



L-Università
ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

**SECONDARY EDUCATION CERTIFICATE LEVEL
2023 MAIN SESSION**

SUBJECT: **Design and Technology**
 PAPER NUMBER: IIA
 DATE: 9th May 2023
 TIME: 9:00 a.m. to 11:05 a.m.

Instructions

Answer **ALL** questions in **ALL** sections.

Non-programmable calculators and drawing instruments are allowed.

Show **ALL** the working for mathematical calculations.

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

Useful Information

Formulae:

$$P = I \times V$$

$$\text{Moments} = \text{Force} \times \text{Distance} = Fd$$

$$V_T = V_{T1} + V_{T2} + V_{T3}$$

Colour	Band A	Band B	Band C	Band D
Black	0	0	X 1	
Brown	1	1	X 10	
Red	2	2	X 100	
Orange	3	3	X 1000	
Yellow	4	4	X 10000	
Green	5	5	X 100000	
Blue	6	6	X 1000000	
Violet	7	7	X 10000000	
Grey	8	8	X 100000000	
White	9	9	X 1000000000	
Gold	-	-	-	5%
Silver	-	-	-	10%

Read the following theme and situation carefully before answering this paper.

Theme: Fun at the Mall

Situation: A new shopping mall will set up an interactive kid’s playing area, allowing families with young children a space to recreate themselves in an imaginary setting. The playing area theme can change from time to time and must include various, safe, and interactive games children can play or ride.

SECTION A: CORE DESIGN & TECHNOLOGY PRINCIPLES

1. This question is about stakeholders.

a. Define the term stakeholders.

_____ (1)

b. Name **THREE** stakeholders that may be involved in different design situations.

i. _____ (1)

ii. _____ (1)

iii. _____ (1)

c. Name **THREE** means that can be used by a designer to present and share a project proposal to stakeholders.

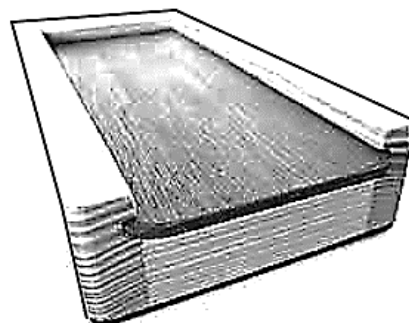
i. _____ (1)

ii. _____ (1)

iii. _____ (1)

(Total: 7 marks)

2. Figure 1 shows a pencil case made of two wooden materials. The base is made of pine wood and the lid is made of walnut wood. Mention the class under which these types of wood are classified.



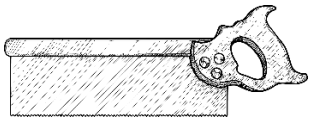

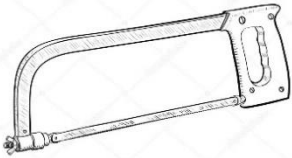

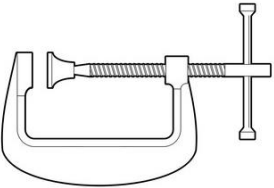
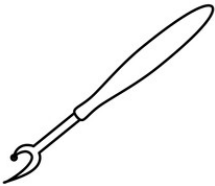
Walnut: _____ (1/2)

Pine: _____ (1/2)

Figure 1

(Total: 1 mark)

3. a. Complete the table below by writing the names and use of each tool. (The first one has been completed as an example.)

Tools/Equipment	Name	Use
	backsaw	Used to cut straight lines in thicker wood.
	nail pincers	
		Is used to make straight cuts in metal or plastic. The blade is held tightly in the frame, with the teeth pointing forwards.
		
		
		

(6)

b. Underline **ONE** correct answer which includes two parts of a pillar drill machine.

- i. Foot Pedal and handwheel.
- ii. Blade and guide.
- iii. Chuck and safety guard.

(1)

(Total: 7 marks)

4. The '3Rs' are sustainable strategies used in designing products. List **TWO** of the 3 Rs in the space provided below.

_____ (½)

_____ (½)

(Total: 1 mark)

5. Mention **TWO** examples of polymer-based textile materials.

Example 1: _____ (1)

Example 2: _____ (1)

(Total: 2 marks)

6. Mention **TWO** health and safety rules that should be observed in a Design and Technology lab.

_____ (2)

(Total: 2 marks)

SECTION B: DESIGN ASPECT

Refer back to the situation on Page 2 and read the following broad Design Brief carefully to answer this section.

7. The following broad Design Brief describes in more detail what is being requested by the shopping mall management:

The shopping mall management would like to introduce a life-sized riding toy for kids aged 3 to 5 years in the play area. Design and make a riding toy that can be either fixed to the floor OR it can be moved around the play area.

a. Write **TWO** specifications that are important to keep in mind when designing a riding toy as described in the brief above.

i. _____ (1)

ii. _____ (1)

b. Mention **ONE** method that designers can use to explore a design problem.

_____ (1)

(Total: 3 marks)

-
8. Ideas need to be generated for this situation.
- a. Sketch **TWO** detailed and different design ideas for the riding toy described in the Situation and Design Brief, to be placed in the play area of the shopping mall. The ideas presented need to be appealing to kids to stimulate their imagination. Use the spaces provided below. Add annotations to your sketches.

Idea 1



(5)

This question continues on the next page.

Idea 2

(5)

- b. Choose the best design idea submitted in part (a) and mention **ONE** advantage the chosen idea has over the other idea.

Chosen idea: _____

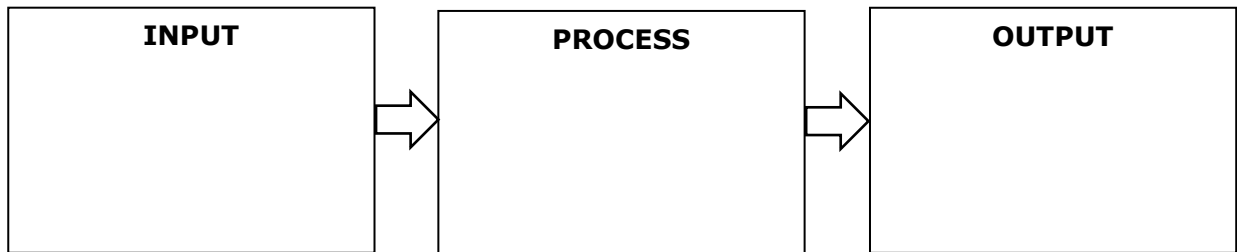
Advantage: _____

_____ (1)

(Total: 11 marks)

9. Planning is very important and is required at different stages of the design process.

- a. While designing the chosen idea of the riding toy, a system plan can be very helpful. Describe the function of the proposed solution by identifying **ONE** input, **ONE** process and **ONE** output and filling the system diagram in Figure 2.



(3)

Figure 2

- b. Before starting the making process of a design solution, a lot of planning is required. Mention **TWO** planning tools that designers can use to organise and communicate the making of a product.

_____ (1)

_____ (1)

(Total: 5 marks)

10. A prototype of the chosen idea was built.

- a. Suggest **TWO** tests that can be used to check the appropriateness of the proposed prototype.

i. _____ (1)

ii. _____ (1)

This question continues on next page.

- b. Documentation will be required from the shopping mall’s staff to manage this toy in the playing area. Draw a simplified instruction diagram that shows how the toy can and **cannot** be used.

Instruction Diagram:

(4)

(Total: 6 marks)

SECTION C: TECHNOLOGY ASPECT

11. In the shopping mall play area one could find a pile of plastic building blocks. Mention **ONE** fabrication process, which is most suitable to manufacture the plastic building blocks shown in the Figure 3.

