



**L-Università
ta' Malta**

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

**SECONDARY EDUCATION APPLIED CERTIFICATE LEVEL
2021 SUPPLEMENTARY SESSION**

SUBJECT:	Engineering Technology
PAPER NUMBER:	Synoptic – Unit 2
DATE:	3 rd November 2021
TIME:	4:00 p.m. to 6:05 p.m.

**THIS PAPER SHOULD BE RETURNED TO THE INVIGILATOR
AFTER THE EXAMINATION.**

Answer **ALL** questions in the space provided. You may answer either in English or in Maltese.

Scenario

A technician working with a manufacturing company is required to answer the following questions on threads, pulleys, gears and ratchets, cam and cranks and lever systems.

Question 1

K-1 (6 marks)

a. List the **TWO** different measuring systems used in thread charts.

Measuring system 1: _____ (1)

Measuring system 2: _____ (1)

b. Figure 1 demonstrates an example of a bolt.

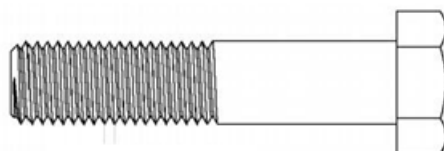


Figure 1: Bolt

Source: <https://www.dreamstime.com>

Outline the following **TWO** terms used when dealing with threads.

Pitch:

_____ (1)

Diameter:

_____ (1)

c. Look at Table 1 below to answer the following questions.

Table 1: Thread chart

Size - Nominal Diameter (mm)	Pitch ¹⁾ (mm)	Tap Drill (mm)
M 1.6	0.35	1.25
M 2	0.40	1.60
M 2.5	0.45	2.00
M 3	0.50	2.50
M 3.5	0.60	2.90
M 4	0.70	3.30
M 5	0.80	4.20
M 6	1.00	5.00
M 8	1.25	6.80
M 10	1.50	8.50
M 12	1.75	10.20
M 14	2.00	12.00
M 16	2.00	14.00
M 20	2.50	17.50

- i. Interpret information from Table 1 above to select the correct tap drill size in milli-meters for the manufacturing of an inside thread for an M4 Bolt.

_____ (1)

- ii. If the following tap drill sizes in Table 2 are available, which tap drill size would you use for the task in Question 1ci.

Table 2: Tap sizes

Tap sizes									
1	1.5	2	2.5	3	3.5	4	4.5	5	5.5

_____ (1)

Please turn the page.

Question 2

K-4 (8 marks)

a. Name **FOUR** different types of gears.

Type 1: _____ (0.5)

Type 2: _____ (0.5)

Type 3: _____ (0.5)

Type 4: _____ (0.5)

b. Outline the function of the driver and driven gears in Figure 2 below.

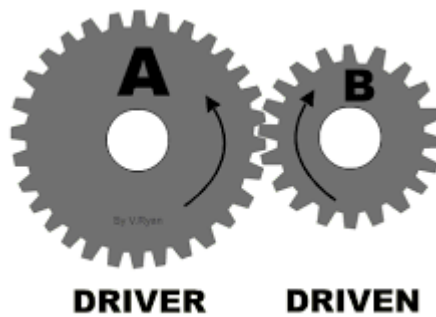


Figure 2: Gears
Source: <https://www.shutterstock.com/>

Driver:

_____ (1)

Driven:

_____ (1)

c. Figure 3 shows a gear system. Describe the outcome of the **TWO** smallest gears (driven) in term of **direction**, if the largest gear (driver) will be rotating **clockwise**.

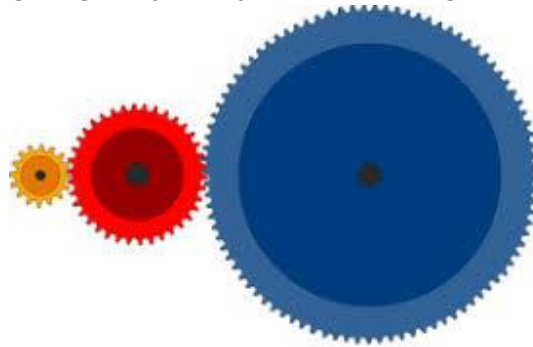


Figure 3: Gear system
Source: <https://www.shutterstock.com>

(4)

Question 3

K-6 (8 marks)

a. Name the different parts of the cam and follower system given in Figure 4.

