



SUBJECT:	Engineering Technology
UNIT:	2
ASSIGNMENT:	3 – Controlled
TITLE:	Mechanical Systems
DATE SET:	15th April 2024
DEADLINE:	15th May 2024

General Instructions

- Lines provided for sub-questions (a) and (b) indicate the length expected in candidate's answers.
- Students are to autonomously answer sub-questions (c). Therefore, lines provided do **not** necessarily indicate the length and depth of the expected answer.
- Application criteria will be assessed in class.
- The time required to complete practical tasks will be communicated by the teacher.
- Answers may be either in English or in Maltese.

Candidate's Declaration of Authenticity

I, the undersigned, _____ (*Name and Surname*), declare that all the work I shall submit for this assignment will be my own.

I further certify that if I use the ideas, words, or passages from existing sources, I will quote those words or paraphrase them and reference them by making use of a reference system.

I am aware that should I submit work which is not mine, or work which has been copied from one or more sources, I will be penalised as per MATSEC Examinations Board policies related to plagiarism.

Candidate's Signature: _____

I.D. Card No.: _____

Date: _____

General Scenario

- Technicians working for a company need to keep themselves updated and sit for frequent tests to assess their knowledge.
- The following test was given to assess knowledge on mechanical systems.
- Complete the following test by answering **ALL** the questions in the space provided.

SECTION A – WRITE-ON

Question 1

K-8 (4 marks)

a. Label the different lever classes given in Table 1.

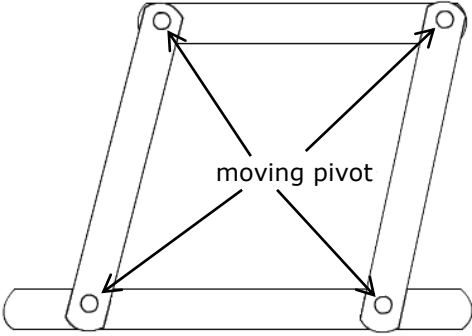
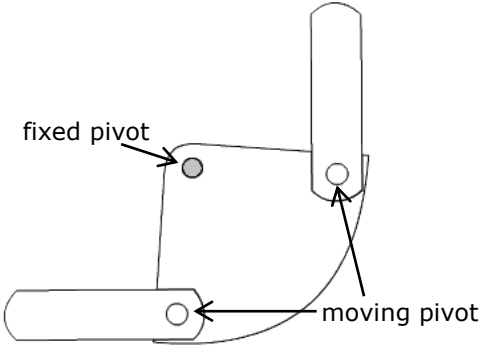
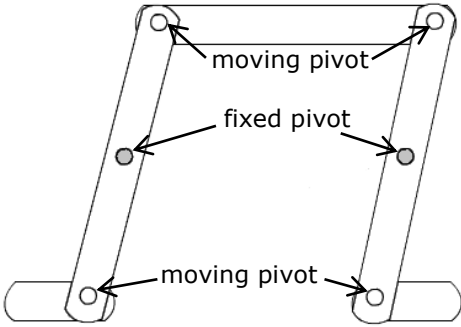
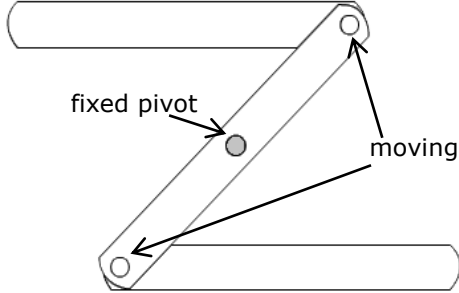
Table 1 – Lever Types

	Type of Levers	Lever Class
i.	<p style="text-align: center;">Fulcrum</p>	_____
ii.	<p style="text-align: center;">Fulcrum</p>	_____

b. Identify the different linkages in lever systems given in Table 2. Use words from the ones provided below.

reversing slider push-pull parallel motion treadle bell crank

Table 2 – Linkages in lever systems

	Lever Systems	Type of Linkage
i.		<hr style="width: 80%; margin: 0 auto;"/>
ii.		<hr style="width: 80%; margin: 0 auto;"/>
iii.		<hr style="width: 80%; margin: 0 auto;"/>
iv.		<hr style="width: 80%; margin: 0 auto;"/>

c. Figures 1a and 1b show a two linkage system, that is composed of a disc that rotates anticlockwise, a slider which slides inside a tube and a connecting rod which joins the parts together. Figure 1a shows the system when the slider is at the maximum position whilst Figure 1b shows the system when the slider is at the minimum position. Describe the output for **each** linkage given in the Figures.