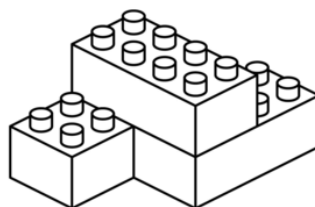


Figure 3

Answer: _____

(1)

(Total: 1 mark)

12. In the shopping mall play area there is also a play-house which is manufactured from a thermoplastic material:

a. Explain what is meant by the term thermoplastic.

_____ (1)

_____ (1)

b. Mention **TWO** thermoplastic materials.

Material 1: _____ Material 2: _____ (1)

c. The playhouse also contains coloured, polymer material windows which allow light to pass into the room. Underline the correct technical term which describes the aesthetic material property of this window.

Opaque Translucent Clear (1)

d. The main colours chosen for the playhouse are Red and Yellow. To create contrast, complementary coloured details were added. State what is the complementary colour of:

i. Red: _____ (1)

ii. Yellow: _____ (1)

(Total: 5 marks)

13. Inside the playhouse there is a table where the kids can pretend to cook and eat something as seen in the 3D pictorial projection Figure 4.

You are required to complete a two-point perspective drawing of the table in the space provided below. Rulers may be used.

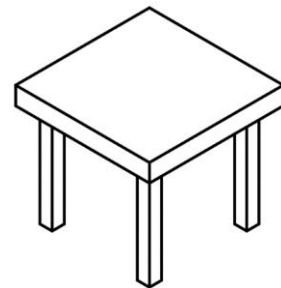
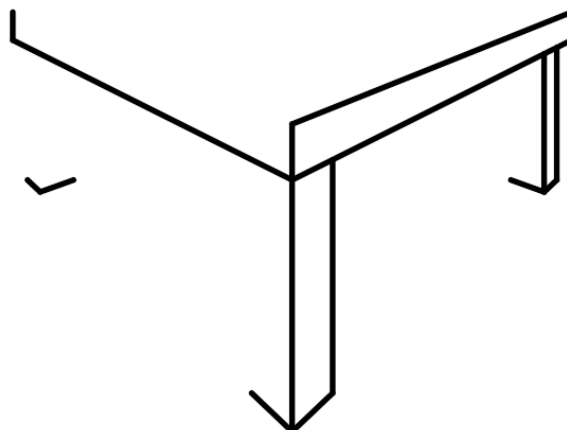


Figure 4



(Total: 2 marks)

14. Figure 5 shows a table lamp.

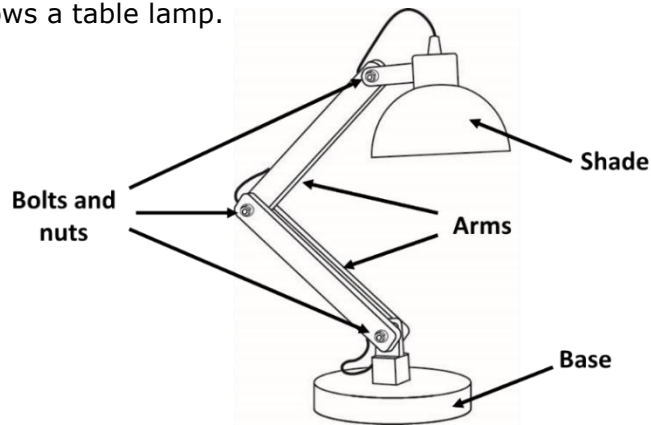


Figure 5

a. The table lamp base is made of walnut because it is dense. Briefly explain how this property affects the lamp's design.

_____ (1)

b. Pine material was chosen for the arms because it is strong. Briefly explain how this property effects the lamp's design.

_____ (1)

c. The lamp parts are joined together with bolts and nuts. Mention **ONE** advantage of bolts and nuts compared to adhesives.

_____ (1)

d. Stainless steel was chosen for the bolts and nuts and aluminium was chosen for the light shade. Mention **ONE** unique advantage of using the following metals in the lampshade. The mentioned advantages must be different for both answers.

i. Stainless steel: _____ (1)

ii. Aluminium: _____ (1)

(Total: 5 marks)

15. In the kids' play area, there are a number of embedded games. For example, there is a shape sorter game as you can see in Figure 6 below.

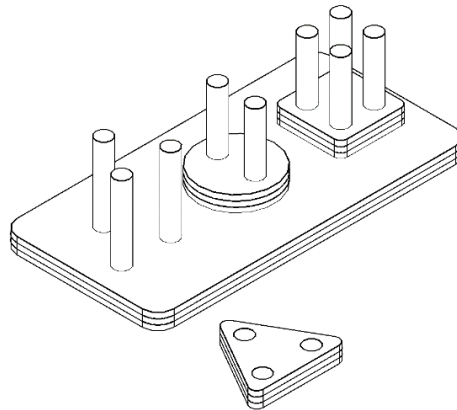


Figure 6

a. The shapes which the kids have to sort are made up of plywood material. Explain how layers of wood are placed in plywood to give it more strength.

_____ (2)

b. Suggest which hand tool would be used to cut the outline of the game shape marked with an arrow in Figure 7.

Hand tool:

_____ (1)

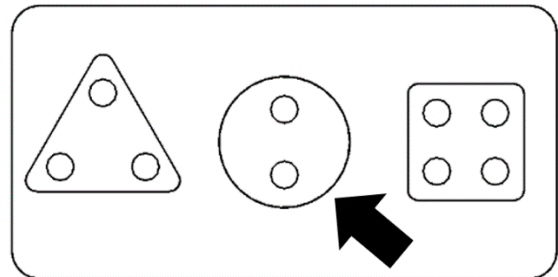


Figure 7

c. A belt sander was used to make the edges of the shapes smoother. Give **TWO** safety precautions that should be taken when using a belt sander.

Safety precaution 1: _____ (1)

Safety precaution 2: _____ (1)

d. The shapes were given a surface finish to make them more attractive. However, surface finishes are not only used for aesthetic reasons. Give **ONE** functional reason for applying a surface finish.

_____ (2)

(Total: 7 marks)

16. A roller display installation is placed in the kids' playing area. Figure 8 shows one side view and one pictorial view of the roller display installation mechanism.

