Index Number:_____ SEC33/1L1-2-3.25m

L-Università ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

SECONDARY EDUCATION CERTIFICATE LEVEL
2025 MAIN SESSION

SUBJECT:	**Design and Technology**
PAPER NUMBER:	I – Level 1-2-3
DATE:	24th April 2025
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.

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

Situation: Throughout the ages, human beings have developed particular interactions with animals. Some of these interactions include humans adopting animals to assist with particular jobs and activities (e.g. petting farms, agriculture, transportation, sport, etc.) or domestic companionship (pets). Improving the animals' conditions leads to a better human-animal interaction. Physical products can be useful to improve or enhance the experience for all those involved.

1. Consider the mind map on Figure 1 which starts exploring the context of the situation.

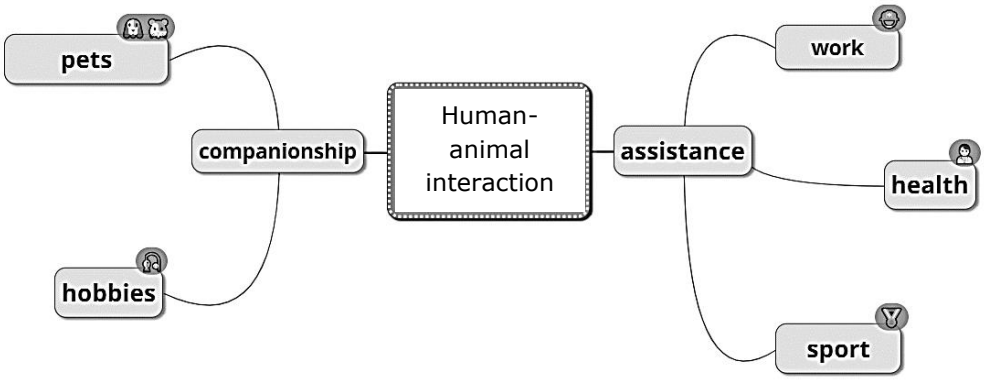


Figure 1

a. Use the mind map on Figure 1 to add **FOUR** more entries which further explore the context of the situation.

(2)

b. From the mind map, choose **ONE** area which can be explored further and identify **FOUR** stakeholders related to this area.

Chosen area:		
Stakeholders:	(½)	(½)
	(½)	(½)

c. Explain the needs of **TWO** of the stakeholders mentioned in question 1b.

Stakeholder 1: _____	(1)
Stakeholder 2: _____	(1)

(Total: 6 marks)

2. Consider products which are already on the market to answer this question.
   a. Sketch **TWO** existing product examples which would satisfy the needs of the stakeholders mentioned in question 1c. Products should be drawn in 3D.

Product Example 1	**Product Example 2**
(1)	(1)

b. On your sketches, highlight and comment about specific features which further satisfy the stakeholders' needs. (2)

(Total: 4 marks)

Please turn the page.

3. Apart from analysing existing product, further research is needed before proposing a design brief.

   a. List **TWO** data sources which can be accessed to gather further information regarding the needs of the stated stakeholders.

   _____

   _____ (1)

   b. Consider the following definition.

> "Creations of the mind, such as inventions; literary and artistic works, designs; and symbols, names and images used in commerce."
>
> *Retrieved 14/01/2025 from https://www.wipo.int/about-ip/en/*

   i. From the list below, circle the term which mostly fit this definition.

data sources	intellectual property	personal data

   (1)

   ii. State what the statement at the bottom of the definition is called.

   _____ (1)

(Total: 3 marks)

4. Write a design brief that includes further needs of the stated stakeholders.

   _____

   _____

   _____

   _____

(Total: 2 marks)

5. Consider the design brief stated in question 4 and previous work done on the situation.
   a. In the space provided, communicate **ONE** detailed design idea which satisfies this design brief.

(4)

   b. Explain how the idea designed in question 5a adds value to the proposed solution.

_____

_____ (1)

(Total: 5 marks)

This question continues on next page.

6. Based on the sketched idea in question 5, fill in the part list shown in Table 1 by:
   a. naming **TWO** parts from the proposed product; (1)
   b. drawing a working sketch of **each** part, including materials and major dimensions; (3)
   c. suggesting **ONE** suitable tool or equipment to manufacture **each** part. (1)

Table 1: Part List

Part Name	Part Drawing	Tool or Equipment

(Total: 5 marks)

7. Refer to the design idea in question 5 and any parts drawn in question 6.
   a. Describe how the product or system is supposed to work when all the parts are put together.

_____

_____

_____

_____ (2)

   b. Give a brief account of the process the designer would have gone through upon designing and making the proposed idea.

_____

_____

_____

_____(2)

(Total: 4 marks)

8. Various CAD-CAM machines can be used in digital manufacturing.

   a. List the machines named below under the correct column in Table 2.

3D printing	milling	vinyl cutting	laser engraving/cutting

Table 2

CNC additive manufacturing	**CNC subtractive manufacturing**	**CNC graphic machines**

(2)

This question continues on next page.

b. State which **ONE** of the CAD-CAM machines listed in Table 2 can be used in the production of the product sketched in question 5. Justify your selection.

_____

_____

_____ (2)

(Total: 4 marks)

9. In the space provided, draw an innovative and appealing chart as a Design Proposal to present the design idea shown in question 5 to the stakeholders.

(Total: 4 marks)

10. In the space provided below, illustrate **ONE** Health and Safety instruction which would guide the user of the proposed idea in question 5.

(Total: 3 marks)

Please turn the page.

11. Consider again the solution presented in question 5 to enhance its aesthetic features.
    a. In the space provided, propose a simple logo for the product. Do **not** include colour at this stage.

(2)

    b. The colour scheme of the logo is set to use complimentary colours.
        i. Name **ONE** warm colour and **ONE** cool colour which are complimentary.

WARM COLOUR: _____

COOL COLOUR: _____ (1)

        ii. Apply these complimentary colours onto the logo sketched in question 11a.

(1)

(Total: 4 marks)

12. Using resources efficiently adds extra value to a product.
    a. List **TWO** ways how to use resources efficiently when producing the idea shown in question 5.

_____

_____

_____

_____ (2)

    b. Explain how using sustainable materials increase the environmental value of the product shown in question 5.

_____

_____

_____

_____ (2)

(Total: 4 marks)

Section B: Answer ALL the questions.

13. Figure 2 shows a tabletop decorative lamp. The lighted part of the lamp is made from sheet acrylic.

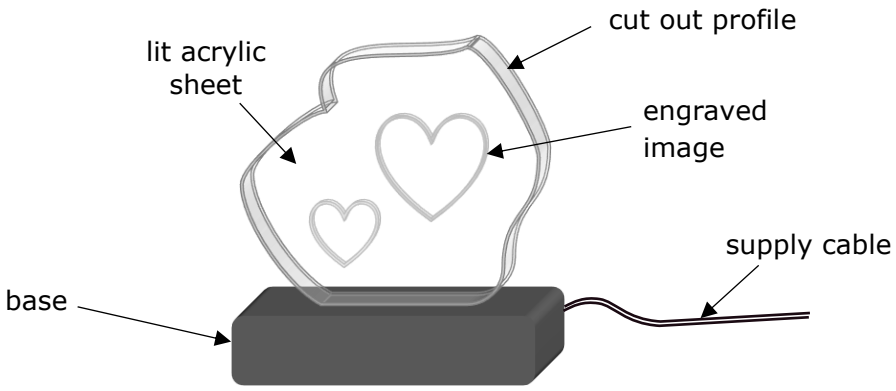


Figure 2

    a. Mention **TWO** properties of acrylic related to the lit part of the lamp.

_____

_____ (2)

This question continues on next page.

b. Describe the manufacturing sequence required to produce the acrylic part of the lamp from scratch using a laser cutting machine. Use a flowchart to illustrate your answer and mention any tools or equipment needed.

(4)

c. Suggest **TWO** procedures which reduce the risks and hazards associated with performing the process in question 13b.

_____

_____

_____ (3)

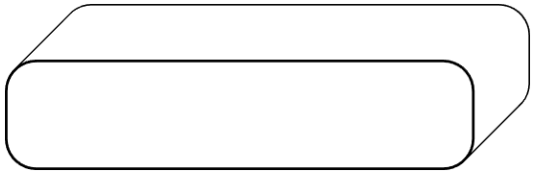
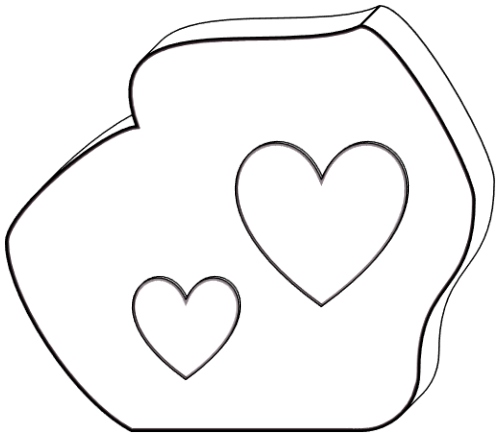
d. Discuss the suitability of digital manufacturing technologies to manufacture the acrylic part of the lamp.

_____

_____ (2)

(Total: 11 marks)

14. Use graphical tools to render the texture of the following parts of the lamp according to the description given.

Matt pine wood base	**Translucent and gloss acrylic upright**
	
(1)	(1)

(Total: 2 marks)

15. Figure 3 shows the development/net design of part of the packaging box for the lamp. Fill in the boxes by naming the types of lines indicated.