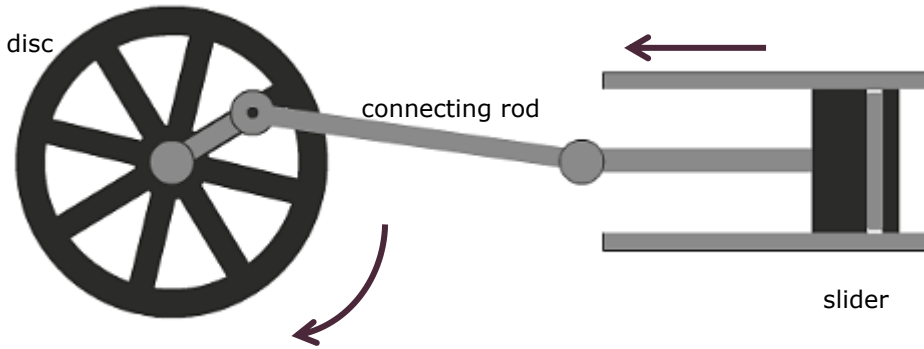


Figure 1a: A two linkage systems shown with the slider at the maximum position

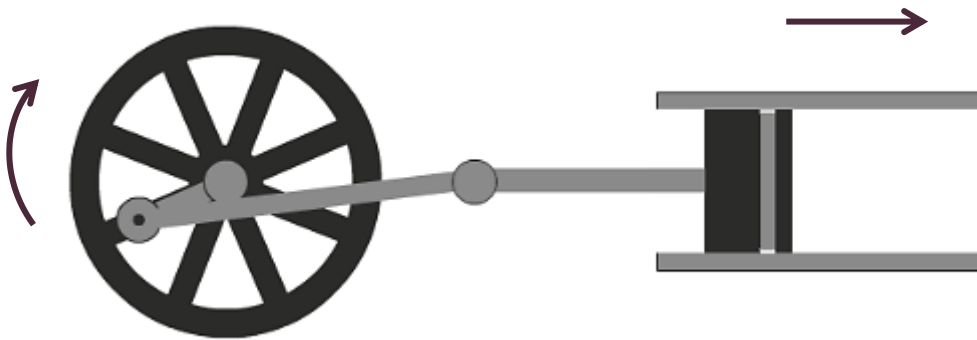
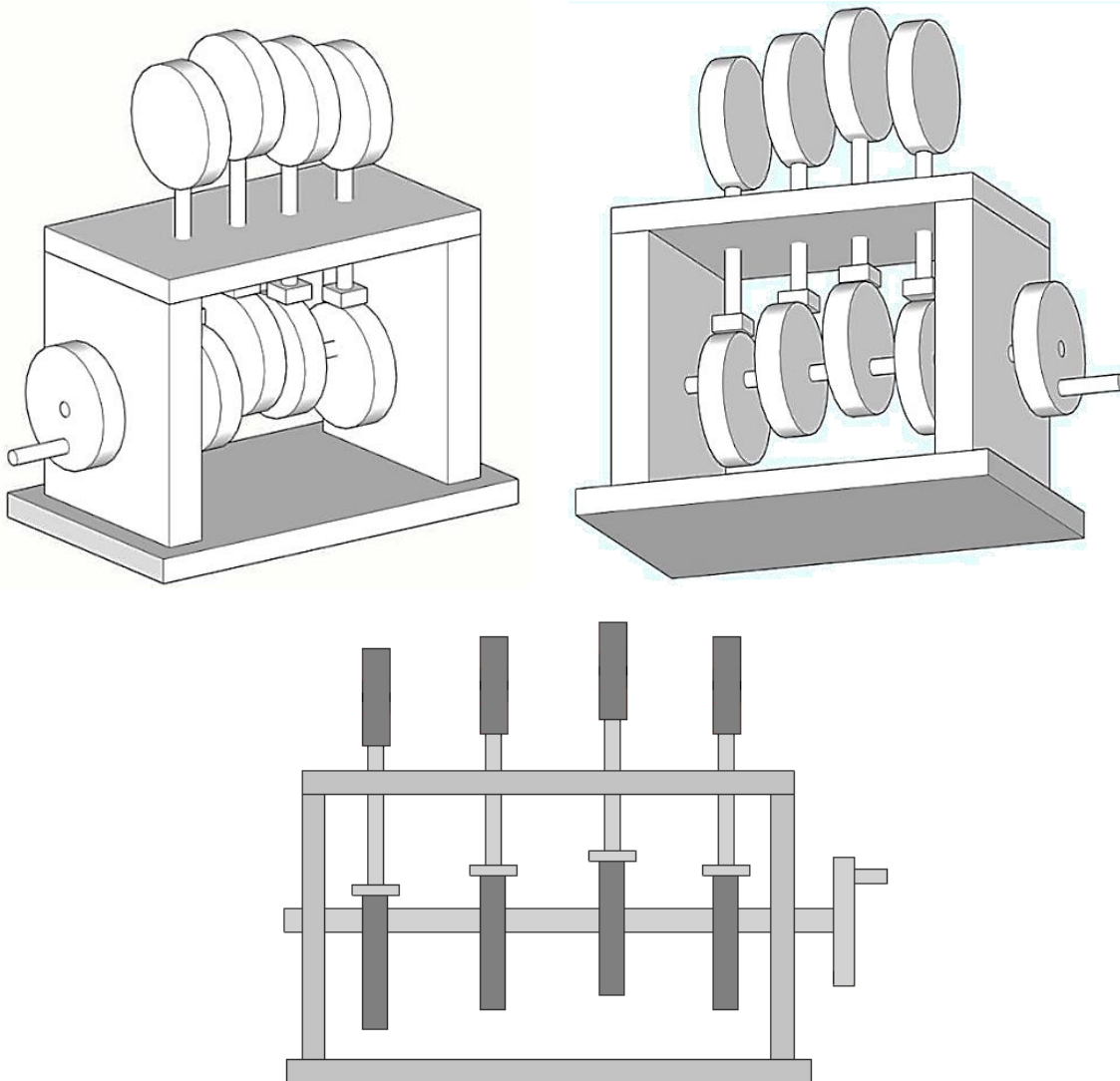


Figure 1b: A two linkage systems shown with the slider at the minimum position
(Source: <https://zaxisinc.com/metering-pump-technologies/>)

SECTION B - PRACTICAL**Background Information**

- You are requested to construct appropriate cams and crank systems to assemble and form the following cam toy shown in the images below.
- You are required to:
 - Construct the housing for the cam and crank systems to given specifications.
 - Construct appropriate cams and crank assemblies according to given specifications.
- The teacher will provide you with the necessary tools, equipment and material required to conduct this exercise.
- During this practical task, you should observe all Health and Safety Procedures and use your own adequate PPE.



Question 1

A-4 (10 marks)

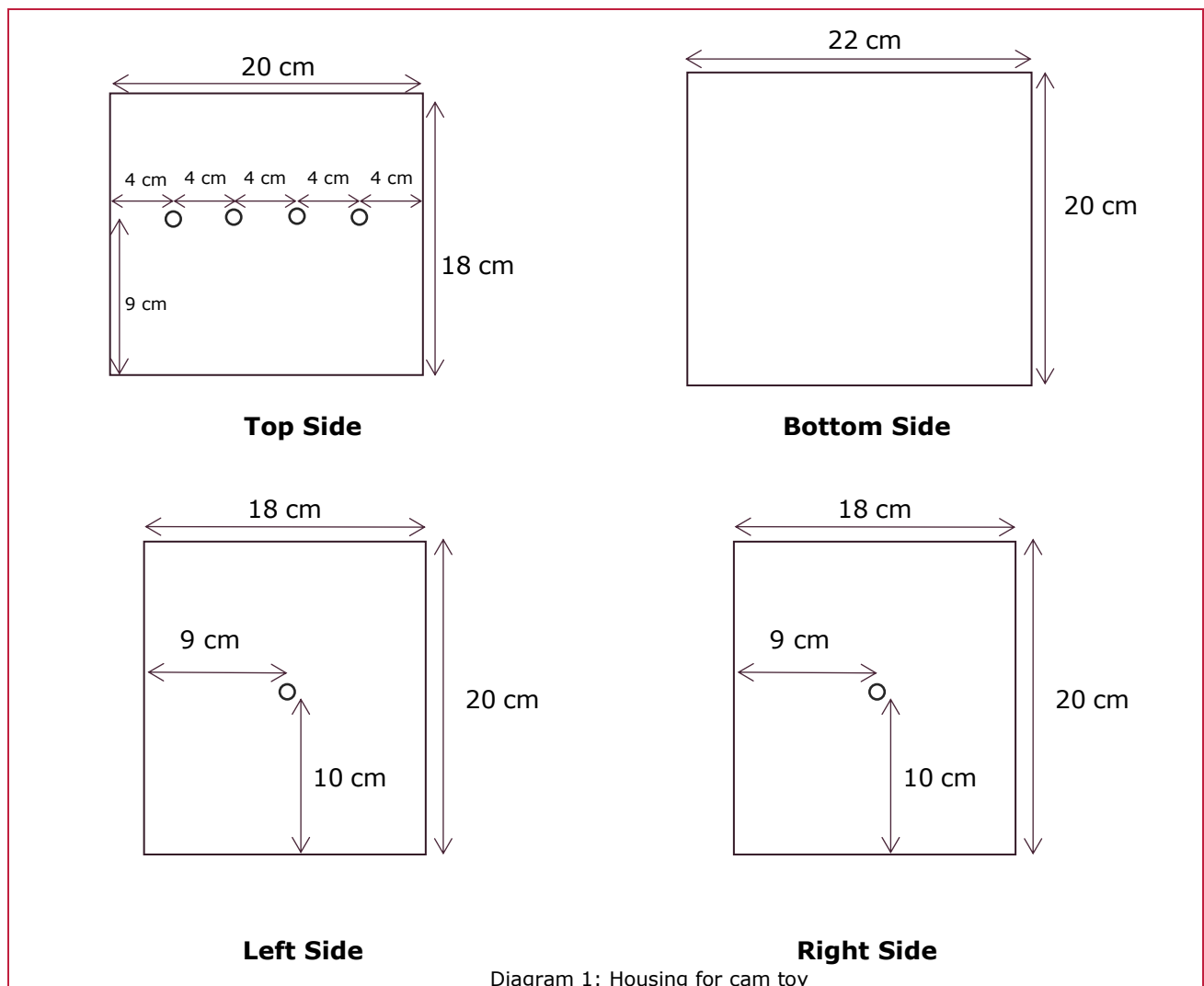
- a. From the tools available in the workshop prepare the appropriate tools/equipment and the necessary PPEs for their use during the task.

