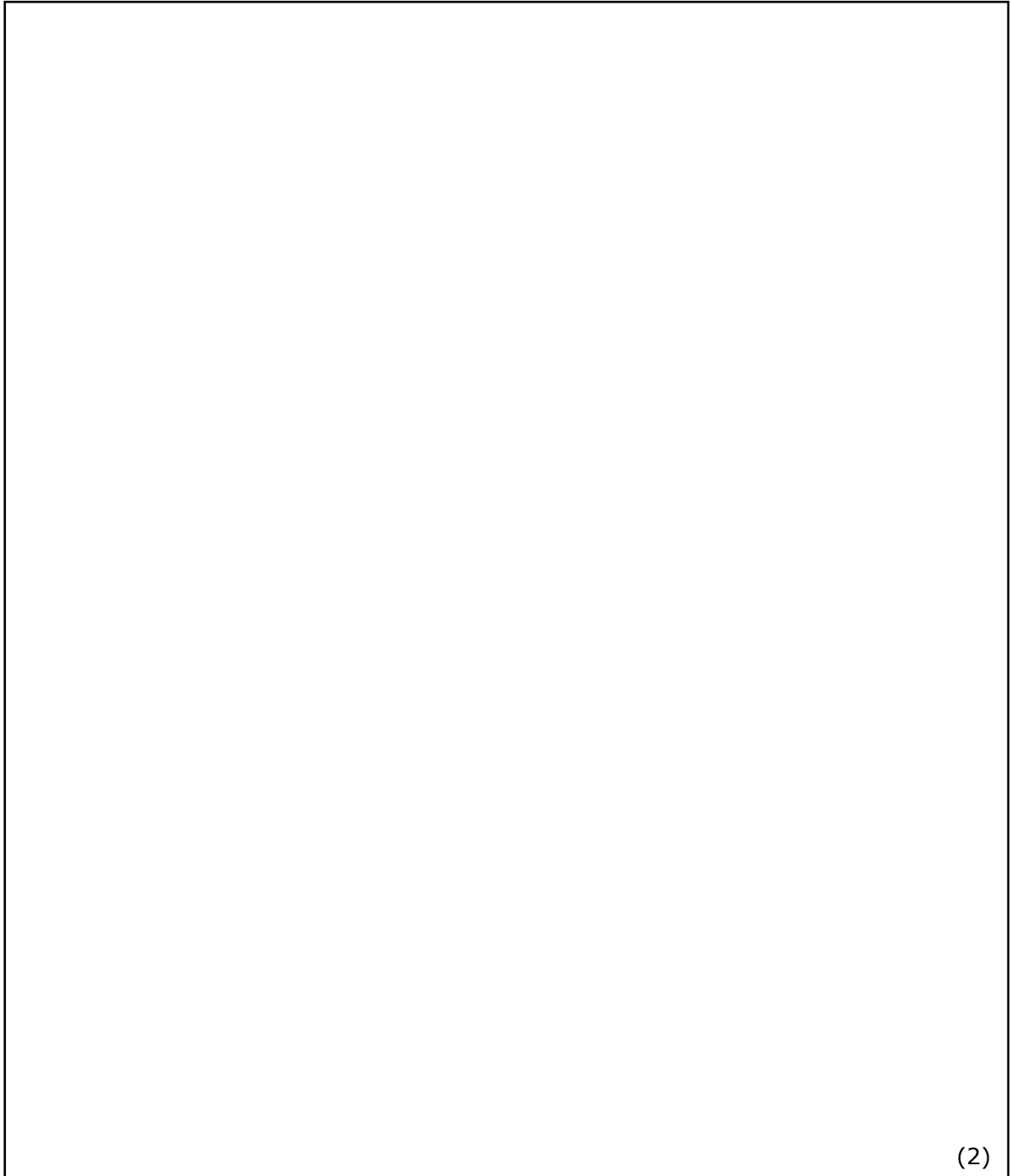
(2)

This question continues on next page.

ii. Discuss these added features in relation to product identity.

(2)

d. In the space provided, draw another sketch to communicate the marketability of the chosen design in relation to children's needs.



(2)

(Total: 18 marks)

19. Figure 7 shows a dustpan made from High Impact Polystyrene sheet.



Figure 7

a. Describe **TWO** properties of High Impact Polystyrene.

 _____ (2)

b. Briefly describe the most suitable manufacturing process to produce the dustpan shown in Figure 7.

 _____ (2)

c. Justify the choice of the manufacturing process mentioned in part b.

 _____ (2)

(Total: 6 marks)

20. Another dustpan was designed and manufactured in a D&T workshop using sheet metal. Table 5 shows the two parts of the dustpan.