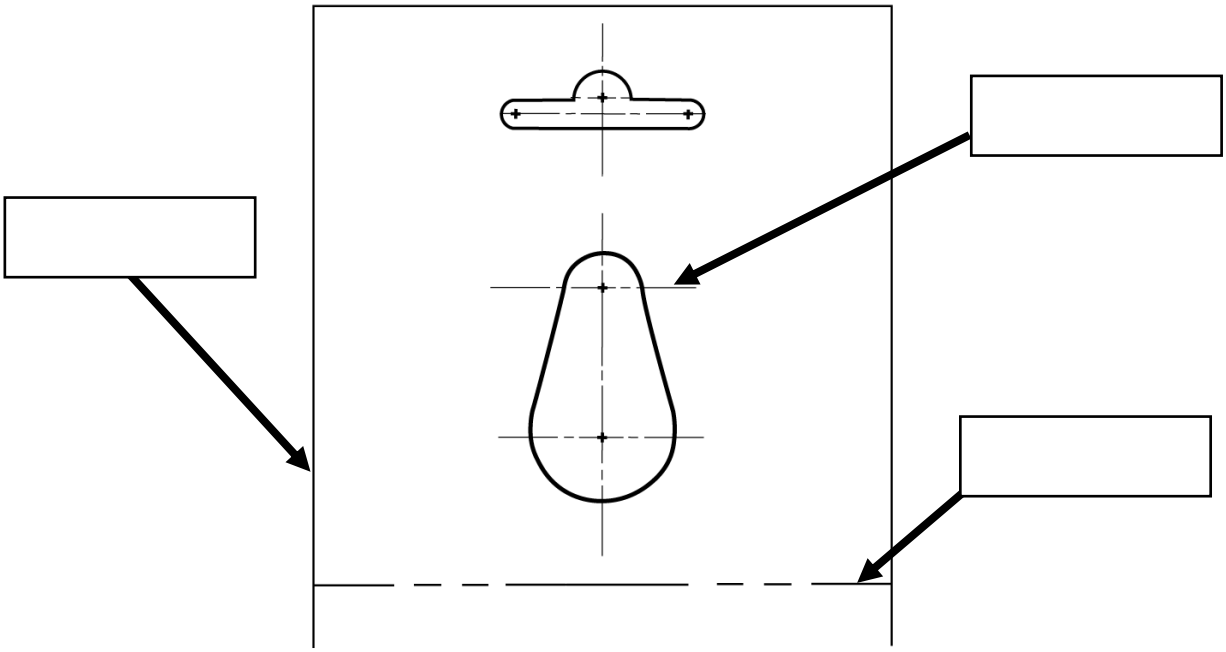


Figure 3

(Total: 3 marks)

16. A group of students are producing the lamp in a workshop. Identify the Health and Safety hazards in the following scenarios and state what the good workshop practice should be.

	Scenario	Health & Safety Hazard	Good Workshop Practice
a.	Student with long loose hair who is using a bench drill	(1)	(1)
b.	Two students trying to utilise a belt sander at once	(1)	(1)
c.	A student started working in the workshop with an untied apron	(1)	(1)

(Total: 6 marks)

17. On Table 3, briefly describe the manufacturing processes that were utilised to produce some parts of the lamp and its packaging.

Table 3

Item being manufactured	Brief description of manufacturing process
vacuum-forming part of the plastic packaging	(2)
soldering the circuit of the lamp	(2)
stencilling the logo on the textile bag which protects the acrylic part in the packaging	(2)

(Total: 6 marks)

18. The lighting system of the lamp shown in Figure 2 consists of an LDR sensor, a microcontroller and an LED. Figure 4 shows an incomplete schematic diagram of the system.

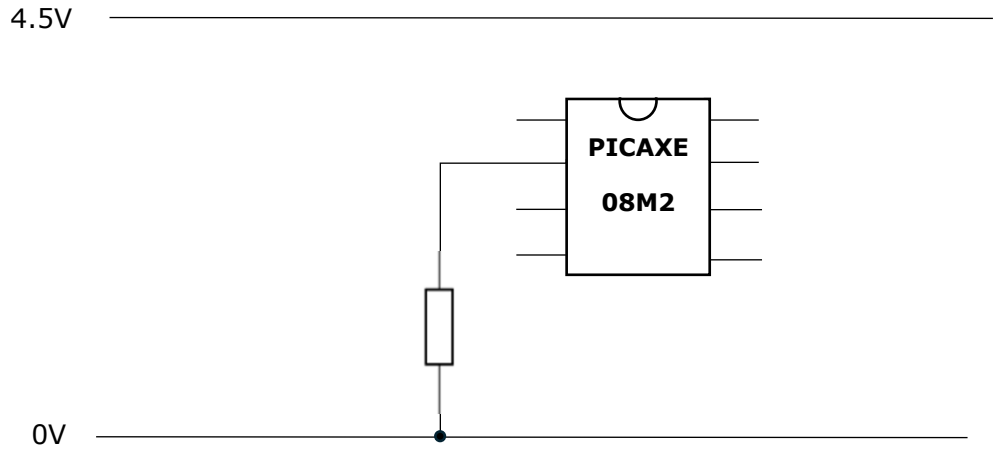
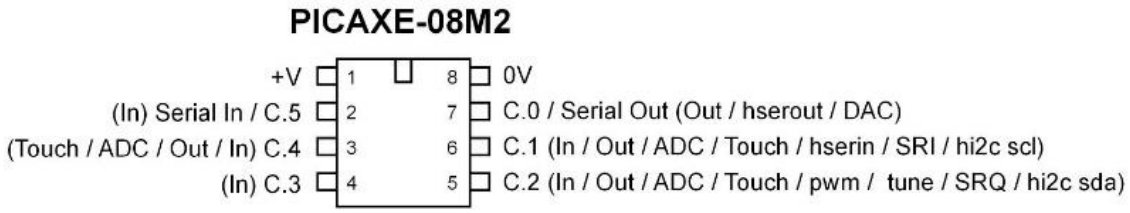


Figure 4

Use the datasheet below to answer the following questions.



a. Connect a potential divider consisting of the LDR and a resistor to an input of the microcontroller. Draw your answer on Figure 4. (2)

b. Complete the circuit by adding the output and power to the IC. (4)

c. Explain how the system can be modified to become more sensitive to darkness.

_____

_____

_____ (2)

(Total: 8 marks)

19. Figure 5 shows the interior of the base of the lamp.

a. Use the phrases in the word bank to label **ALL** the parts mentioned.

PCB	casing	screw terminal connector
mounting screw	integrated circuit	power cable

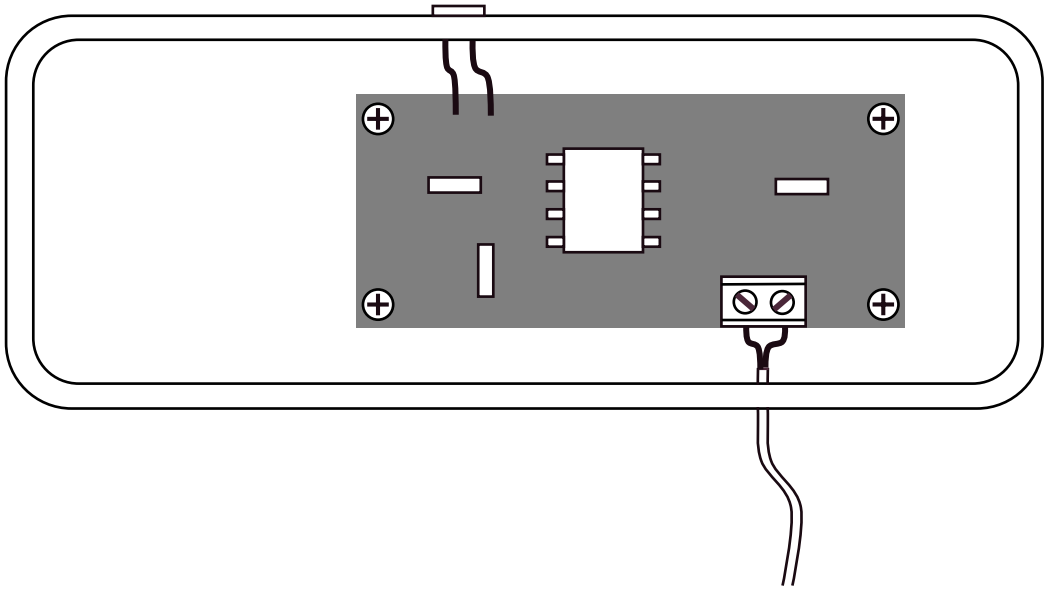


Figure 5

(3)

b. A bench drill is used to drill the holes in the base of the lamp. Name the safety parts of the bench drill depicted in Figure 6.