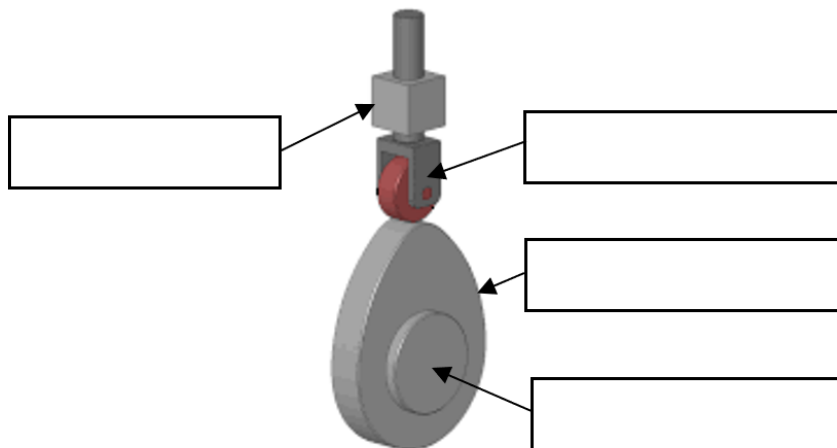


Figure 4: Cam and follower system 1
Source: shorturl.at/dCKRT


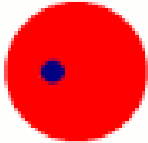
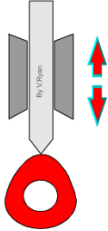
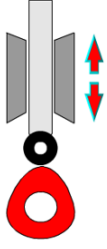
(2)

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b. Identify the cams and followers in different systems given in Table 3 below. Use terms from the ones provided below.

roller	drop	knife	plate	heart	eccentric
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Table 3: Cam and follower systems

i.	ii.	iii.	iv.
 <p>Source: https://www.technologystudent.com/</p>	 <p>Source: https://www.technologystudent.com/</p>	 <p>Source: https://www.technologystudent.com/</p>	 <p>Source: https://www.technologystudent.com/</p>

(2)

c. Describe the motions in the following cam and follower system when the crank is rotated.

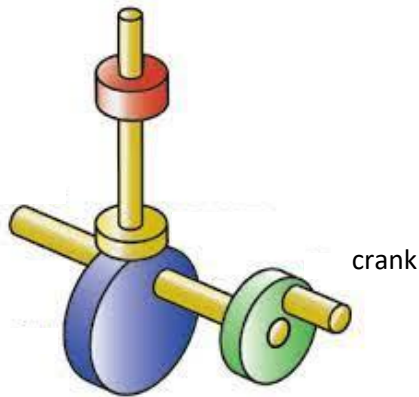


Figure 5: Cam and follower system 2
Source: shorturl.at/mALU0



(4)

Question 4

K-2 (8 marks)

a. Identify the **TWO** types of pulleys given in Table 4 below.

Table 4: Pulleys

	Pulley	Type of Pulley
i.	 <p>Source: https://gigglepin4x4.net/</p>	<p>_____ (1)</p>
ii.	 <p>Source: https://www.harborfreight.com/</p>	<p>_____ (1)</p>

b. Label the different parts in the pulley and belt system shown in the Figure 6 below.

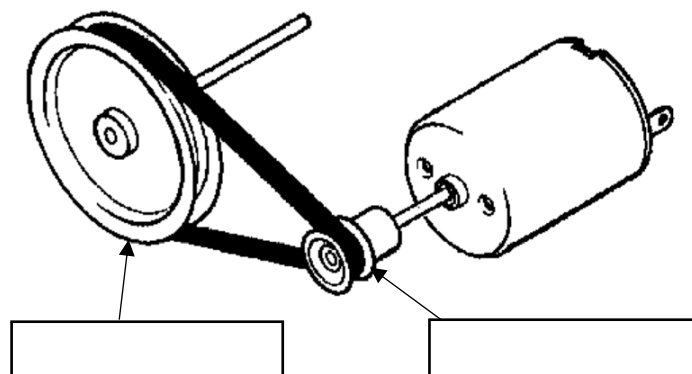


Figure 6: Pulley and belt system
Source: <https://ccea.org.uk/>

(2)

c. Describe the outcome of the compound pulley system shown in Figure 7, when the handle is turned in terms of driver pulley, driven pulley and load.



Figure 7: Compound pulley system
 Source: <https://www.pinterest.com/>

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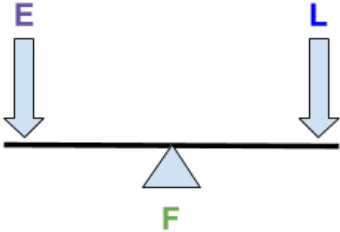
Question 5

K-8 (8 marks)

a. Label the lever classes given in Table 5.

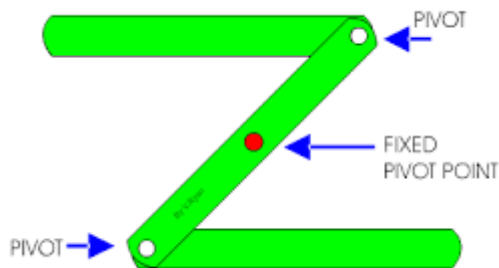
Table 5: Level Classes

	Lever Class	Lever Systems (E – Effort, L – Load, F – Fulcrum)
i.	_____ (1)	

ii.	<hr style="border: 0; border-top: 1px solid black; margin-bottom: 5px;"/> <div style="text-align: right;">(1)</div>	
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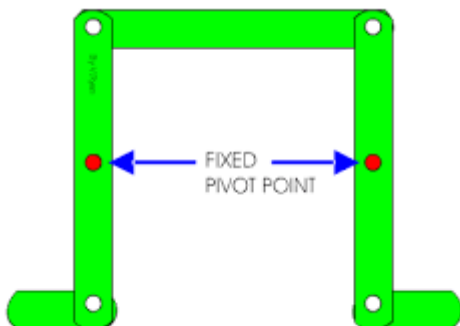
b. Identify the **TWO** different types of linkages in the lever systems shown in Figure 8 and Figure 9. Use words from the ones provided below.