The following questions should be worked out together.

- b. Construct the housing for the cam and crank system;
- c. Construct appropriate cams and crank assemblies to complete the toy.

The teacher will be giving you the necessary materials to construct the housing and the mechanical parts. Use the drawings given below as reference.

- i. Drill necessary 6 mm holes at the sides and top of the housing as shown in Diagram 1.



- ii. Construct the first part forming the housing for the cam system. Ensure precise and accurate work to a tolerance ± 5 mm as shown in Diagram 2.

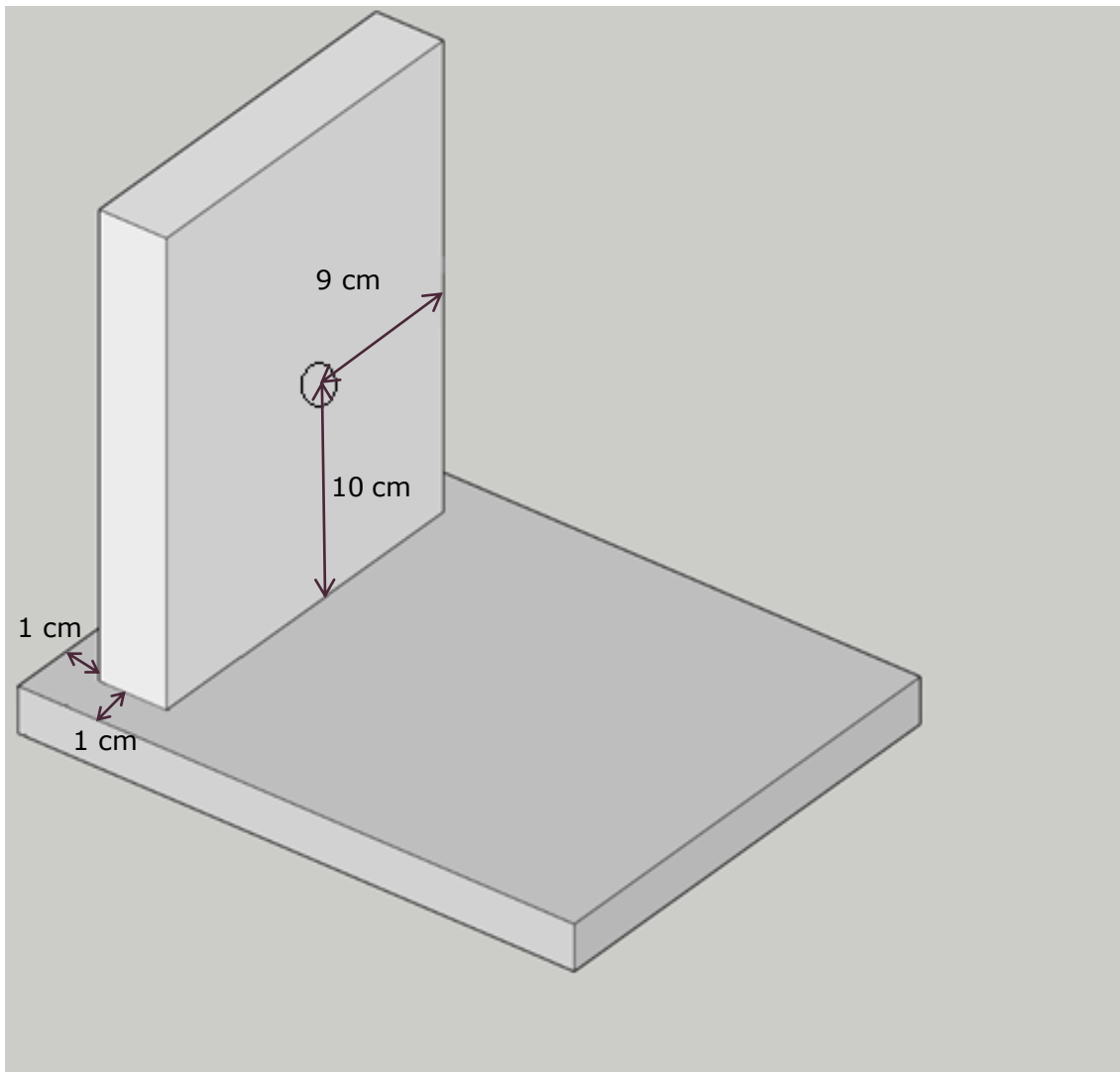


Diagram 2: Housing for cam toy

iii. Use glue to mount the cams to the shaft as shown in Diagram 3.