- a. On Table 5, give the name of a suitable fastener to join the two parts of the dustpan. (1)
 b. On Table 5, graphically describe the physical features of the fastener mentioned in part a. (1)

Table 5

Parts to combine	Fastener
	Name:
	Sketch:

This question continues on next page.

- c. Give **ONE** reason why the fastener mentioned in part a was chosen to join the two parts.

(2)

- d. Draw the elevation of the metal dustpan on the grid given in Figure 8. Each square represents 20 mm. Include hidden detail for the thickness of the material to the elevation. Estimate the thickness of the material to be proportional to the drawing. (4)

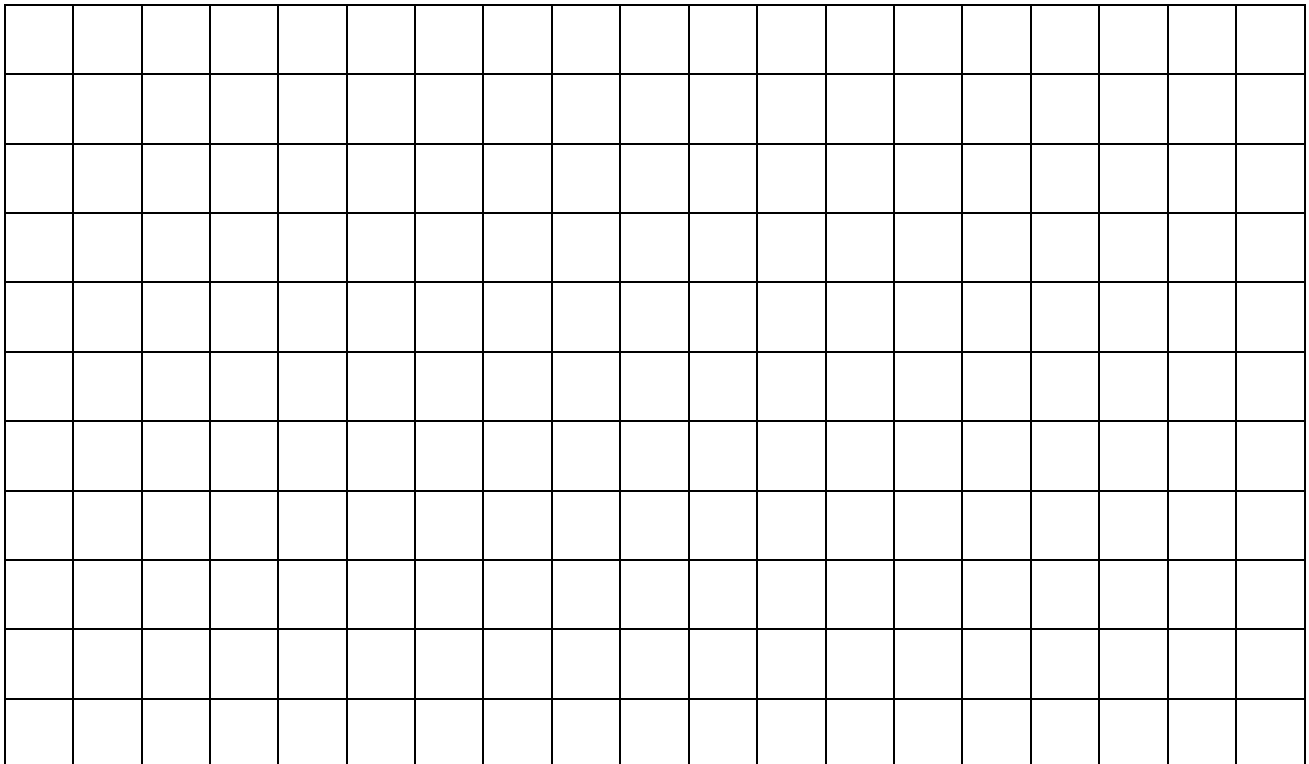


Figure 8

(Total: 8 marks)

21. Figure 9 shows a concept design of toy cleaning station. A circuit having a 9 V battery shall be used to add an electronic feature to the toy cleaning station.

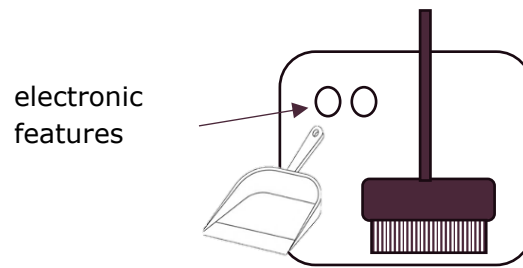


Figure 9

- a. During preliminary research some calculations were required.
- i. Calculate the current produced by a 9 V battery flowing through a resistor of 200 Ohms.