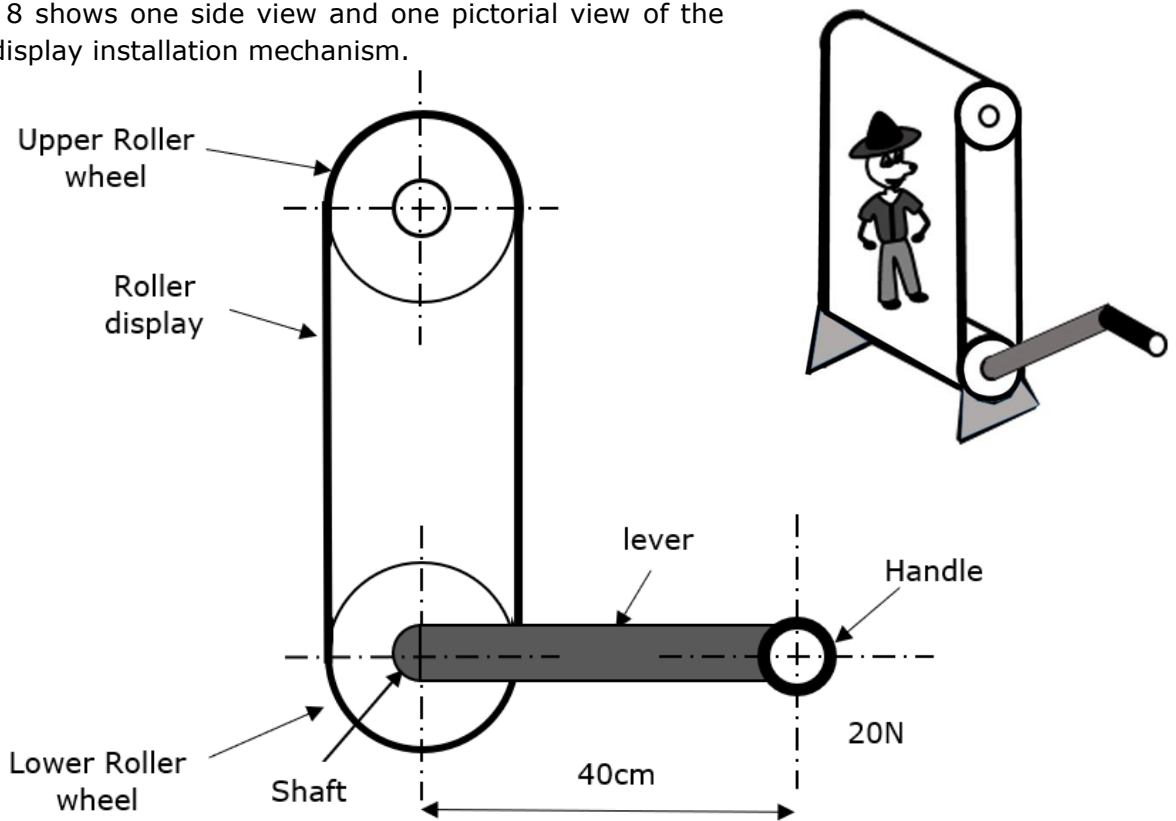


Figure 8

a. Which class of lever is represented by the crank lever shown in Figure 8?

_____ (1)

b. Add labelled arrows on Figure 8 to identify the effort and load and their direction. (2)

c. Calculate the moments being applied to the shaft of the lower roller wheel, by turning the handle clockwise with a force of 20N in Figure 8. (2)

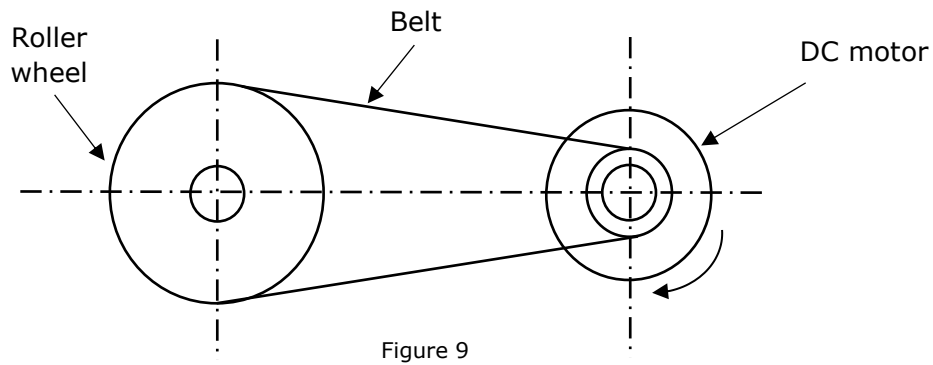
d. A 3D printer was used to manufacture the handle of the roller display.

i. Name **ONE** appropriate file extension used to save a 3D digital design for 3D printing.
 _____ (1)

ii. Name **ONE** 3D software package that can convey a 3D digital design.
 _____ (1)

(Total: 7 marks)

17. The interactive roller display mechanism mentioned in Figure 9 has been modified to work with a DC motor. A mechanical system was used to reduce the roller speed. The diagram in Figure 9 shows how this mechanism is set up.



a. Name the type of mechanical system in Figure 9. (1)

b. Give **ONE** reason why a V-belt was chosen over flat belt to transfer the rotational motion of the DC motor. (1)

c. On Figure 9, draw the rotational direction of the roller wheel. (1)

d. The DC motor works with a voltage of 24 V and has a power rating of 200 W. Calculate the current that this motor needs in order to work. (3)

(Total: 6 marks)

18. An interactive installation of a fire truck was put up on one of the kids' area walls. The installation consists of rotating parts to keep the kids occupied. Figure 10 shows the proposed circuit.

A switch was used to operate a motor for a period of time. When a child hits the switch (start key) the motor starts rotating the fire truck's wheels.

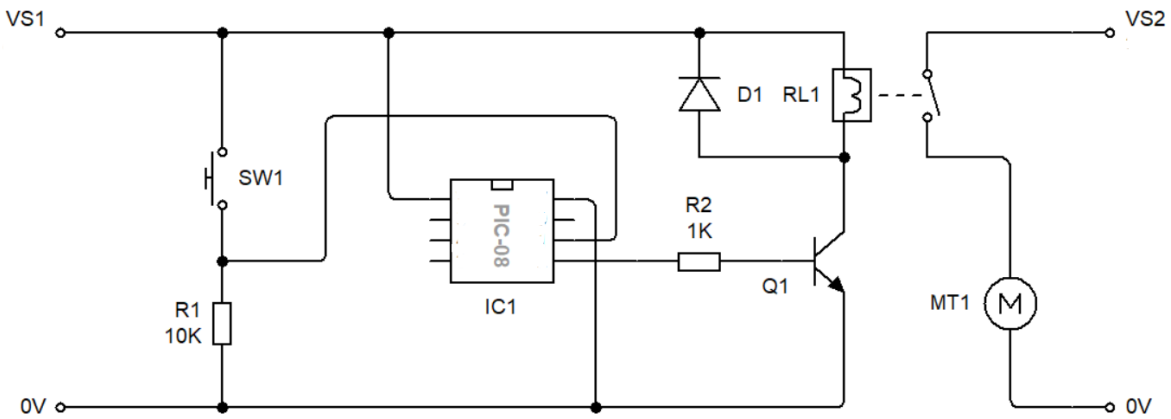


Figure 10

a. On Figure 10, circle the **TWO** components that are within the INPUT section of this system. (1)

b. SW1 functions as a non-latching switch. Name **ONE** suitable non-latching switch which is suitable for the intended users of this game. (1)

_____ (1)

c. The circuit designer decided to add a latching switch to the circuit, in order to switch off the circuit completely. On Figure 10 indicate by drawing an X, where such a switch would be appropriately placed. (1)

d. Resistor R1 has the value of 10 K. From the given table write down the first **THREE** colour bands of the resistor. (3)

_____, _____, _____ (3)

e. Mention **ONE** actuator used in the circuit. _____ (1)

f. Figure 11 shows an illustration of a diode.

i. Label the leads of the diode on Figure 11. (1)

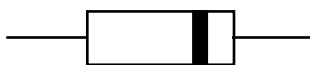


Figure 11

ii. A diode is a discrete component. Complete the following sentence:

A diode is classified as a _____ (1)

iii. The diode is connected in parallel to the relay. Describe the function of the diode in this circuit.

_____ (1)

g. The power supply of the controlling circuit uses 3 AA batteries. Calculate the total voltage at the controlling circuit.

(2)

(Total: 12 marks)

19. Measuring component parameters correctly is very important.

a. Name an electronic instrument used to measure the voltage in a circuit.