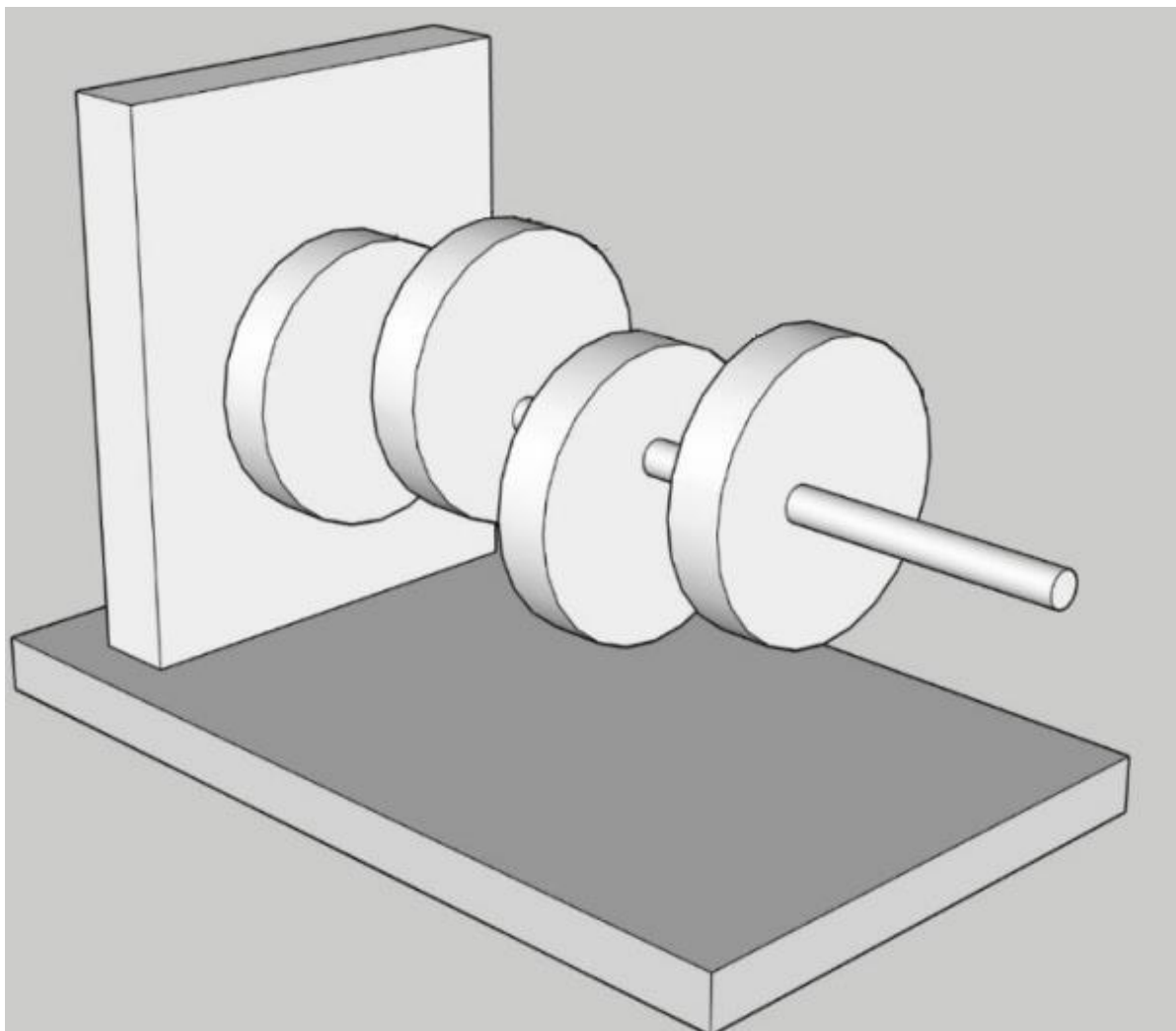
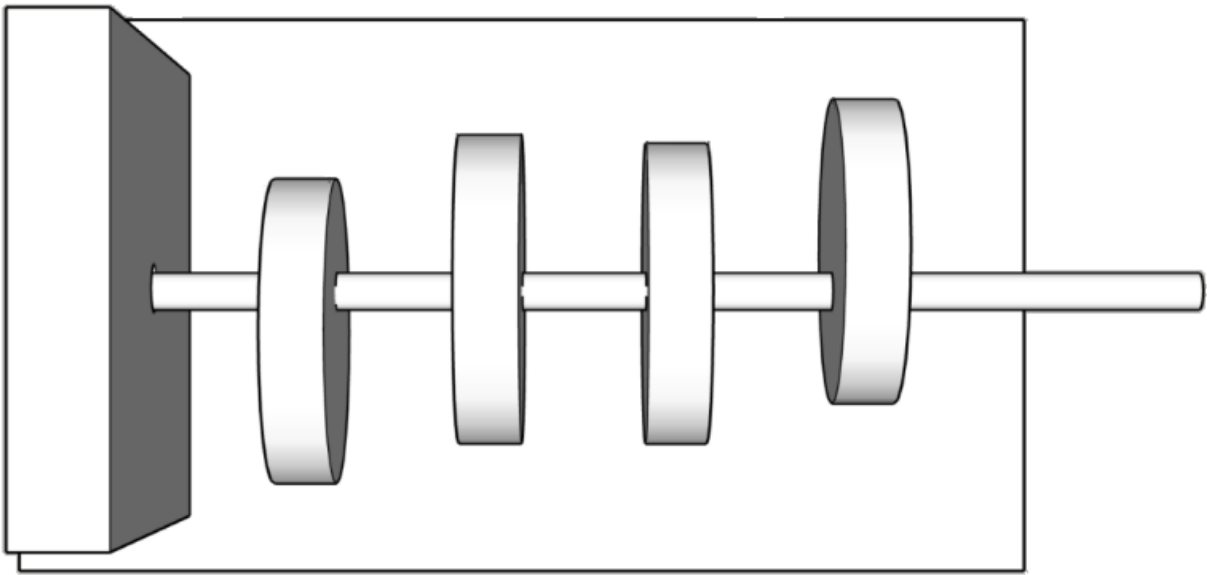
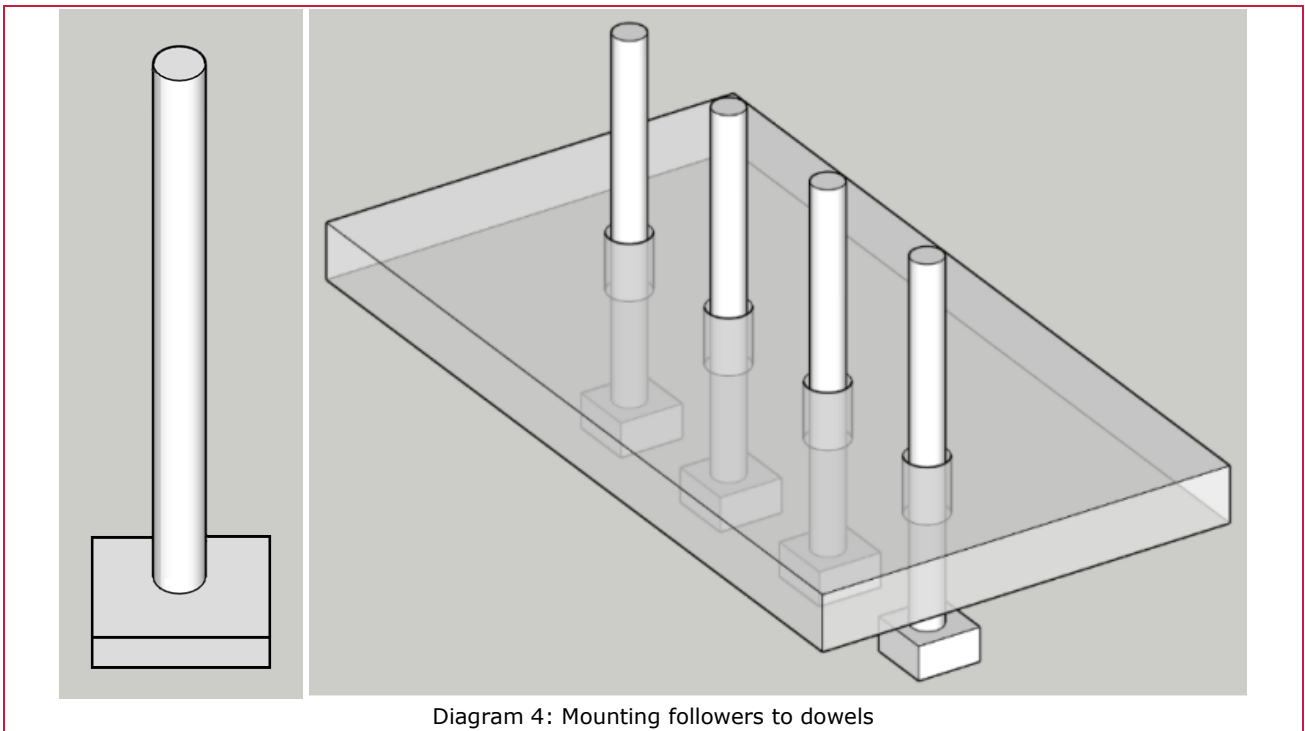
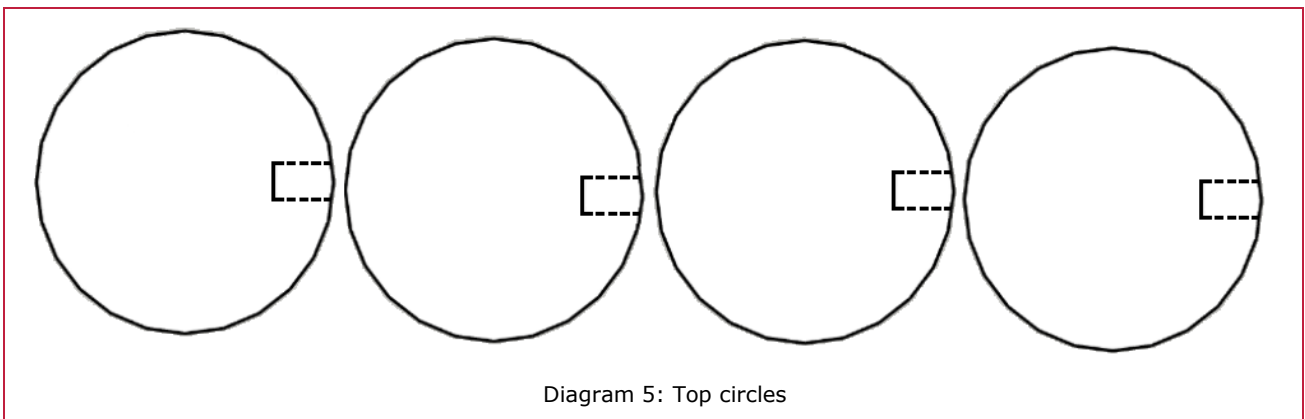