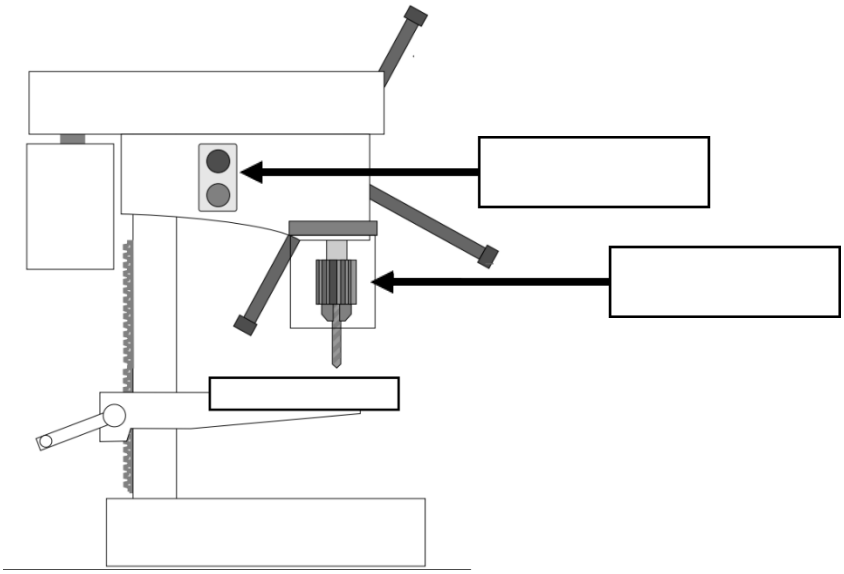


Figure 6

(2)

(Total: 5 marks)

20. The manufacturer of the lamp issued a mechanical upgrade which adds the function of a moving heart shape, themed with the static lamp. Figure 7 shows a mechanical system which makes the shape move.

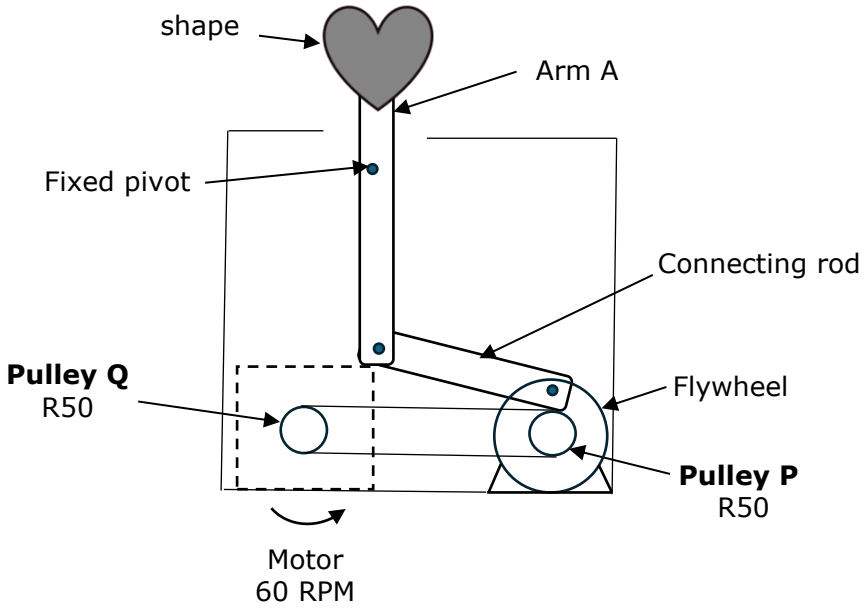


Figure 7

a. State the type of motion which the shape does when the motor rotates.

_____ (1)

b. On Figure 7, indicate the direction of movement of the shape by means of arrows. (1)

c. Arm A and the connecting rod were made of mild steel.

i. Describe the standard form of supply of this material.

_____

_____ (1)

ii. Explain why mild steel was used for these parts. Give **TWO** reasons.

_____

_____

_____ (2)

d. Figure 8 shows an incomplete pulley part of the mechanism shown in Figure 7.
On Figure 8, use sketches and annotations to explain how to make Pulley P rotate at half the motor speed.

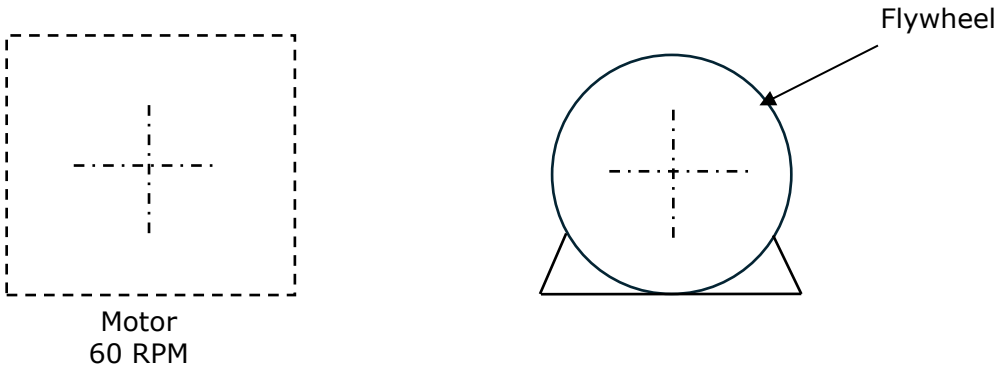


Figure 8

(3)

(Total: 8 marks)

21. Name **ONE** tool, machine or equipment which would be used to complete **each** task described in Table 4.

Table 4

Task	**Name of tool, machine or equipment**
cutting a 50mm hole for the outlet of Arm A	(½)
stitching the textile bag which protects the acrylic part in the packaging	(½)
manually cutting the steel connecting rods	(½)
additive manufacturing of the plastic pulleys	(½)
finishing smoothly the profile of the acrylic upright	(½)
assembling the wooden parts with nails	(½)

(Total: 3 marks)

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MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

SECONDARY EDUCATION CERTIFICATE LEVEL
2025 MAIN SESSION

SUBJECT:	**Design and Technology**
PAPER NUMBER:	II – Level 1-2
DATE:	24th April 2025
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:

$$MA = \frac{Output\ Force}{Input\ Force}$$

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

1. Table 1 shows the main stages of the broad design process and their descriptions. Match the stages with their respective descriptions by writing the stage number in empty column.

Table 1: Main Stages of the Broad Design Process

Stage			Description
1	Explore		Providing visual solutions to a given situation.
2	Design		Learning about a newly presented situation.
3	Make		Finalise improvements and modifications.
4	Evaluate		Building and testing a chosen design idea.

(Total: 2 marks)

2. Fill in the blanks by using the terms from the word bank below.

prediction	functionality	validity	usability

a. _____ tests are used to check specific parts of a prototype, while _____ tests are applied to see how users feel when handling the product.

b. A _____ refers to a statement outlining how something is expected to perform within a design task.

c. The _____ of a test refers to whether a test was fairly designed and performed.

(Total: 2 marks)

3. Figure 1 below shows a 2D sketch of a toy controller.

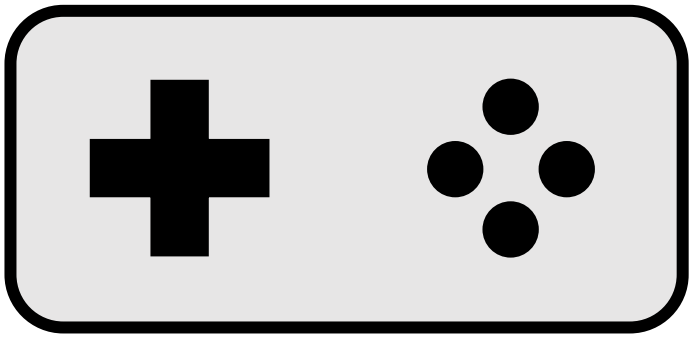


Figure 1

a. In the space provided below draw this controller in 3D showing some thickness.

(2)

b. On the 3D sketch of the controller, show a key feature by adding an annotation. (1)

(Total: 3 marks)

4. Suggest how a designer could build:

a. a physical mock-up of a linkage system:

_____ (1)

b. a digital model of an electronic circuit:

_____ (1)

(Total: 2 marks)

Please turn the page.

5. Put **each** joining methods in the word bank near the corresponding heading in Table 2.

mitre joint	soldering	adhesives
plain seam	dowel joint	french seam

Table 2

Type of assembly	**Joining Methods**	
Heat joining		
Mechanical joining		
Fabric joining		
Chemical joining		

(Total: 2 marks)

6. Underline the correct answer in the brackets.

   From the various types of manufacturing processes, engraving is a (cutting / wasting / deforming) process, while line bending is a (cutting / wasting / deforming) process.

(Total: 1 mark)

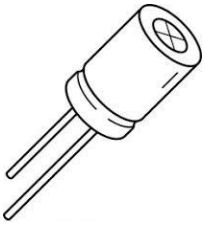
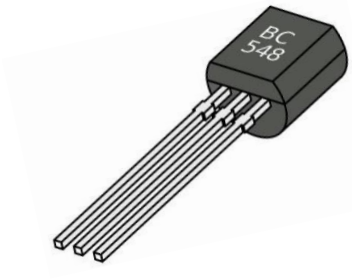
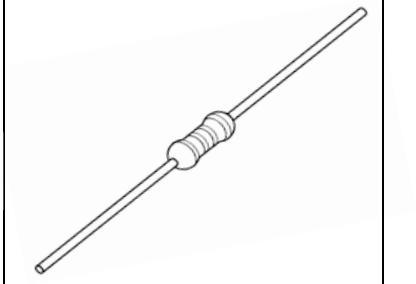
7. List **ONE** advantage and **ONE** disadvantage of using microcontrollers in an electronic system.

Advantage	
Disadvantage	

(Total: 2 marks)

8. Name the components shown in Table 3.

Table 3

Diagram			
Name			

(Total: 3 marks)

9. Use the following word bank to fill in the blanks. Some phrases are to remain unused.

truth table	binary inputs	a binary output
logic circuit	a binary input	binary outputs

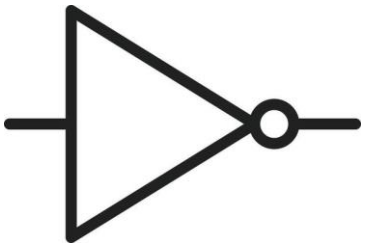
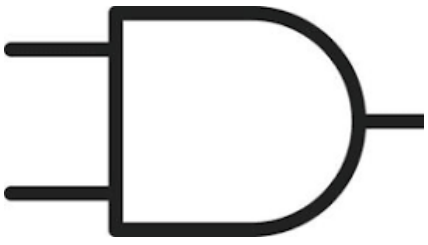
a. Logic gates take _____ to produce _____.

b. Combing several logic gates together forms a _____ which is designed to carry out a specific function.

c. The result of the output from a logic gate or logic circuit is shown by a _____.