_____ (1)

b. Describe how this instrument should be connected in order to measure the voltage across a component.

_____ (1)

(Total: 2 marks)

20. Health and safety considerations are important while building a circuit.

a. Mention **ONE** hazard which can be encountered during electronic circuit fabrication.

_____ (1)

b. Identify **TWO** ways how to reduce risk during electronic circuit fabrication.

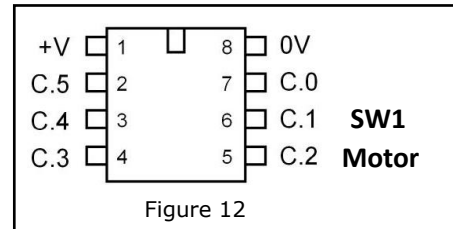
 _____ (2)

(Total: 3 marks)

21. The system shown in Figure 10 (in Question 18) was designed to be controlled by microcontroller.

Figure 12 lists the components which are connected to certain pinouts of the microcontroller. The microcontroller will be programmed to perform the following operations:

- When the switch SW1 is pressed the motor starts working.
- The motor works for a period of 30 seconds.
- The motor stops working after 30 seconds.
- All sequence restarts when the switch is pressed again.



Complete the flowchart in Figure 13 to operate the program according to the description above. In the flowchart, refer to the pinouts shown in Figure 12, as required.

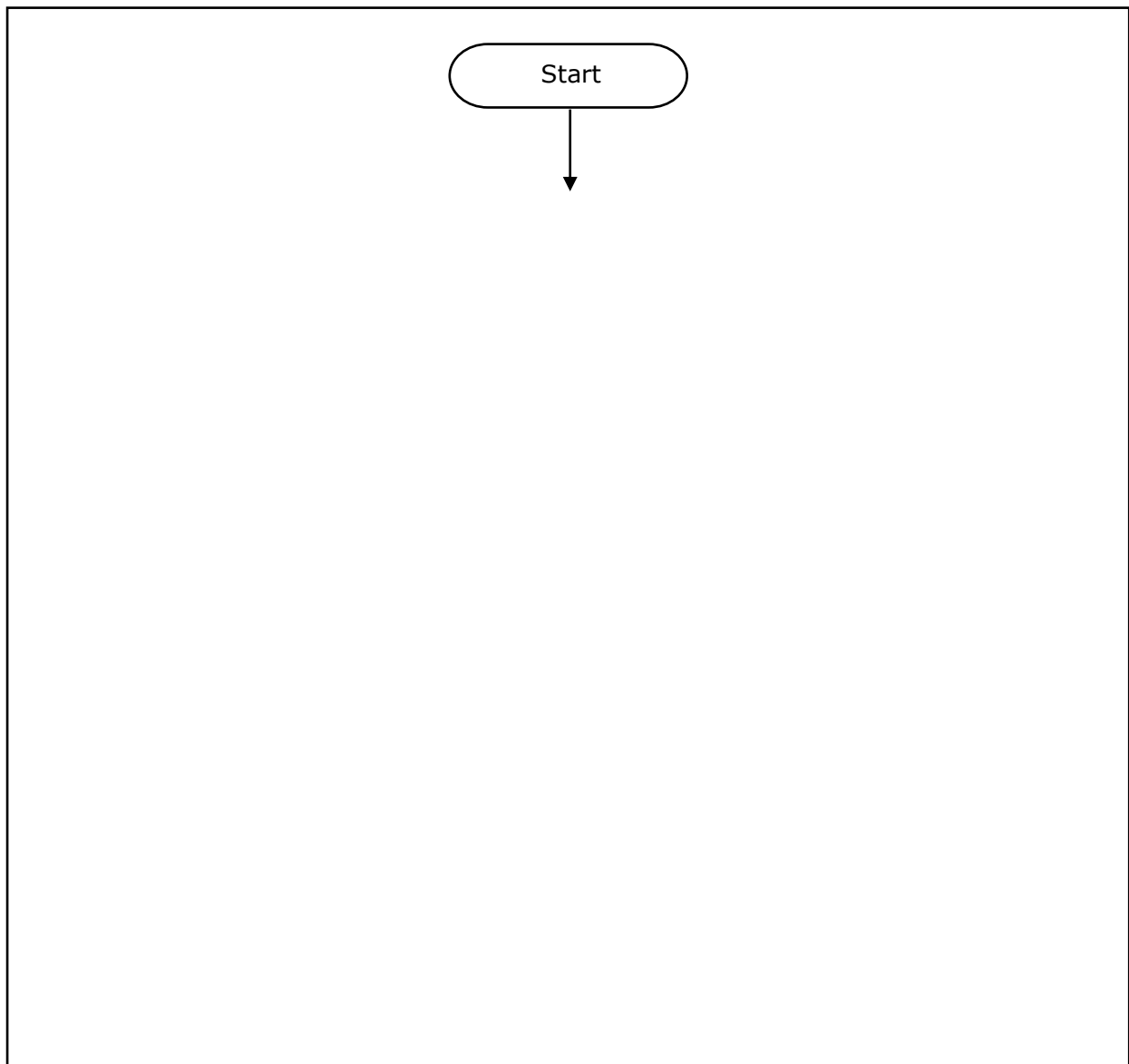


Figure 13

(Total: 5 marks)



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 PAPER NUMBER: IIB
 DATE: 9th May 2023
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Answer **ALL** questions in **ALL** sections.

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Useful Information

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Red	2	2	X 100	
Orange	3	3	X 1000	
Yellow	4	4	X 10000	
Green	5	5	X 100000	
Blue	6	6	X 1000000	
Violet	7	7	X 10000000	
Grey	8	8	X 100000000	
White	9	9	X 1000000000	
Gold	-	-	-	5%
Silver	-	-	-	10%

Read the following theme and situation carefully before answering this paper.

Theme: Fun at the Mall

Situation: A new shopping mall will set up an interactive kid’s playing area, allowing families with young children a space to recreate themselves in an imaginary setting. The playing area theme can change from time to time and must include various, safe, and interactive games children can play or ride.

SECTION A: CORE DESIGN & TECHNOLOGY PRINCIPLES

1. This question is about stakeholders.

a. Define the term stakeholders.

_____ (1)

b. Name **THREE** stakeholders that may be involved in different design situations.

i. _____ (1)

ii. _____ (1)

iii. _____ (1)

c. Name **THREE** means that can be used by a designer to present and share a project proposal to stakeholders.

i. _____ (1)

ii. _____ (1)

iii. _____ (1)

(Total: 7 marks)

2. Figure 1 shows a pencil case made of two wooden materials. The base is made of pine wood and the lid is made of walnut wood. Mention the class under which these types of wood are classified.

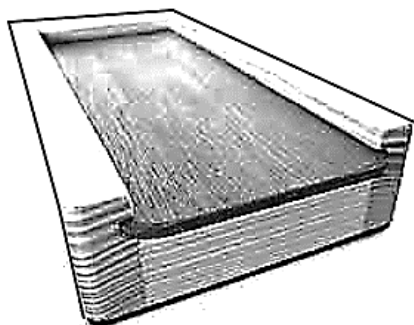


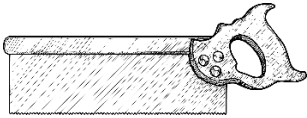

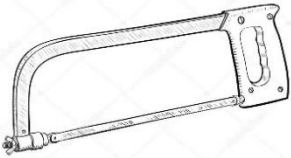

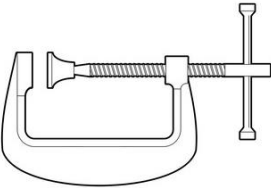
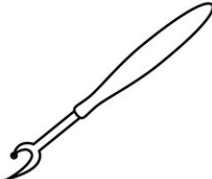
Figure 1

Walnut: _____ (1/2)

Pine: _____ (1/2)

(Total: 1 mark)

3. a. Complete the table below by writing the names and use of each tool. (The first one has been completed as an example.)