Diagram 3: Mounting cam to shaft

iv. Mount and glue the parts as shown in Diagram 4 and prepare the top cover.



v. Drill holes of suitable diameter and depth on the edge of the **FOUR** circles to be used for the top part as shown in Diagram 5.



vi. Complete the toy by gluing the top circle and the respective rods and the control circle and its lever.

vii. Affix the top cover, front and followers to the remaining of the toy as shown in Diagram 6.

viii. Ensure the functionality of the toy with the complete unit as shown in Diagram 7.

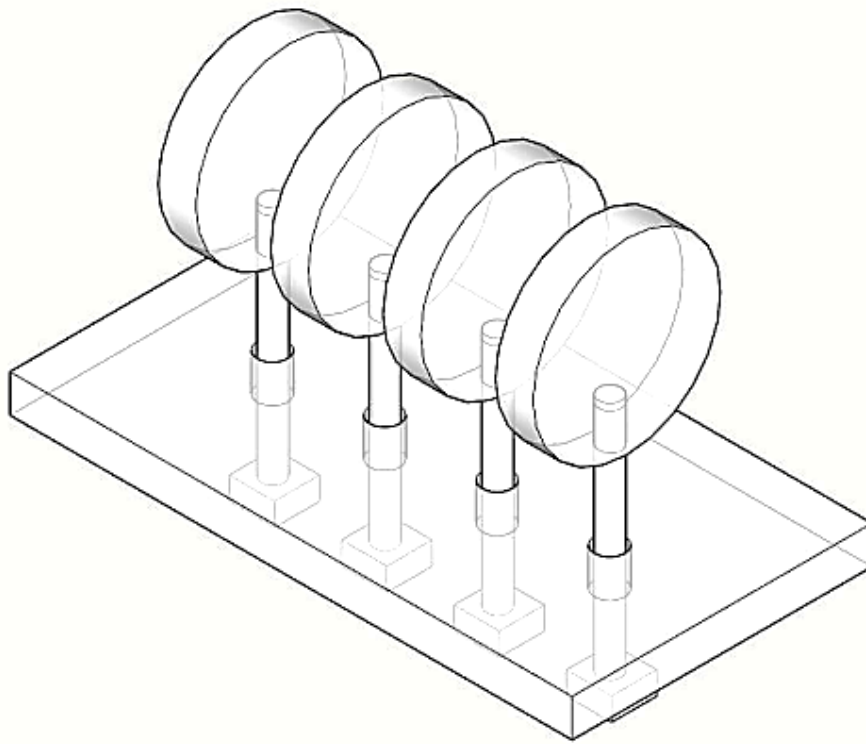


Diagram 6: Top part of the cam toy

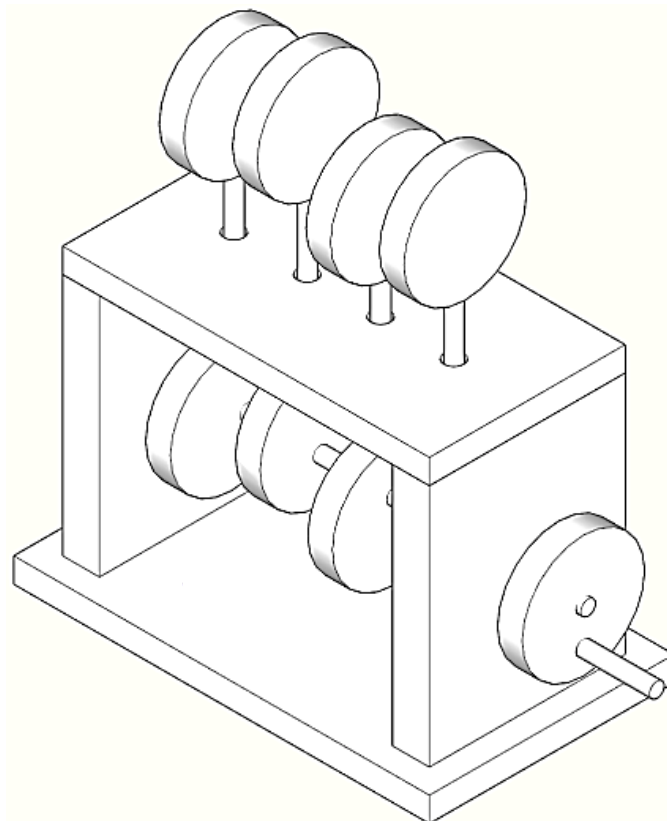
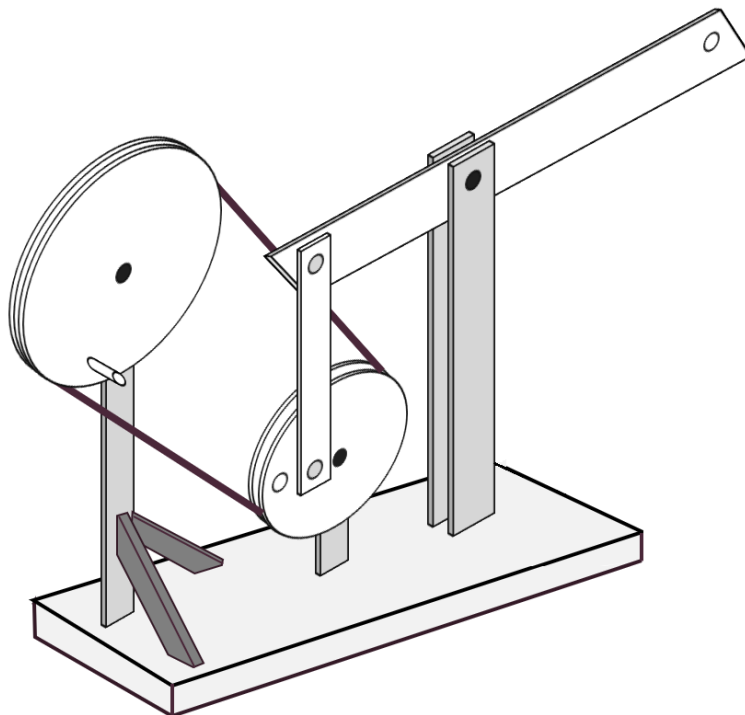