(Total: 2 marks)

10. Name the logic gates shown below.

(Total: 2 marks)

Please turn the page.

11. Explain how to scale a raster image in an image editing software.

_____

_____

(Total: 2 marks)

12. Name **ONE** PPE to wear when making use of a soldering iron.

_____

(Total: 1 mark)

13. In the space provided below, use sketches to describe **TWO** standard forms of supply of materials.

	Standard form 1	**Standard form 2**
Name		
Sketch		

(Total: 3 marks)

14. Describe **ONE** distinctive property of the following materials:

    a. Stainless steel:

    _____ (1)

    b. Gold:

    _____ (1)

(Total: 2 marks)

15. Figure 2 below illustrates a particular wood.

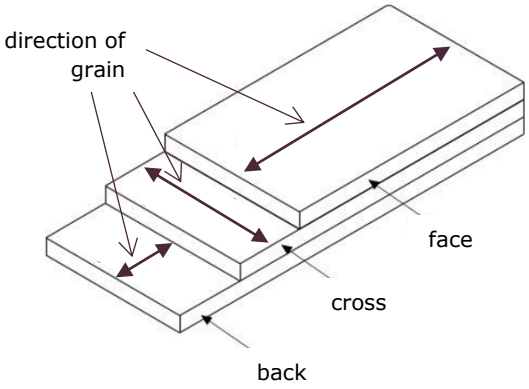


Figure 2

Give the name of this wood material, based on its composition: _____

(Total: 1 mark)

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

Read carefully the following theme and situation.

Theme: Families on the move

Situation: Families often face challenges while travelling, especially when accompanied by toddlers. Long journeys whether by car, plane, or bus can be stressful for parents as young children may become restless and agitated. Toddlers require engaging toys that are safe, portable, and age-appropriate to keep them occupied during these trips. Moreover, these toys are a great opportunity to teach the toddlers something new about transport and technology.

16. Answer the following questions by referring to the situation above.

    a. List **TWO** examples of data sources that could provide information about how the product should be designed.

    _____ (1)

    b. State **ONE** appropriate tool that could be used to collect the data retrieved from one of the mentioned data sources.

    _____ (1)

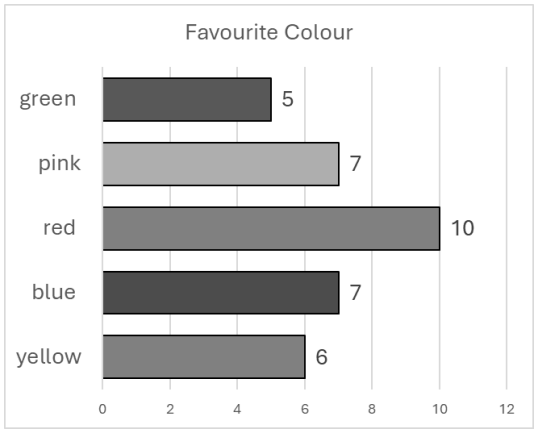
    c. Describe the tool mentioned in question 16b.

    _____

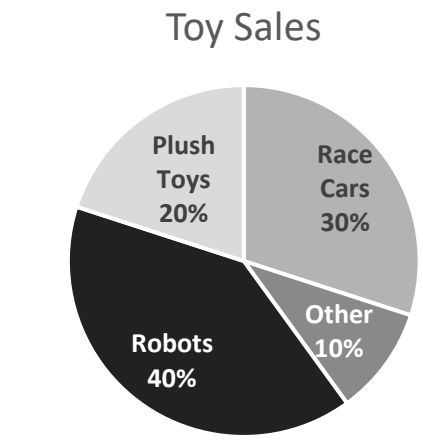
    _____ (2)

(Total: 4 marks)

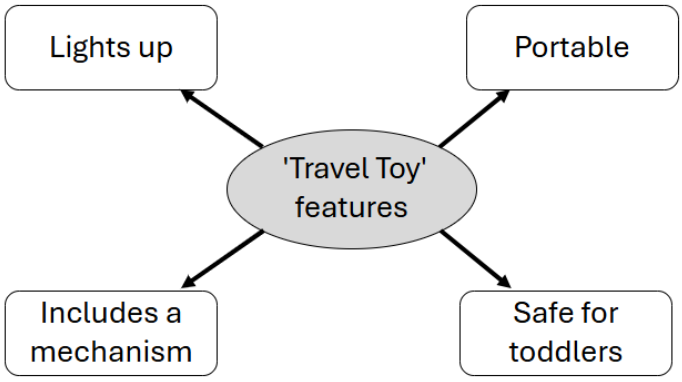
17. Further work on the collection of data is used to prepare the design brief for this project.
    a. The collected data was represented in a number of infographics. State the name of **each** infographic.



(A)_____



(B)_____



(C)_____

(3)

    b. Identify the following specific information from the infographics provided in question 17a.

    i. Children's favourite colour: _____ (1)

    ii. Most sold toy: _____ (1)

c. Write **TWO** different specifications for the travel toy based on the data shown above.

_____

_____

_____

_____ (2)

d. Complete the following statement to create a suitable and marketable design brief by referring to the explored situation and the specifications listed in questions 16 and 17.

Design and make an engaging _____

suitable for _____

_____

_____

_____ (3)

(Total: 10 marks)

18. Referring to the specifications in question 17c and the design brief in question 17d, draw **TWO** different initial ideas in the space provided. Each sketch should be in 3D and include colour, annotations and dimensions.

This question continues on next page.

Idea 1

(5)

Idea 2

(5)

(Total: 10 marks)

19. Choose **ONE** of your ideas from question 18 and write your choice below.

Idea Number: _____

a. State **ONE** advantage and **ONE** disadvantage for the idea you have chosen when compared to the specifications and design brief listed in questions 18c and 18 d.

Advantage:	_____ _____ _____ (1)
Disadvantage:	_____ _____ _____ (1)

b. Modify your chosen idea so that it better addresses the disadvantage mentioned. The sketch should be in 3D and include colour, annotations and dimensions.

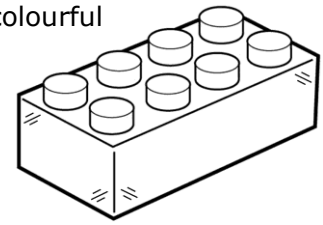
Modified chosen idea:

(3)

(Total: 5 marks)

20. Table 4 shows two toys currently available on the market.

Table 4

glossy, smooth and colourful 	natural grain 
Toy 1	Toy 2

a. Name **ONE** suitable material to make the toys shown in Table 4:

Material of Toy 1: _____(1)

Material of Toy 2: _____(1)

b. State **ONE** physical or mechanical property of **each** chosen material in Question 20a.

Material property of Toy 1: _____ (1)

Material property of Toy 2: _____ (1)

(Total: 4 marks)

21. A variety of tools and machines were used to create the toy shown in Figure 3.

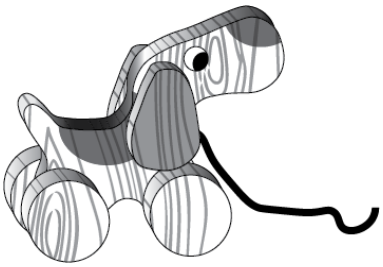
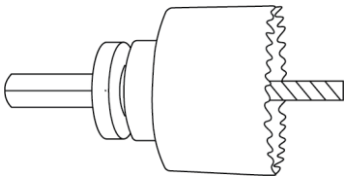
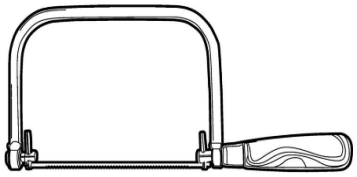
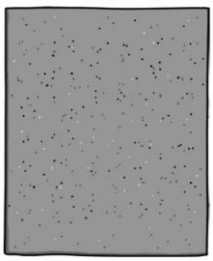
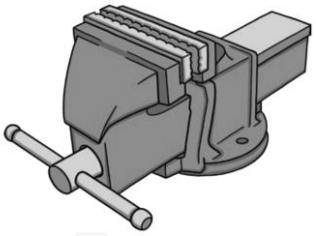
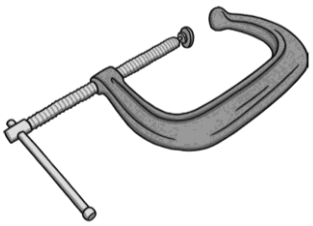


Figure 3

This question continues on next page.

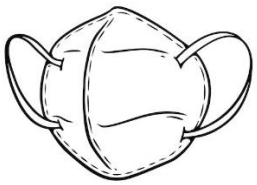
a. Write the name of the following tools under the respective picture.

 _____	 _____	 _____
 _____	 _____	 _____

(3)

b. Table 5 contains images of some of the PPE that was worn while sanding the edges of Toy 2. Write the name of **each** PPE below its picture.

Table 5

 _____	 _____	 _____

(3)

c. Mention **TWO** types of finishes that could be applied to the toy in Figure 3.