Tools/Equipment	Name	Use
	backsaw	Used to cut straight lines in thicker wood.
	nail pincers	
		Is used to make straight cuts in metal or plastic. The blade is held tightly in the frame, with the teeth pointing forwards.
		
		
		

(6)

b. Underline **ONE** correct answer which includes two parts of a pillar drill machine.

- i. Foot Pedal and handwheel.
- ii. Blade and guide.
- iii. Chuck and safety guard.

(1)

(Total: 7 marks)

Please turn the page.

4. The '3Rs' are sustainable strategies used in designing products. List **TWO** of the 3 Rs in the space provided below.

_____ (1/2)

_____ (1/2)

(Total: 1 mark)

5. Mention **TWO** examples of polymer-based textile materials.

Example 1: _____ (1)

Example 2: _____ (1)

(Total: 2 marks)

6. Mention **TWO** Health and Safety rules that should be observed in a Design and Technology lab.

_____ (2)

(Total: 2 marks)

SECTION B: DESIGN ASPECT

Refer back to the situation on Page 2 and read the following broad Design Brief carefully to answer this section.

7. The following broad Design Brief describes in more detail what is being requested by the shopping mall management:

The shopping mall management would like to introduce a life-sized riding toy for kids aged 3 to 5 years in the play area. Design and make a riding toy can be either fixed to the floor OR it can be moved around the play area.

a. List **TWO** keywords from the broad Design Brief above, that are important aspects when exploring the problem above.

i. _____ (1/2)

ii. _____ (1/2)

b. Sketch **TWO** detailed and different design ideas for the riding toy described in the Design Brief, to be placed in the play area of the shopping mall. The ideas presented need to be appealing to kids to stimulate their imagination. Use the spaces provided below.

Marks will be awarded for dimensions, annotations (include materials), clarity, presentation and good use of colour, and relevance of idea to the Situation in page 2 as well as the broad Design Brief above.

Idea 1

(5)

This question continues on next page.

Idea 2

A large empty rectangular box with a black border, intended for writing the response to 'Idea 2'. The box occupies most of the page's vertical space below the header.

(5)

c. Compare Idea 1 with Idea 2, from the previous question, in Table 1 by entering ✓ or X in the given rows, for the given criteria, and then choose the most appropriate idea:

Table 1

Criteria	Idea 1	Idea 2
Safe		
Appealing		
Age appropriate		
Easy to manufacture		
Easy to use		

Chosen Idea: _____ (3)

(Total: 14 marks)

8. Planning is very important and is required at different stages of the design process.

a. While designing the chosen idea of the riding toy, its useful to identify different parts or components of a system that will determine how the product functions. From the chosen idea in question 7 part c, name:

i. **ONE** input: _____ (1)

ii. **ONE** process: _____ (1)

iii. **ONE** output: _____ (1)

b. Before starting the making process of a design idea, a lot of planning is required, such as lists and drawings. Write the full name of **TWO** of these planning tools:

i. _____ (1)

ii. _____ (1)

(Total: 5 marks)

Please turn the page.

9. A prototype of the chosen idea was built and can be tested in different ways. As illustrated in Table 2 below, use arrows to connect the correct description to the corresponding test. The first one has been done for you.

Table 2

TEST		DESCRIPTION
i. Usability of toy		Test the product by checking for sharp edged, toxic materials etc.
ii. Safety		Test the product by simulating any moving parts to check how they work.
iii. Appearance		Test the prototype by showing it to kids of the same age group.

(Total: 2 marks)

10. Documentation will be required from the shopping mall’s staff to manage the toy solution suggested in question 7, part c, for the playing area.

- a. Draw a simple infographic sign to show **ONE** of the following:
- This toy is suitable for ages 3-5 only
 - Remove shoes to enter the play area
 - No food/drinks are allowed in the play area.

Infographic Sign chosen: _____

(3)

b. Mention **ONE** important precaution that users should take while using this toy.

_____ (1)

(Total: 4 marks)

SECTION C: TECHNOLOGY ASPECT

11. In the shopping mall play area one could find a pile of plastic building blocks.

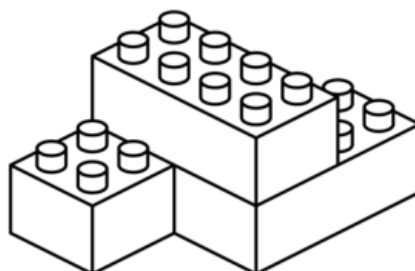


Figure 2

From the list below underline **ONE** fabrication process, which is most suitable to manufacture the plastic building blocks shown in Figure 2.

- Injection moulding Extrusion Vacuum Forming

(Total: 1 mark)

12. In the shopping mall play area there is also a play-house which is manufactured from a thermoplastic material.

a. Tick with a ✓ the correct statement.

Thermoplastics are polymers which can be heated and shaped only once.	<input type="checkbox"/>
Thermoplastics are polymers which can be heated and shaped many times.	<input type="checkbox"/>
Thermoplastics are polymers which cannot be bent.	<input type="checkbox"/>

(1)

b. Circle the thermoplastic materials from the word bank below.

Polyester Resin	Copper	PET
PMMA (Acrylic)	Carbon Fibre	PVC
Bakelite	ABS	Cardboard

(2)

c. The playhouse also contains clear polymer material windows as a glass substitute. This allows the children to see what is happening outside when they are inside the playhouse. Underline the correct technical term that describes the aesthetic property of this window from the word bank below: (1)

Shiny	Matt	Transparent
-------	------	-------------

(Total: 4 marks)

13. Inside the playhouse, there is a table where the children can pretend to cook and eat something, as seen in the 3D pictorial projection Figure 3 below. You are required to complete the one-point perspective drawing of the table in the space provided below. Rulers may be used.