Diagram 7: Complete cam toy

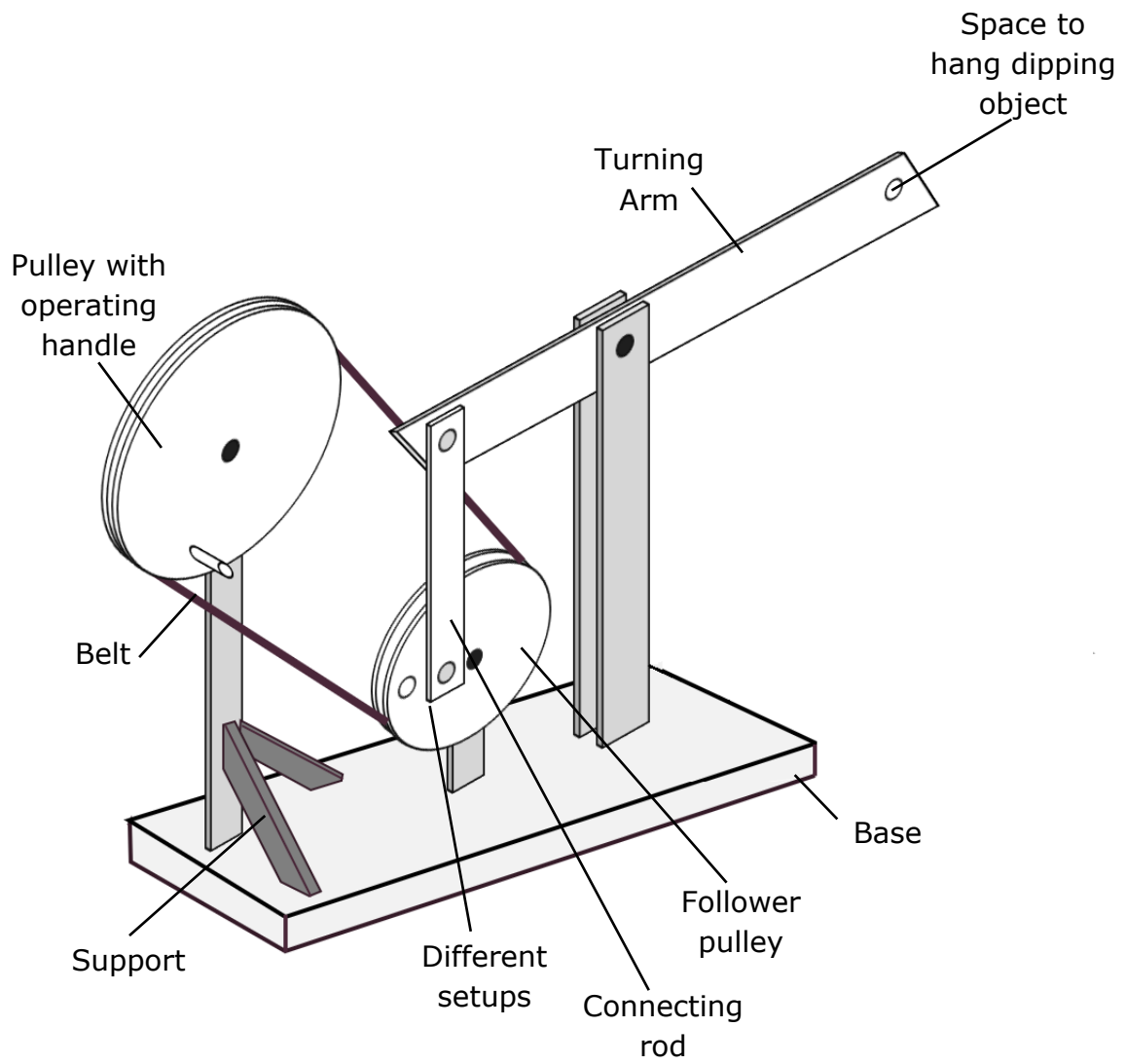
SECTION C - PRACTICAL

Background Information

- You are requested to construct a 'dipping machine' composed of two mechanical sub-systems. The following drawings show the completed machine. A labelled drawing is also included.
- You are required to follow the instructions and:
 - Construct the housing for the different mechanical sub-systems.
 - Construct a mechanical system composed of different mechanical sub-systems.
 - Assemble all parts. The machine should produce motion patterns according to the setting of the rotating disc.
- The teacher will provide you with the necessary tools, equipment and material required to conduct this exercise.
- During this practical task, you should observe all Health and Safety Procedures and use your own adequate PPE.



Dipping machine