Finish 1: _____

Finish 2: _____ (1)

(Total: 7 marks)

22. A toy manufacturing company specialises in creating interactive toy vehicles for toddlers to play with during travel, such as the one presented in Figure 4.

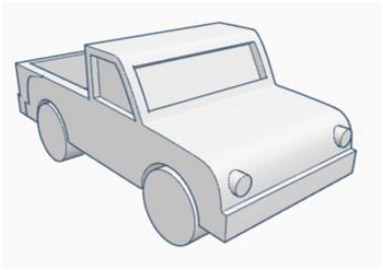
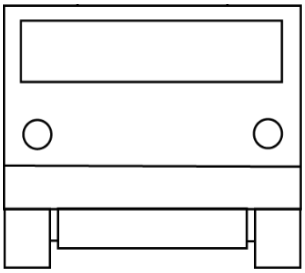


Figure 4

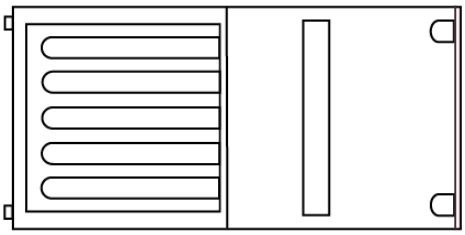
a. Identify the front and plan views of the toy truck in the views below.

View 1



_____

View 2



_____

(1)

b. The toy truck in Figure 4 could be made of HIPS, which is a type of thermoplastic.

i. Give the meaning of HIPS.

H_____-I_____ P_____ (1)

ii. State **ONE** environmental benefit of using thermoplastics rather than thermosetting polymers.

_____

_____ (2)

This question continues on next page.

c. Figure 5 shows the mould of a toy vehicle to be manufactured in industry.

i. Circle the correct manufacturing process which requires such a mould.

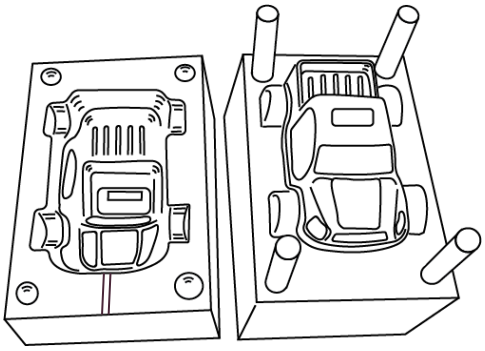


Figure 5

line bending	injection moulding	extrusion

(1)

ii. Identify other manufacturing process which can be used to produce the toy vehicle shell from HIPS.

_____ (1)

(Total: 6 marks)

23. Consider again the toy car in Figure 4. Describe the tests that could be conducted to check:

a. the durability of the toy:

_____

_____ (1)

b. the mechanism of the toy:

_____

_____ (1)

c. whether the chosen colours are attractive enough:

_____

_____ (1)

d. the safety of the toy:

_____

_____ (1)

(Total: 4 marks)

24. A toy racing car's packaging is designed to showcase part of the car to customers through a window cutout. The packaging development/net is shown in Figure 6.

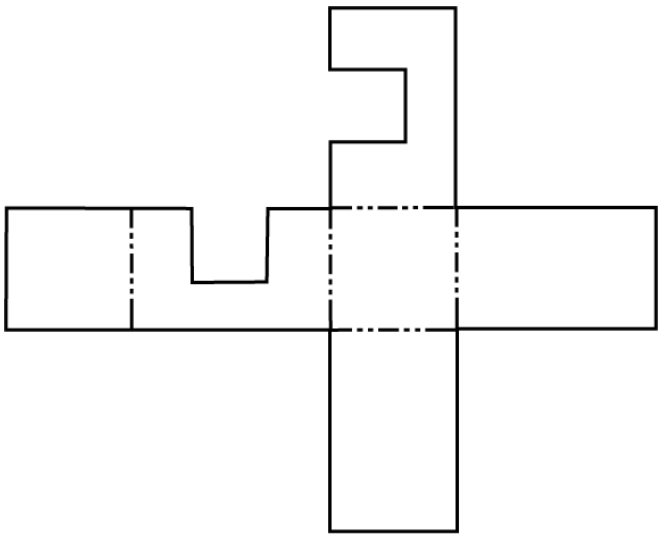
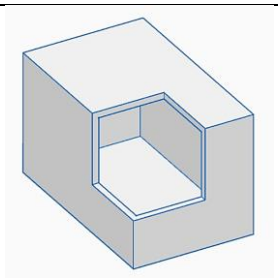
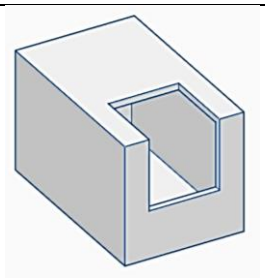
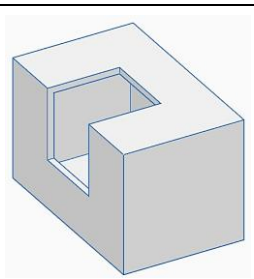


Figure 6

a. Identify which of the following 3D drawings represents the folded version of the development/net in Figure 6 by ticking the correct box.

 ☐	 ☐	 ☐

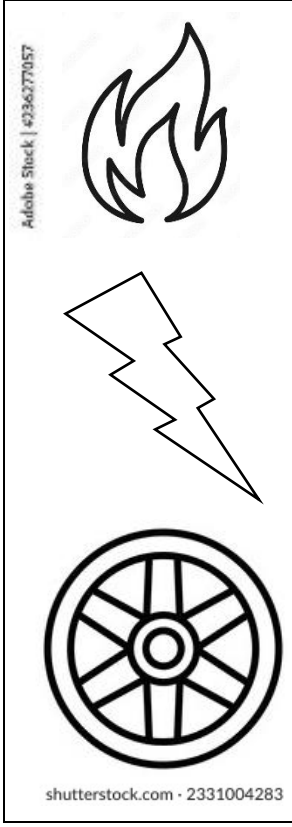
(2)

b. Inside the toy car's package, there was a sheet of decals for the child to decorate their toy car. Mention **ONE** graphic CNC machine capable of cutting these decals made from thin sheets of polymer.

_____ (1)

This question continues on next page.

c. By using the shapes given, sketch a logo for the toy racing car. You do **not** need to use all shapes. Choose an appropriate colour scheme for the logo.

Shapes to Combine	**Logo for toy racing car**
	

(4)

(Total: 7 marks)

25. This time, the toy manufacturers created a toy crane that functions with a pulley system as illustrated in Figure 7. The hook attached at the end of the cable goes up and down when a child manually rotates the crank in different directions.

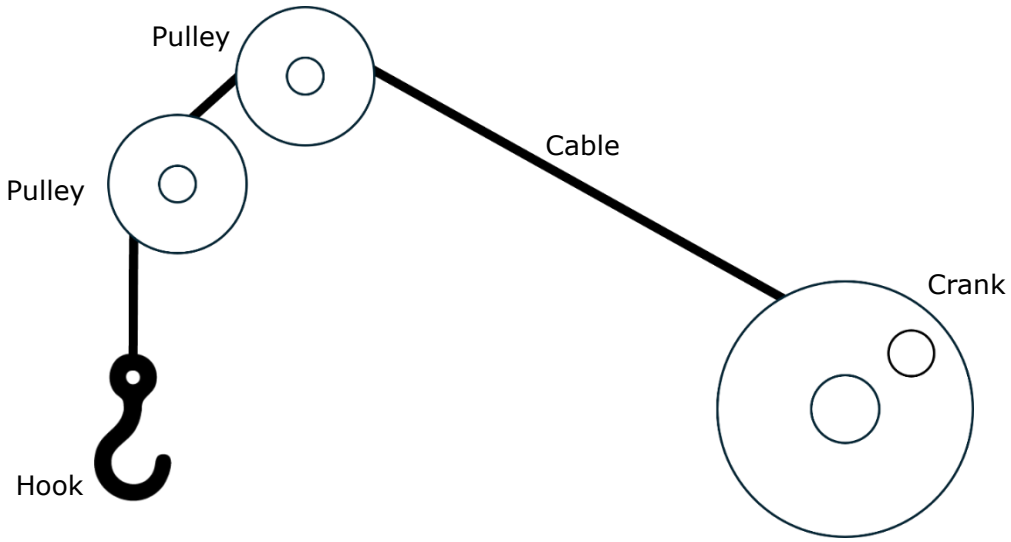
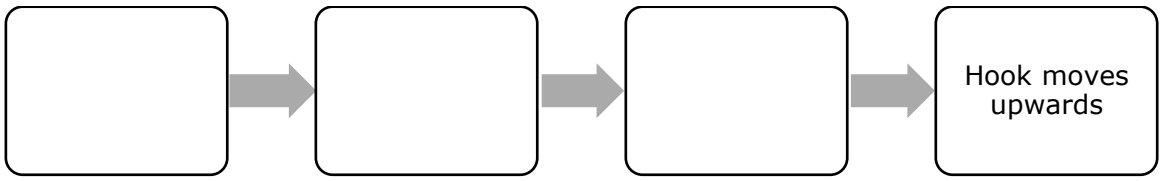


Figure 7

a. Describe how the hook moves upwards by completing the block diagram below. Include the direction of movement of both pulleys and crank.



(3)

b. The mechanical advantage of the pulley system is 1. Calculate the force needed to be exerted by a child playing with the crane if the load on the hook is 2 N.

(2)

(Total: 5 marks)

26. The manufacturers of the toy crane decided to make the crane move by using a microcontroller system. Figure 8 shows the schematic diagram of the circuit.