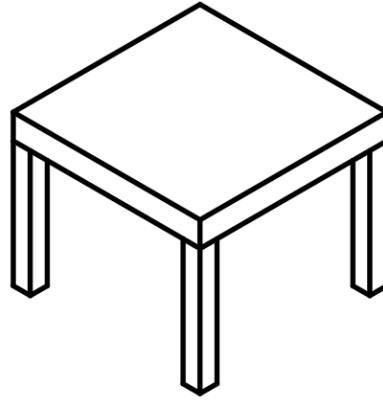
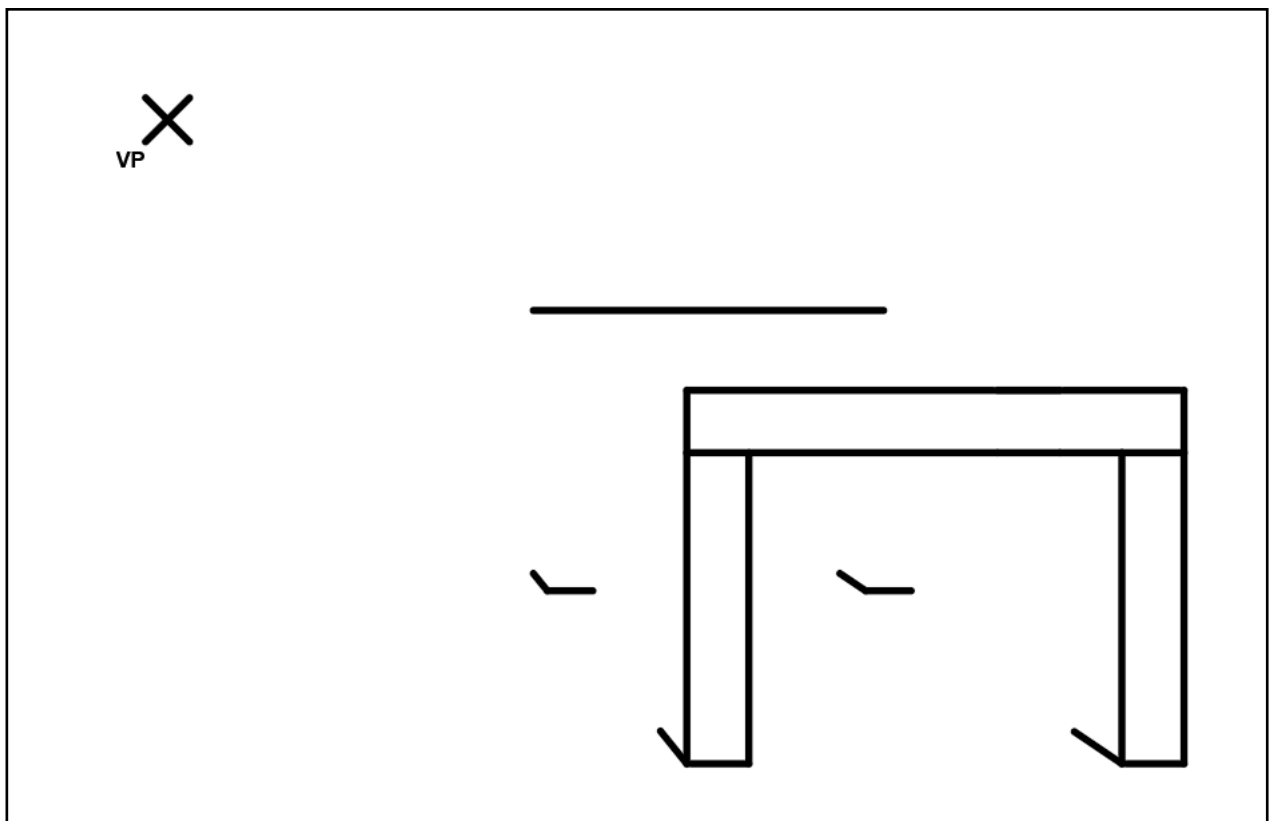


Figure 3



(Total: 3 marks)

14. The colours chosen for the playhouse are the following:

Red	Blue	Yellow	Green	Orange	Violet
-----	------	--------	-------	--------	--------

Put the colours mentioned in the word bank above under the correct category.

Warm colours	Cool colours

(Total: 3 marks)

15. Figure 4 shows a table lamp sold in one of the home decoration shops in the shopping mall. The table lamp base is made of walnut and the upper arms are made of pine wood.

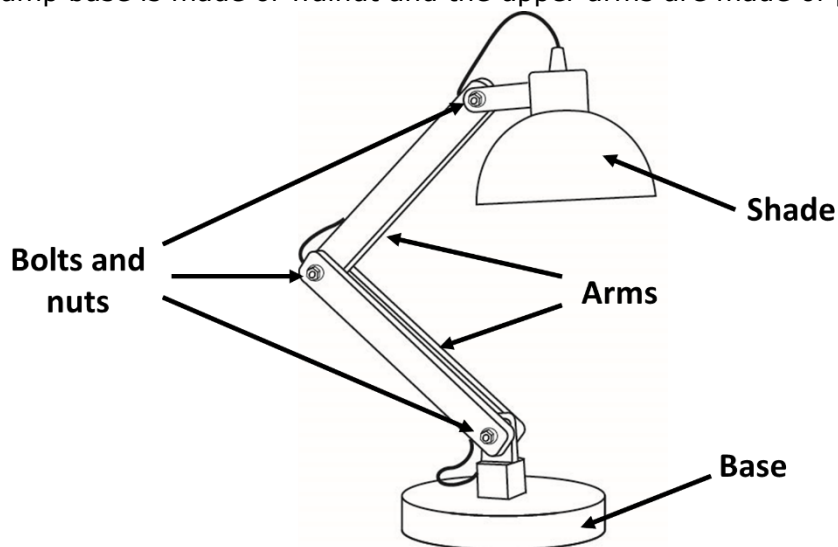


Figure 4

a. Mention the class under which these types of woods are classified.

Wood Material	Hardwood or Softwood
Walnut	
Pine	

(1)

This question continues on the next page.

b. The walnut material for the lamp’s base was chosen because it is both dense and strong. Tick the statements which best describe these two properties.

i. Density

The ability of a material to stretch and then return to its original shape.	
The ability of a material to resist scratching and is very difficult to cut.	
How heavy the material is in comparison to its size.	

(1)

ii. Strength

The ability of a material to be drawn out into a thin wire.	
The ability to withstand a pulling force (tension) without breaking or bending.	
The ability of a material to resist scratching.	

(1)

c. The lamp parts are joined together with bolts and nuts. Mention **ONE** advantage of bolts and nuts compared to adhesives.

(1)

d. The material chosen for the bolts and nuts is stainless steel and for the light shade, it is aluminium. Tick **ONE** advantage of using the chosen metal for each of the following parts.

i. Stainless steel for the bolt and nuts because it:

conducts electricity	
is brittle	
is corrosion resistant	

(1)

ii. Aluminium for the light shade because it is:

light weight	
ductile	
tough	

(1)

(Total: 6 marks)

16. Organic & Co is a clothing shop inside the shopping mall. They sell clothes made from organic materials. Circle **TWO** other examples of organic textile materials from Table 3 below.

Table 3

Polyester	Linen	Carbon fibre
Cotton	Spandex	Fibreglass
Nylon	Acrylic	Silk

(Total: 2 marks)

17. In the kids' play area, there are a number of embedded games. For example, there is a shape sorter game as you could see in Figure 5.

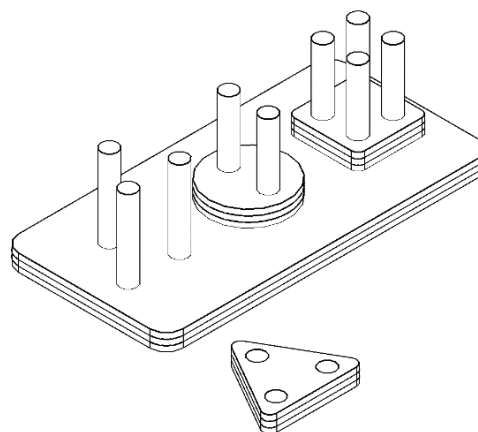


Figure 5

a. The shapes which the kids have to sort are made up of a manufactured wood which is made up of several thin veneers layered on top of each other. From the word bank below, underline which type of manufactured board is described above.

Chipboard	Medium Density Fibreboard (MDF)
Plywood	Hardboard

(1)

b. Tick which hand tool would be used to cut the outline of the game shape marked with an arrow in Figure 6. (1)

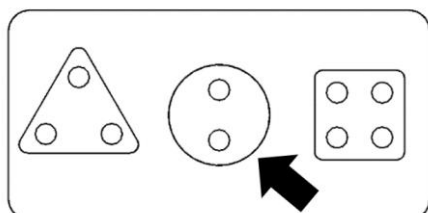


Figure 6

Junior hacksaw	
Coping saw	
Backsaw	

This question continues on next page.

c. A belt sander is used to make the edges of the shapes smoother. Give **ONE** Health and Safety precaution that should be taken when using a belt sander.