(2)

- ii. Explain **ONE** specific modification that should be done in a battery-resistor system to decrease the current.

(2)

This question continues on next page.

- b. Figure 10 shows the design of a reward system to be integrated with the toy cleaning station. The product consists of three layers of materials. The front part is transparent to show the reward stars. Children are given stars when they complete a cleaning task. These stars should slide easily in the middle section through the opening in the upper part of the product.

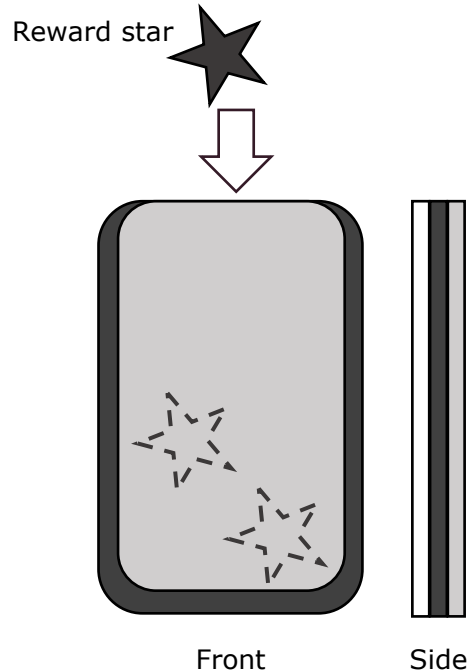


Figure 10

- i. If the reward system had to be manufactured using a laser CNC machine, describe, in a logical sequence, the steps involved to produce the product. In your answer include the materials, the tools or equipment that are needed in the process.

(5)

- ii. State **TWO** procedures to reduce risks and hazards associated with the manufacturing process described in part bi.

(2)

- iii. Discuss the suitability of CNC machines for this specific task.

(2)

(Total: 13 marks)

22. Figure 11 shows a foot-pedal waste bin which includes a mechanical system to open the lid. The pedal is attached at point X. The rod XY has a fixed pivot at the centre.

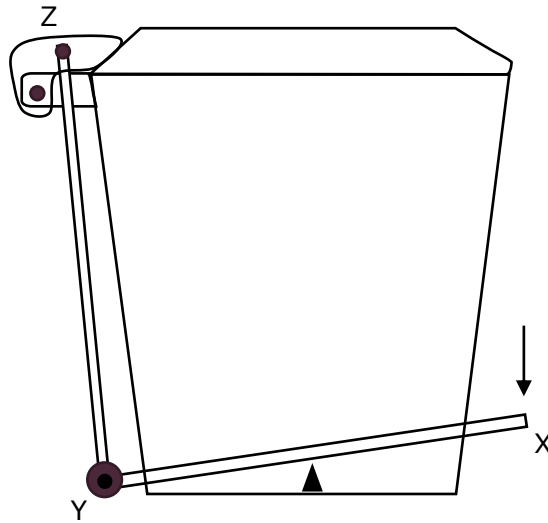


Figure 11

- a. Give **ONE** reason why steel rods were used to fabricate the levers. (1)
- _____
- b. Explain how the mechanical system can be modified to make it easier for the user to press the pedal. (2)
- _____
- _____
- c. On Figure 11, add an arrow to show how point Y moves. (1)
- d. Discuss how an emergent technology concept could be incorporated in the design of the pedal waste bin to improve the product. (2)
- _____
- _____
- e. The foot-pedal bin was redesigned to operate with a microcontroller. The system has a micro-switch under the pedal. When this micro-switch is activated, a series of three LEDs light up sequentially, and a tune plays afterwards.

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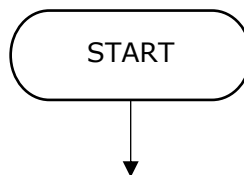
The following is an explanation of the logical sequence of program in the system.

- LED1 turns ON
- Wait 1 second
- LED2 turns ON (LED1 remains ON)
- Wait 1 second
- LED3 turns ON (LED1 and LED2 remain ON)
- Play Tune
- The program starts again once the switch is pressed

Assume the following connection to the microcontroller:

- Micro-switch connected to pin C.3
- LEDs are connected to pins C.0, C.1 and C.4 respectively
- Speaker is connected to pin C.2

In the space provided, use a flowchart to design the microcontroller program according to the given specifications.



(6)

(Total: 12 marks)

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