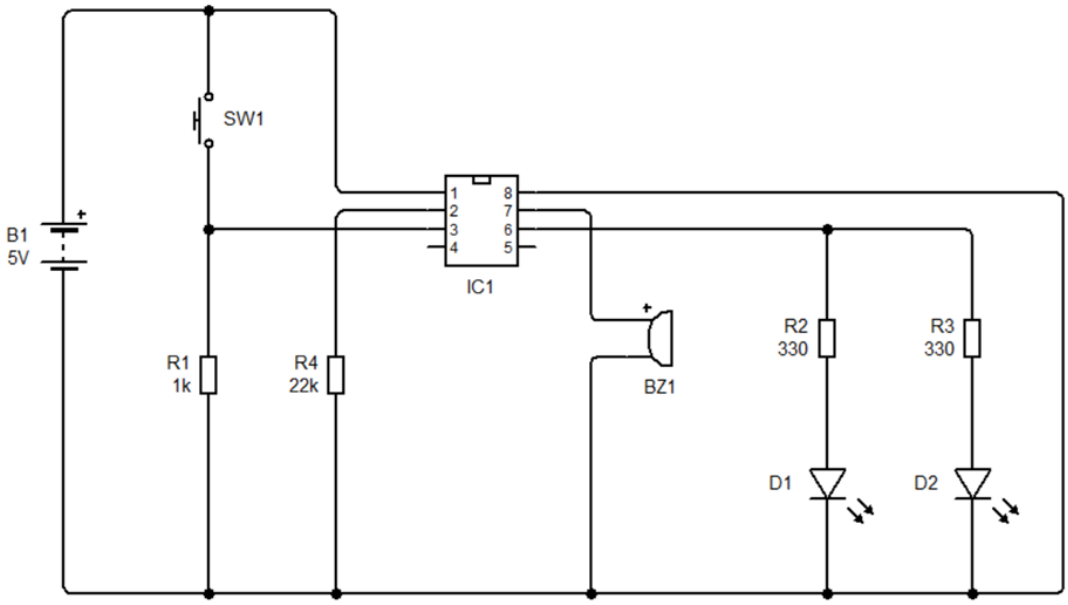


Figure 8

a. Name the components labelled as:

B1: _____ R1: _____

BZ1: _____ SW1: _____ (2)

This question continues on next page.

b. Study the information given in Figure 9.

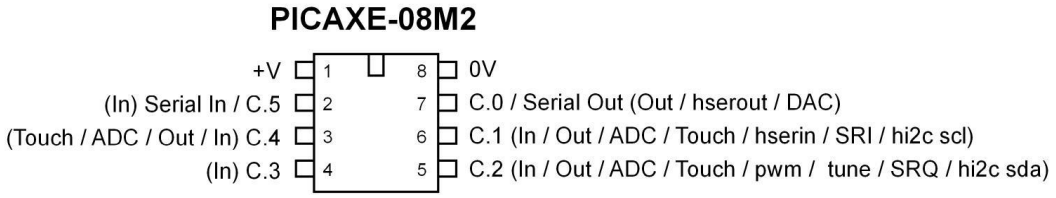
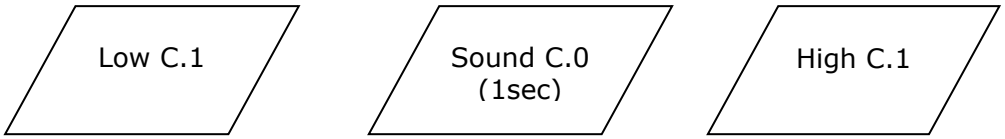


Figure 9

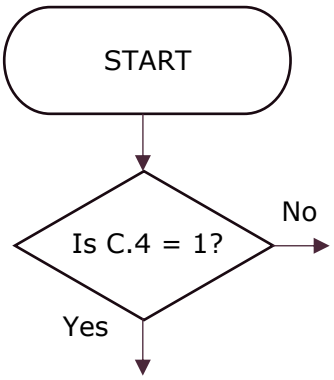
State the code of the pin where the following components are connected according to the circuit in Figure 8:

LEDs:_____ Switch: _____ (1)

c. The microcontroller system works as follows:
- Whenever the switch is pressed, two LEDs light up and a beeping sound is made every 1 second.
- All outputs stop whenever the switch is released.



Use the above given commands to complete the program below and achieve the required control.



(5)

(Total: 8 marks)

Index Number:_____ SEC33/2L2-3.25m

L-Università ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

SECONDARY EDUCATION CERTIFICATE LEVEL
2025 MAIN SESSION

SUBJECT:	**Design and Technology**
PAPER NUMBER:	II – Level 2-3
DATE:	24th April 2025
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:

$$V_T = V_1 + V_2 + \cdots$$

$$V = I \times R$$

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

1. Table 1 shows the main stages of the broad design process and their descriptions. Match the stages with their respective descriptions by writing the stage number in empty column.

Table 1: Main Stages of the Broad Design Process

Stage			**Description**
1	Explore		Providing visual solutions to a given situation.
2	Design		Learning about a newly presented situation.
3	Make		Finalise improvements and modifications.
4	Evaluate		Building and testing a chosen design idea.

(Total: 2 marks)

2. Fill in the blanks by using the terms from the word bank below.

prediction	functionality	validity	usability

a. _____ tests are used to check specific parts of a prototype, while _____ tests are applied to see how users feel when handling the product.

b. A _____ refers to a statement outlining how something is expected to perform within a design task.

c. The _____ of a test refers to whether a test was fairly designed and performed.

(Total: 2 marks)

3. Figure 1 shows an initial sketch for a toy controller.

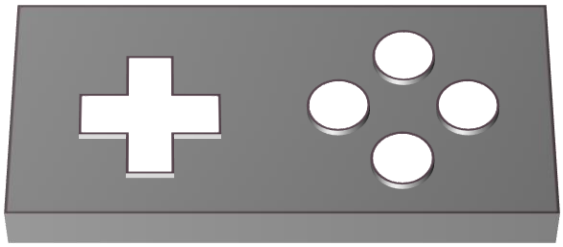
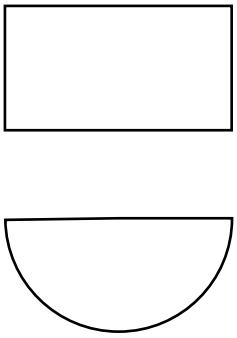


Figure 1

a. Redesign the outer form of the controller by using the two shapes shown in Table 2 and refining further. Present your sketch in 3D on the same table.

Table 2

Shapes to Combine	**3D sketch of new toy controller**
	

(2)

b. Add annotations on the new design sketched in question 3a to explain **ONE** function of the controller. (1)

(Total: 3 marks)

4. Describe **ONE** effective way how to communicate the marketability of a design to stakeholders.

_____

_____

(Total: 1 mark)

Please turn the page.

5. Suggest how a designer could build:

   a. a physical mock-up of a linkage system:

   _____ (1)

   b. a digital model of an electronic circuit:

   _____ (1)

   (Total: 2 marks)

6. Give **ONE** reason why:

   a. a french seam is used when joining a light and transparent fabric:

   _____(1)

   b. screws are preferred over nails when joining chipboard parts:

   _____(1)

   (Total: 2 marks)

7. Complete the truth table for the logic gate in Figure 2.

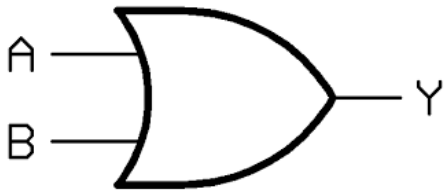


Figure 2

Table 3: Truth Table

INPUTS		OUTPUT
A	B	Y

(Total: 2 marks)

8. Explain why a transistor was used in the system shown in Figure 3.

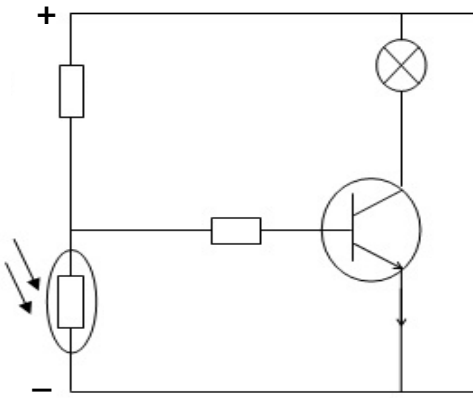


Figure 3

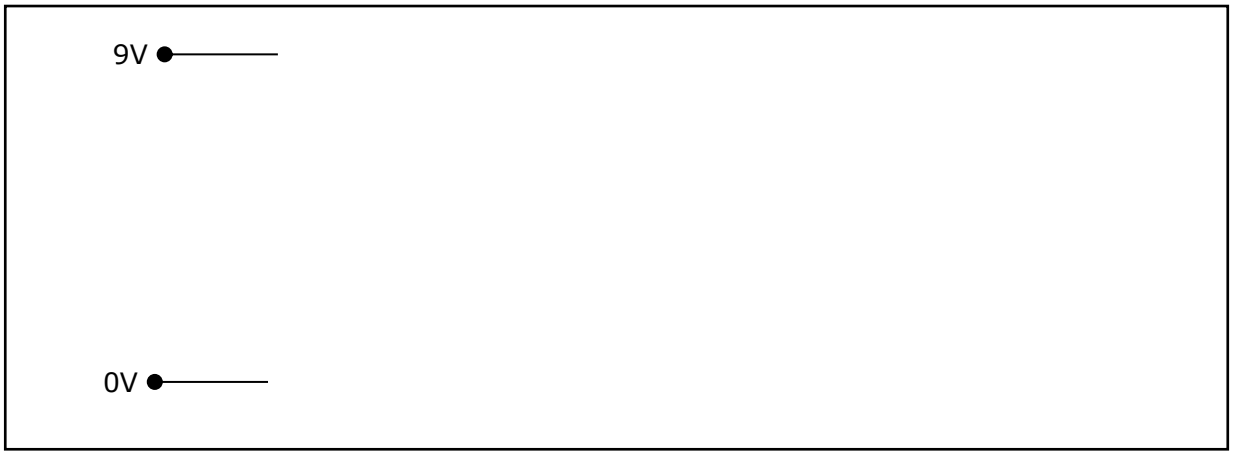
_____

_____

(Total: 2 marks)

9. An electronic system is made up of the following components:
   - SPST switch
   - 330Ω resistor
   - LED

   In the space provided, design a functional labelled schematic circuit diagram using these components to produce a simple LED lighting system. The power supply has been given.