_____ (1)

d. The shapes were given a surface finish to make the pieces more attractive for the kids. Give **ONE** example of surface finish one can apply to wood materials.

_____ (1)

(Total: 4 marks)

18. A roller display installation is placed in the kids' playing area. Figure 7 shows the side view and pictorial illustration of the roller display installation mechanism.

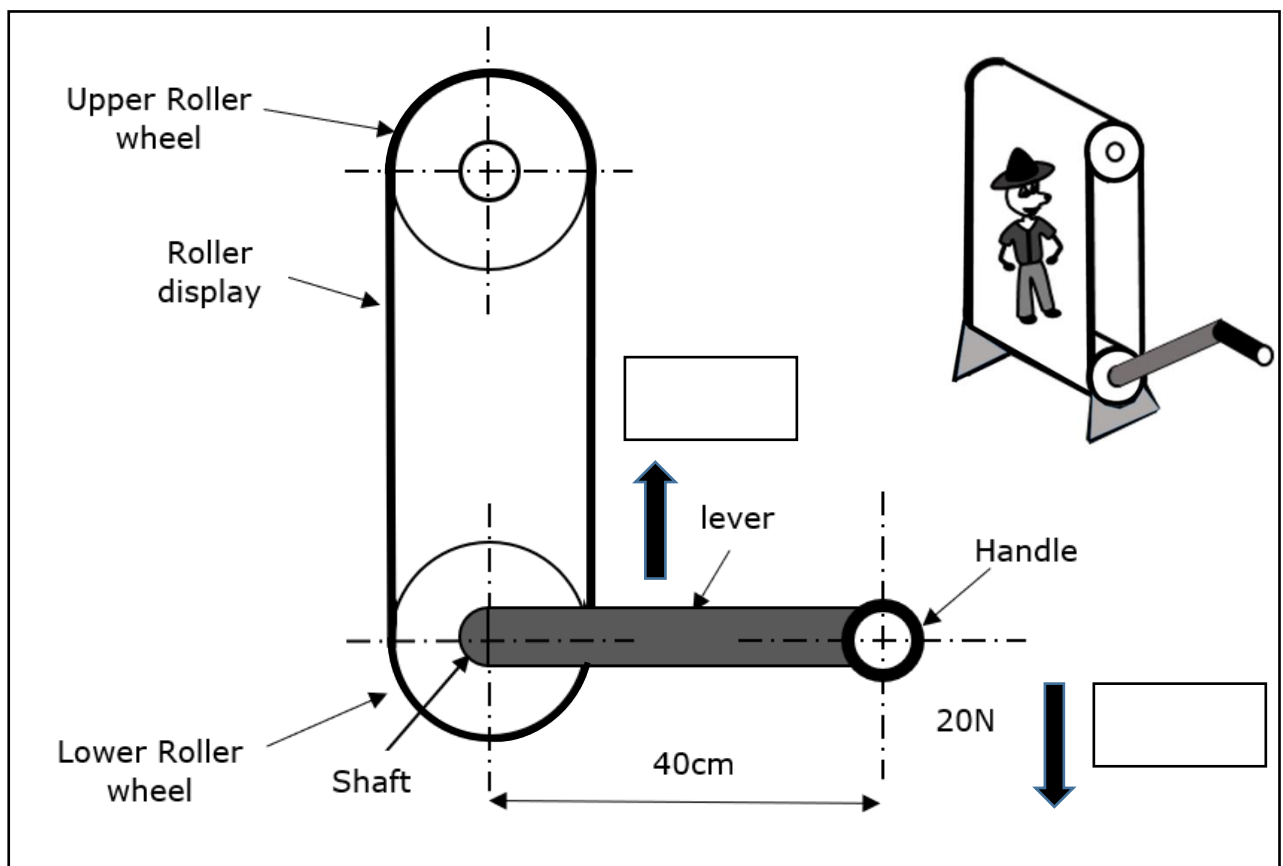


Figure 7

a. Which type of class lever is represented by the crank lever shown in Figure 7?

_____ (1)

b. On Figure 7, label the arrows identifying the effort and load in the spaces provided. (1)

c. Calculate the moments being applied to the shaft of the lower roller wheel shown in Figure 7, when turning the handle clockwise with a force of 20 N. (3)

d. A 3D printer was used to manufacture the handle.

i. From the given word bank, underline the appropriate file extension used to save a 3D digital design for 3D printing.

.STL **.DOC** **.JPG** (1)

ii. Name **ONE** 3D software package that can convey a 3D digital design.

_____ (1)

(Total: 7 marks)

Please turn the page.

19. The interactive roller display mechanism mentioned in Figure 7 has been modified to work with a DC motor.

The mechanical system in Figure 8 was used to reduce the roller speed.

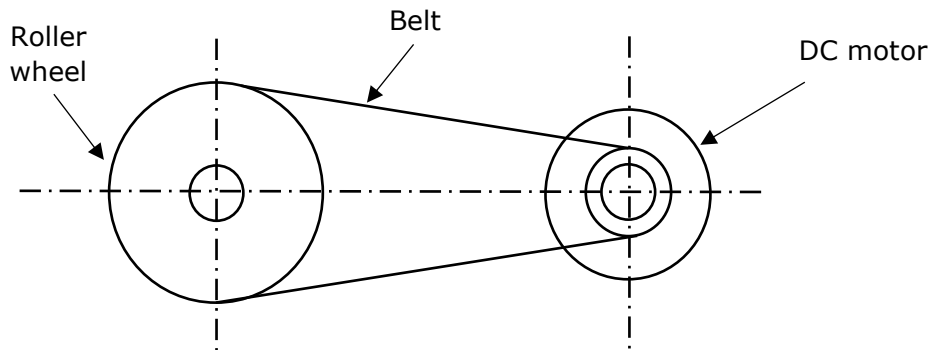


Figure 8

- a. Name the type of mechanical system in Figure 8. _____ (1)
- b. Name which component from Figure 8 is being used to transfer the rotational motion of the DC motor to the roller display wheel.
_____ (1)
- c. On Figure 8 draw the rotating direction of the roller wheel. (1)
- d. The DC motor works with a voltage of 24 V. A current of 10 A is needed for the DC motor to work. Find the power rating of the motor. (3)

(Total: 6 marks)

20. An interactive installation of a fire truck was put up on one of the kids' area walls. The installation consists of rotating parts to keep the kids occupied. A switch was used to operate a motor for a period of time. When a child hits the switch (start key) the motor starts rotating the fire truck's wheels.