Labelled diagram of the machine

SECTION C - PRACTICAL

Question 1

A-5 (10 marks)

- a. From the tools available in the workshop prepare the appropriate tools/equipment, material and the necessary PPEs for their use during the task.

The following questions should be worked out together.

- b. Construct the housing for the mechanical systems.
c. Build the dipping machine composed of different mechanical sub-systems.

The teacher will be giving you the necessary materials to construct the housing and the mechanical parts. Ensure precise and accurate work to a tolerance of ± 5 mm. Use the drawings given below as reference to:

- i. Mark the position where the components will be joined with the base. Use the drawing in Diagram 8 as reference.

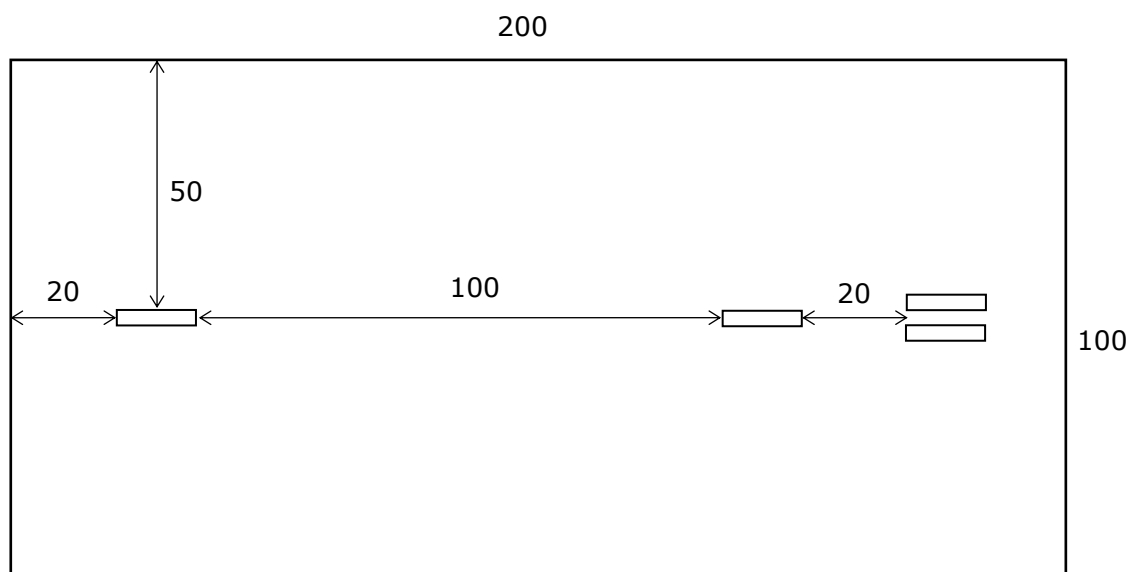
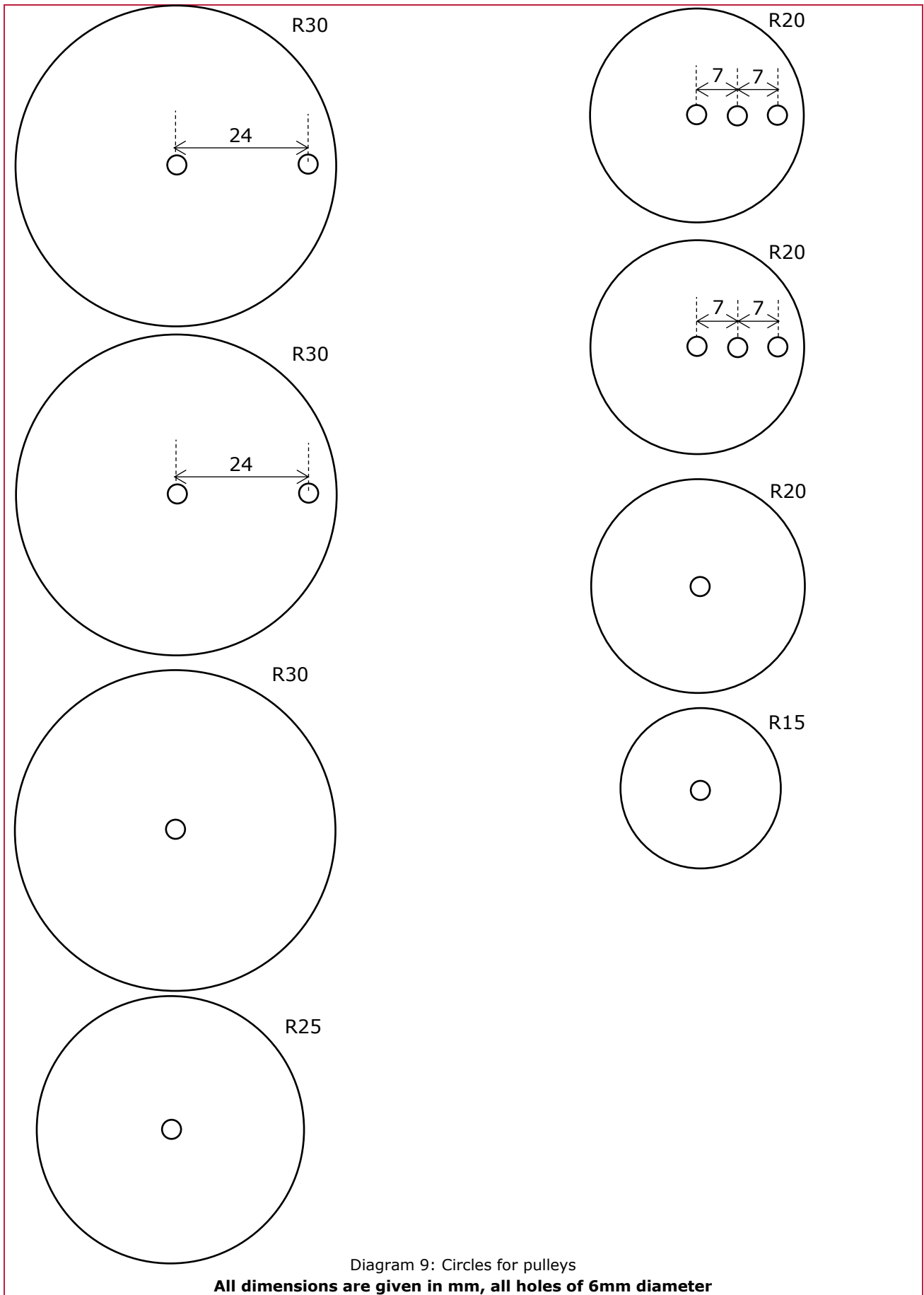
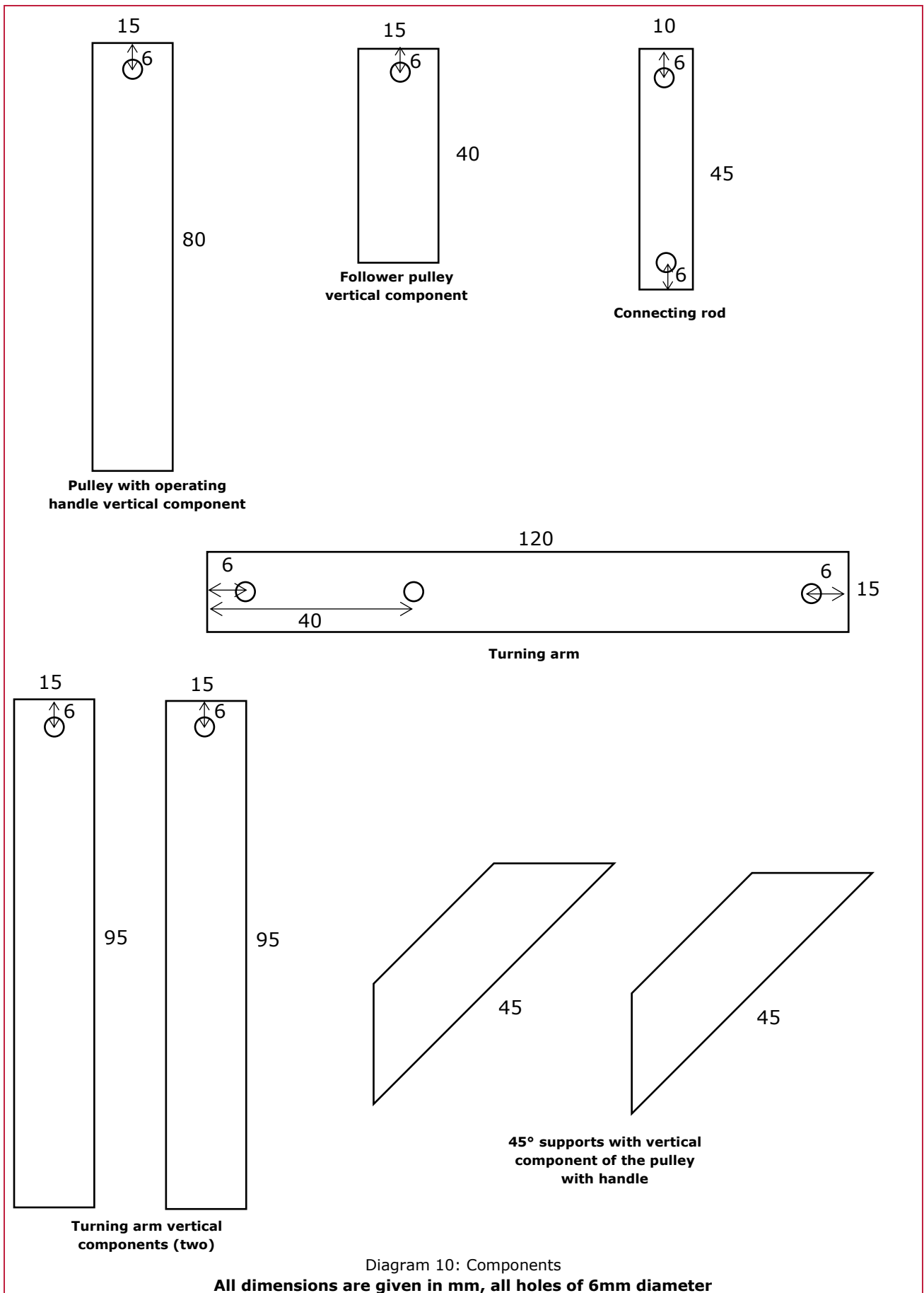