- | | | | |
|-----------|-----------------|------------|-----------|
| push-pull | parallel motion | bell crank | reversing |
|-----------|-----------------|------------|-----------|



_____ (2)

Figure 8: Lever system 1



_____ (2)

Figure 9: Lever system 2

c. Describe the output of the following linkage systems.

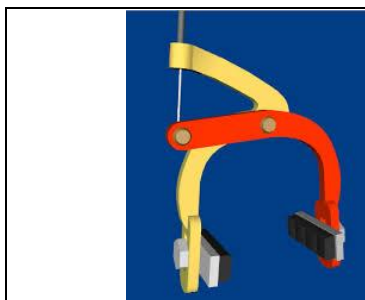


Figure 10: Bicycle Brakes (Linkage system 1)
<https://technologystudent.com/>



Figure 11: Toolbox (Linkage system 2)
<https://rodavigo.net/>

(4)

Question 6

C-1 (12 marks)

a. Figure 12 below, shows a crane structure.

i. Outline the force that the wire rope is having due to the load.

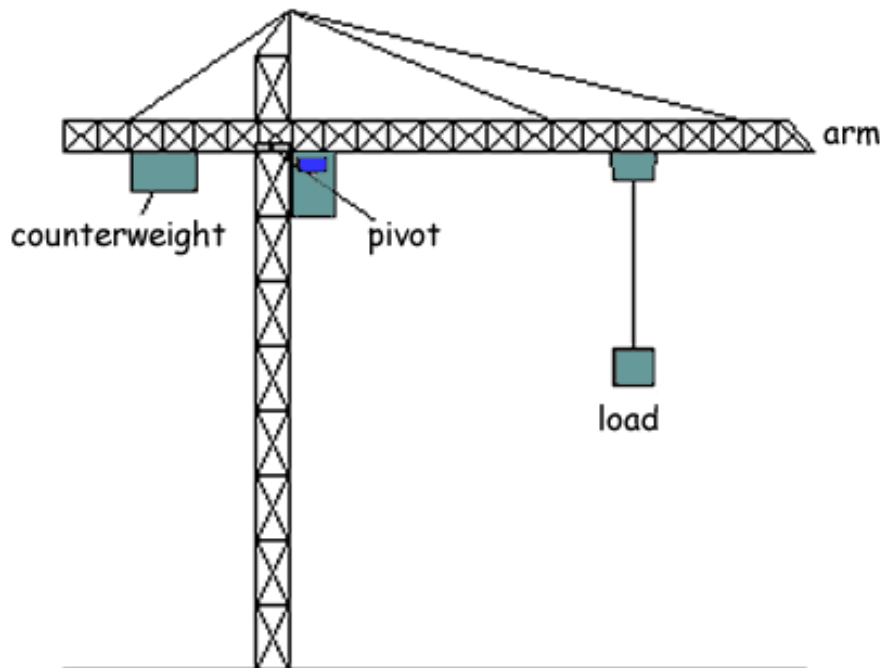


Figure 12: Crane structure

(2)

ii. Outline the force that the load and counterweight are having on the arm.

(2)

b. Figure 13 shows two pulley setups. Explain F_1 and F_2 when lifting the 100N load.

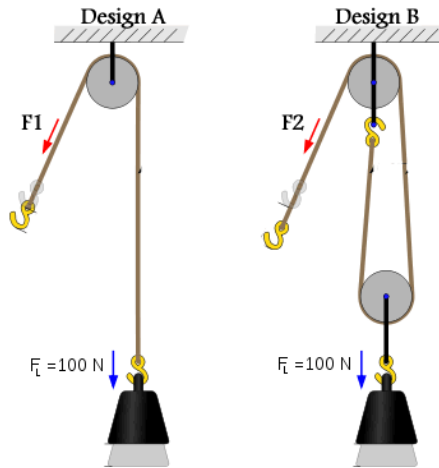


Figure 13: Pulley Setup 2
Source: shorturl.at/dftwL

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c. Determine the effort force F in Newtons, if the mass m in Figure 14 is 4kg. Show all workings.

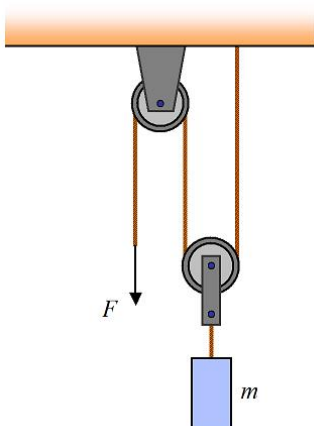


Figure 14: Pulley Setup

Source: <https://www.real-world-physics-problems.com/pulley-problems.html>

(4)