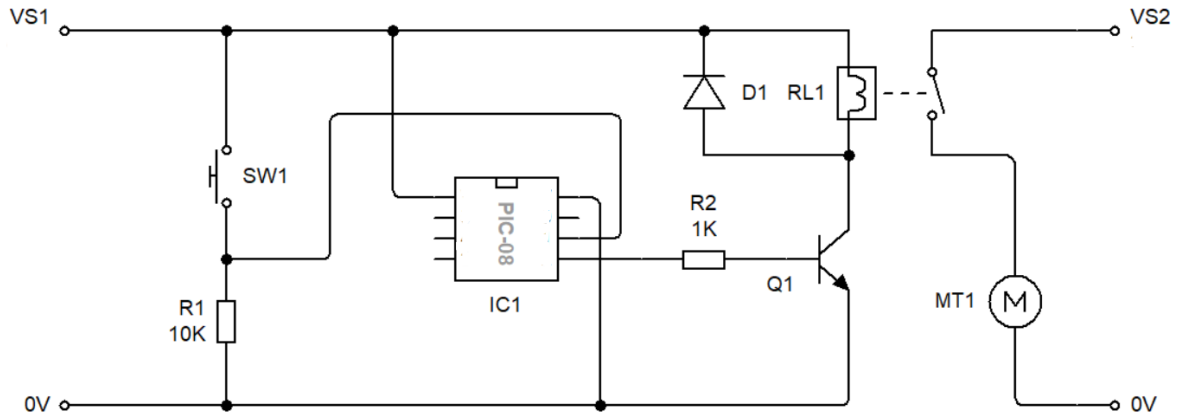


Figure 9

a. Sketch a rectangle around the input section of this circuit including the main power supply on the circuit diagram on Figure 9. (1)

b. SW1 functions as a non-latching switch. Underline **ONE** suitable non-latching switch which is suitable for the intended users of this game. (1)

Emergency switch Micro switch DPDT switch

c. The circuit designer decided to add a latching switch to the circuit in order to switch off the circuit completely. On Figure 9 indicate, by drawing an X, where such a switch would be appropriately placed. (1)

d. Figure 10 shows an illustration of a 10 K resistor. Find and fill in the first **THREE** colour bands of the resistor. (3)

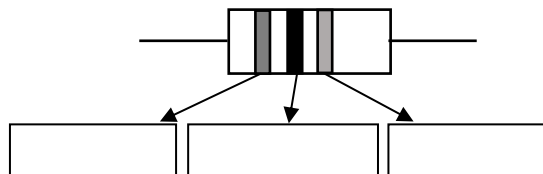


Figure 10

This question continues on next page.

e. Figure 11 shows an illustration of a diode.

i. On Figure 11, label the leads of the diode as Anode and Cathode. (1)



Figure 11

ii. Underline the correct classification from the words in the brackets in this sentence.

A diode is classified as a/an (Semi-conductor, Integrated circuit, Sensor) (1)

iii. In Figure 9, a diode is connected in parallel to the relay. Fill in the missing words in the following statement:

The function of the diode in this circuit is to _____ the IC from back EMF. (1)

f. From the given circuit in Figure 9 mention **ONE** actuator. _____ (1)

g. The power supply of the controlling circuit uses 3 AA batteries. Calculate the total voltage at the controlling circuit. (2)

h. A multi-meter is an electronic instrument which is used for testing the circuit. Name **ONE** parameter that this instrument can read.

_____ (1)

i. Mention **ONE** hazard that can be experienced while soldering a circuit.

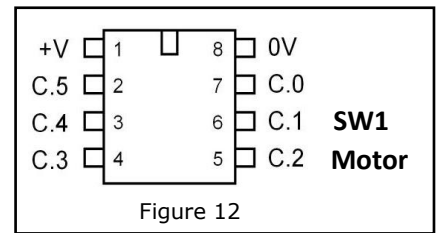
_____ (1)

(Total: 14 marks)

21. The system shown in Figure 9 (in Question 20) was designed to be controlled by a microcontroller. The pinouts of the PIC are shown in Figure 12.

The microcontroller will be programmed to perform the following operations:

- When the switch SW1 is pressed the motor starts working.
- The motor works for a period of 30 seconds.
- The motor stops working after 30 seconds.
- All sequence restarts when the switch is pressed again.



Use the given commands to complete the flowchart in Figure 13 in order to operate the program according to the description above.

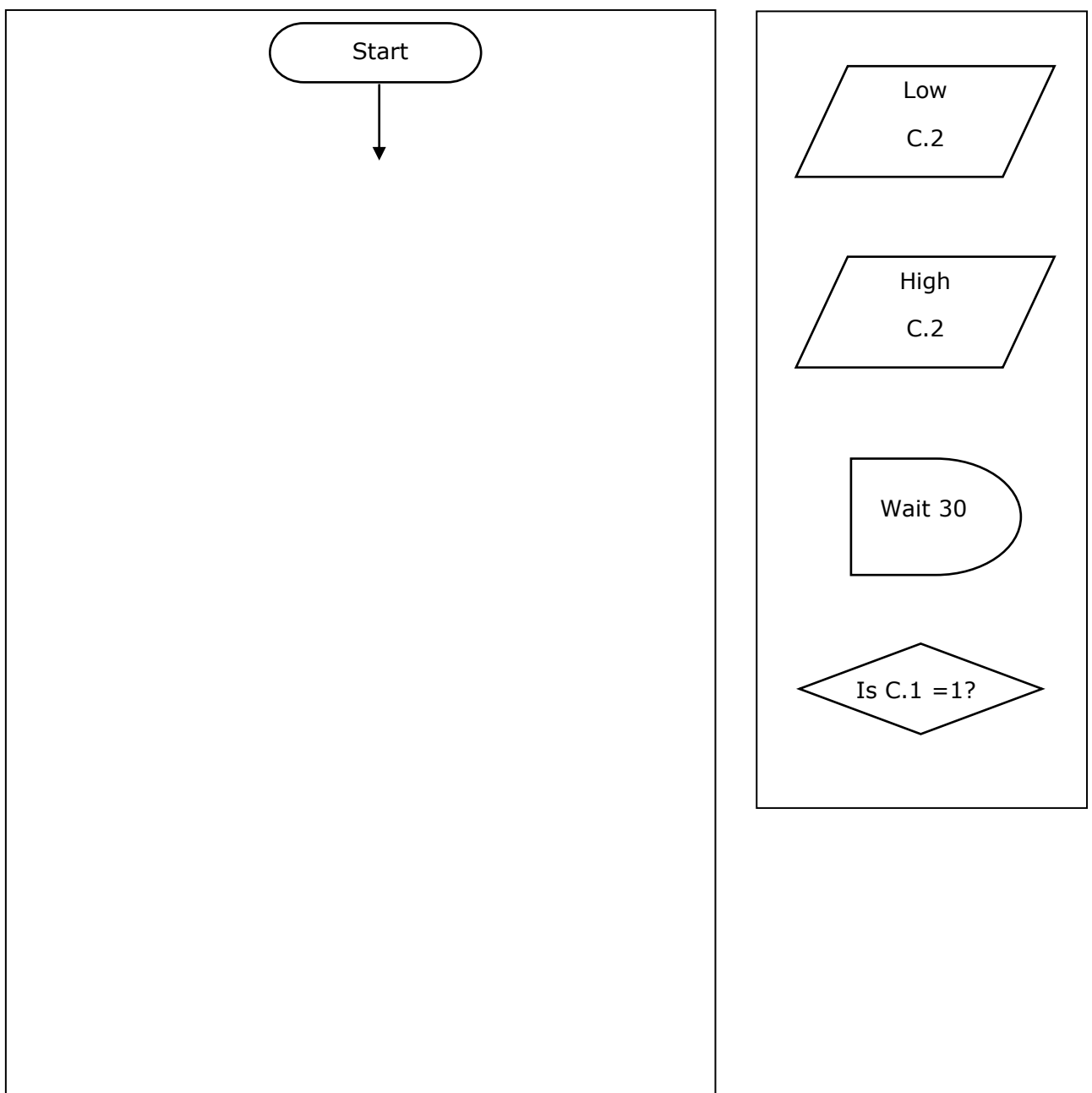


Figure 13

(Total: 5 marks)

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