Diagram 8: Housing (base) markings
All dimensions are given in mm

- ii. Drill the appropriate holes in four of the provided circles as shown in Diagram 9. Ensure precise and accurate work to a tolerance of ± 5 mm and $\pm 3^\circ$.





- iii. Glue the circles to form the pulley with the operating handle. Be careful to align the centre and ensure that the sequence of gluing is respected according to the list below.
 - 2x R30 (with two holes)
 - 1x R25 (with one hole)
 - 1x R30 (with one hole)

- iv. Glue the circles to form the follower pulley. Be careful to align the centre and ensure that the sequence of gluing is respected according to the list below.
 - 2x R20 (with three holes)
 - 1x R20 (with one hole)
 - 1x R15 (with one hole)

- v. Affix the vertical supports as per markings indicated in Diagram 8. Glue the dowels to form the cranks on both pulleys.

- vi. Construct the turning arm according to the dimensions given in Diagram 10.

- vii. Assemble all parts according to the labelled diagram of the machine in Page 13, including the dowel as the 'handle' and support.

- viii. Mount rubber band connecting both pulleys.

- ix. Ensure functionality - Machine should dip the object mounted on the end of the moving arm. The depth of the dip is according to the setting the follower pulley is set at.

SECTION D – WRITE-ON

Question 1

C-3 (6 marks)

Different mechanical systems were used to construct the dipping machine. Answer the following questions using the mechanical system constructed in Section C Question 1.

- a. Classify the given parts into the following parameters: 'input and output' or 'process' by ticking ✓ the corresponding boxes below.

	Input and/or output	Process
Turning arm	<input type="checkbox"/>	<input type="checkbox"/>
Pulley with operating handle	<input type="checkbox"/>	<input type="checkbox"/>

- b. Describe the parameters of the mechanical system you constructed in Section C Question 1.

Input and Output: _____

Process: _____

- c. Explain the parameters of the mechanical system constructed in Section C Question 1 by stating how and why the sub-mechanical systems work to produce the required result.