(Total: 3 marks)

10. Draw a general block diagram to illustrate what a closed-loop system is.

(Total: 2 marks)

11. Explain how to scale a raster image in an image editing software.

_____

_____

(Total: 2 marks)

12. Name **ONE** PPE to wear when making use of a soldering iron.

_____

(Total: 1 mark)

13. In the space provided below, use sketches to describe **TWO** standard forms of supply of materials.

	Standard form 1	**Standard form 2**
Name		
Sketch		

(Total: 3 marks)

14. Describe **ONE** distinctive property of the following materials:

a. Stainless steel:

_____ (1)

b. Gold:

_____ (1)

(Total: 2 marks)

15. Figure 4 below illustrates a particular wood.

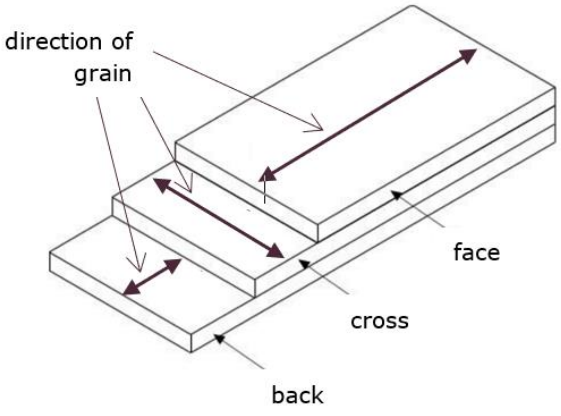


Figure 4

Give the name of this wood material, based on its composition: _____

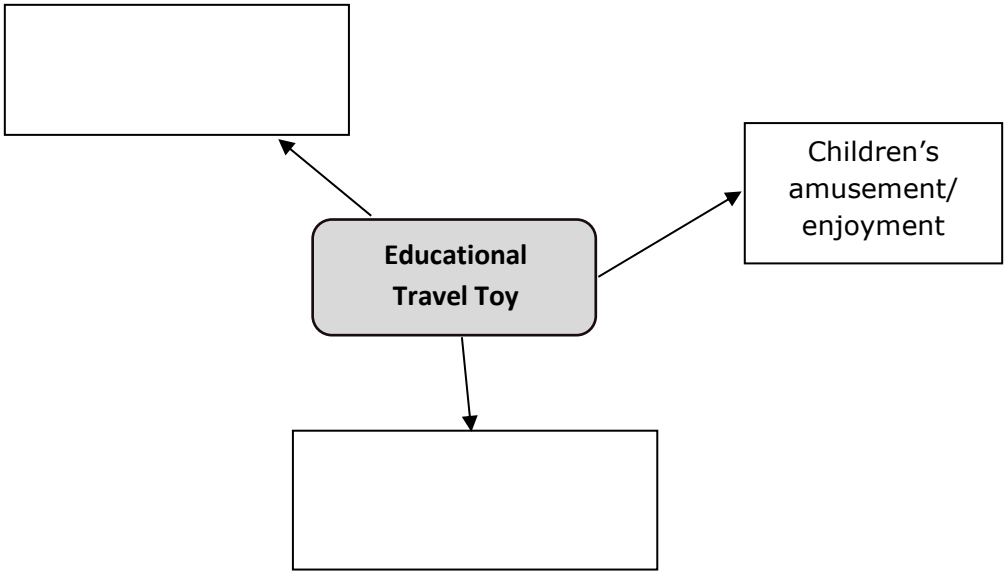
(Total: 1 mark)

Section B: Answer all questions. This section carries 70 marks.
READ the following theme and situation carefully before answering this section.

Theme: Families on the move
Situation: Families often face challenges while travelling, especially when accompanied by toddlers. Long journeys – whether by car, plane, or bus – can be stressful for parents as young children may become restless and agitated. Toddlers require engaging 'Travel Toys' that are safe, portable, and age-appropriate to keep them occupied during these trips. Moreover, these toys are a great opportunity to teach the toddlers something new about transport and technology.

16. Answer the following questions by referring to the situation above.

a. Complete the following web diagram, to explore further needs which are **not** stated in the situation. One example has been provided. (1)



b. State **ONE** of the needs of the **each** of following stakeholders, and explain why this is an important aspect to consider.

i. Manufacturer:

_____

_____(1.5)

ii. Parents/Guardians:

_____

_____(1.5)

This question continues on next page.

c. Write a suitable and marketable Design Brief mentioning the stakeholders' needs.

_____

_____

_____ (3)

d. Write **ONE** specification referring to **each** of these product aspects:

i. Aesthetic:

_____

_____ (1)

ii. Educational:

_____

_____ (1)

iii. Functional:

_____

_____ (1)

(Total: 10 marks)

17. Referring to the situation in Section B, Table 4 shows last year's sales for a toy company which manufactures different travel toys for toddlers.

Table 4

Toys	**Shape sorter**	**Board Games**	**Stuffed animals**	**Puzzles**	**Mechanical toys**
Total Sales in thousands of € for 2024	600	400	700	500	1000

a. Explain why the data shown in Table 4 is relevant for the design situation.

_____

_____(1)

b. Identify the toy that made the least sales in 2024 according to Table 4.

_____(1)

c. Use **ONE** adequate tool to organise and communicate effectively the data shown in Table 4. Draw your answer in the space provided below.

(4)

(Total: 6 marks)

Please turn the page.

18. Refer to the situation, design brief and specifications identified in question 16.
    a. Sketch **TWO** different design ideas, including dimensions and annotations. Your design should be drawn in the space provided as Idea 1 and Idea 2.

IDEA 1

(5)

IDEA 2

(5)

b. Choose between the two solutions and give **TWO** reasons for your choice.

Chosen Idea: _____

Reason 1: _____

_____ (1)

Reason 2: _____

_____ (1)

c. In the space provided below, develop further improvements on the chosen design idea to extend its sustainability factor. Use sketches and annotations.

(3)

d. Write a modified design brief which reflects the further developments in the design idea shown in question 18c.

_____

_____

_____ (2)

(Total: 17 marks)

19. When placing products on the market, manufacturers are required to provide information about the products' use and care.
    a. Write **ONE** instruction related to safe use of the product developed in question 18c.

    _____

    _____ (1)

    b. Write **TWO** instructions related to the maintenance of the developed product in question 18c.

    _____

    _____

    _____ (2)

    c. Explain the importance of being ethical with regards to data protection and referencing when writing any part of the design documentation.

    _____

    _____ (1)

(Total: 4 marks)

20. The supply voltage of the circuit shown in Figure 5 is 4.5 V. The voltage drop across the LED is 1.2 V while the optimal forward current is 20 mA.

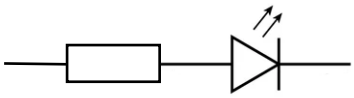


Figure 5

    a. Calculate the value of the resistor connected to the LED.

(3)

This question continues on next page.

b. Consider that only the following resistor values are available in stock.

130 Ω	270 Ω	270 kΩ	330 kΩ

i. Circle the most suitable resistor value to match the calculation you have done in question 21a. (0.5)

ii. Explain your choice of resistor value.

_____

_____(1.5)

(Total: 5 marks)

21. Toys can be made of different materials.
Give the origin and class of the materials stated in Table 5.

Table 5

Material Name	Origin	Class
mild steel		
oak		
ABS		

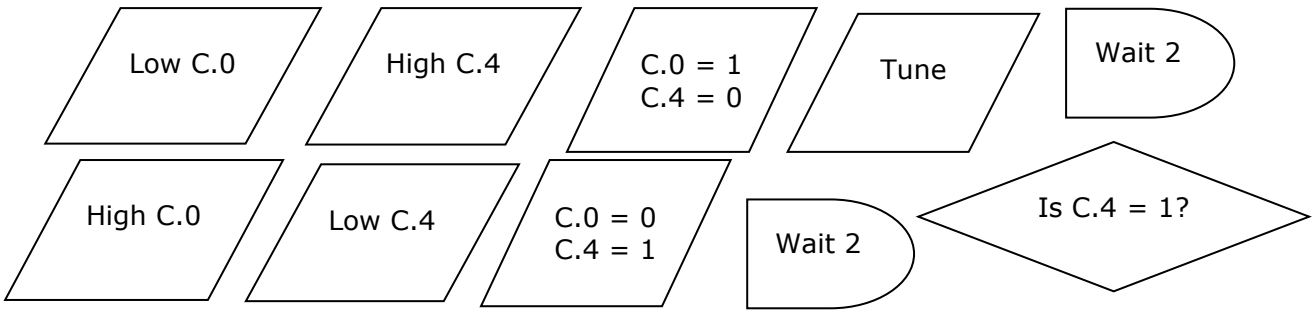
(Total: 3 marks)

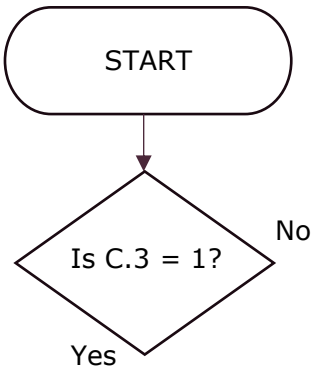
22. A toy truck was proposed to the manufacturer. The toy includes a non-latching switch, which should be operated by the toddler. The switch gives a signal to a microcontroller system which then gives the following output in sequence:
- LED 1 turns ON for 2 seconds;
- LED 1 turns OFF and LED 2 turns ON for another 2 seconds;
- LED 2 turns OFF and a recorded tune plays.

The program starts again once the switch is pressed again.

Assume that the switch is connected to C.3 and that the LEDs are connected to C.0 and C.4.

Use the following commands to complete the microcontroller program. **Not all** commands have to be used.





(Total: 5 marks)

23. Figure 6 shows a disk cam which is attached to the rear axle of a toy truck. The cam rotates to move a flat follower up and down through a slider.

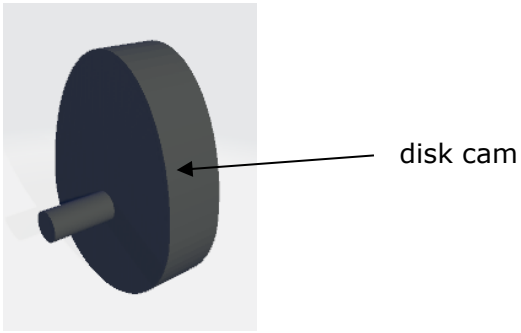


Figure 6

a. Complete Figure 7 to describe the input, process and output of the cam system.

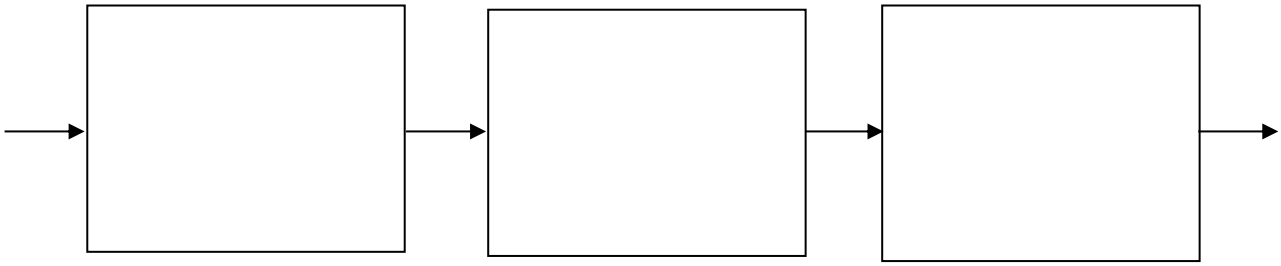


Figure 7 (3)

b. While moving up and down, the follower also needs to rotate.
Complete the front elevation in Figure 8 to show how the cam and camshaft need to be positioned in order to achieve the rotation and reciprocation of the follower. (3)

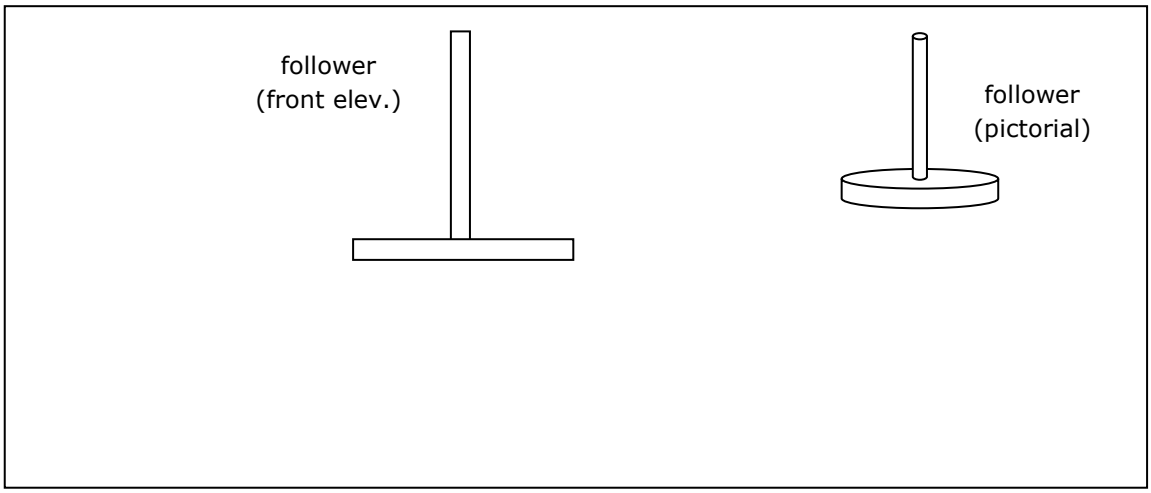


Figure 8

c. Give **ONE** reason why a flat follower was chosen for the toy truck instead of a roller follower.

_____

_____ (2)

d. Give **ONE** reason for selecting rough-textured ABS to manufacture the disk cam.

_____ (2)

e. A prototype of the disk cam can be manufactured in a D&T workshop using other materials. Describe, in a logical sequence, the steps involved to produce the profile of the cam. Mention any materials, tools or equipment that are needed in the process.

_____

_____

_____

_____

_____

_____ (3)

(Total: 13 marks)

24. A design of a cardboard packaging for the toy truck was proposed. The packaging includes a transparent viewing window to see the toy inside the box. Figure 9 shows the outside 3D projection of the cardboard packaging box for the toy with the cutout for the viewing window.

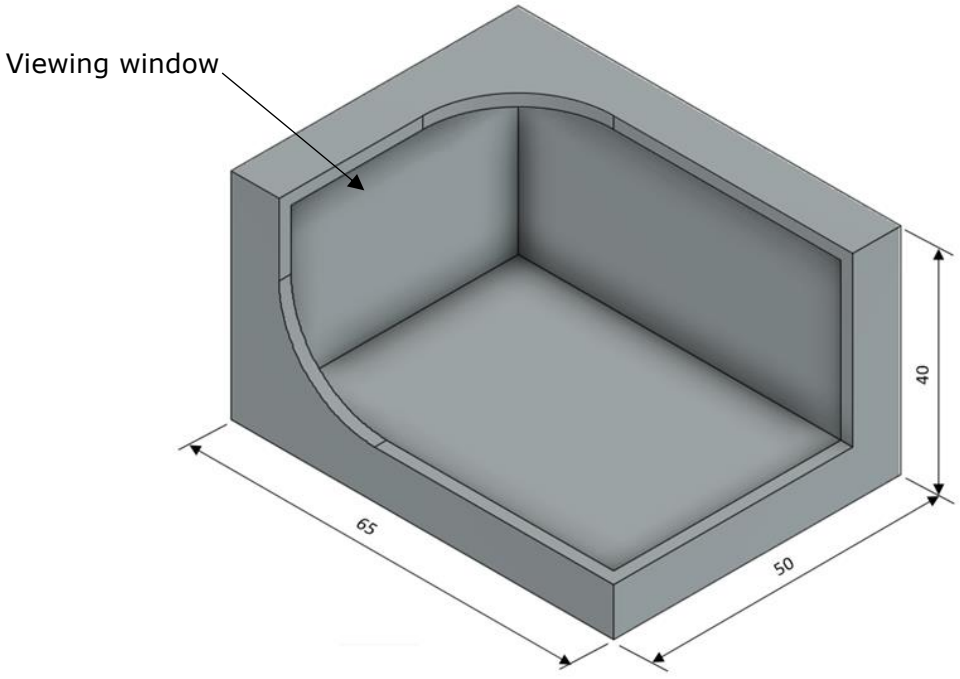


Figure 9

This question continues on next page.

a. In the space provided, draw an estimated working sketch of the FRONT ELEVATION and END ELEVATION of the cardboard box, including the cutout of the window.
Add dimensions and label the elevations. Keep the drawing in proportion.

(4)

b. The packaging is to be developed from a single cardboard sheet.
Starting from the given faces in Figure 10, sketch an estimated, proportional surface development of the packaging. Mark **ALL** folding lines and outlines. Do **not** add glue flaps.

(3)

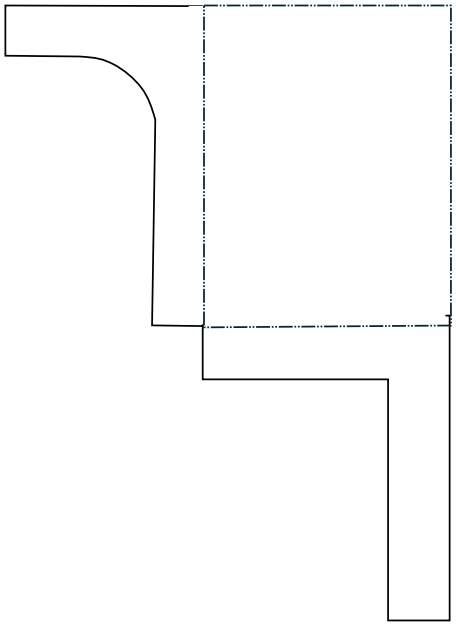


Figure 10

(Total: 7 marks)

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