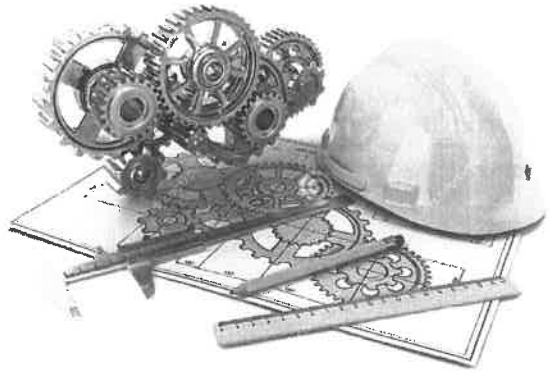
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assessment matters

NATIONAL SENIOR CERTIFICATE EXAMINATION

MAY 2022

ENGINEERING GRAPHICS AND DESIGN
MARKING GUIDELINES
PAPER 2

MARKS: 200
TIME: 3 HOURS



FOR OFFICIAL USE ONLY					
QUESTION	SECTION	MARK	MODERATED	MAXIMUM	CODE
1	MECHANICAL ANALYTICAL			20	
2.1	LOCI MECHANISM			15	
2.2	LOCI CAM			25	
3	ISOMETRIC DRAWING			40	
4	MECHANICAL ASSEMBLY			100	
	TOTAL			200	

CHECKED BY

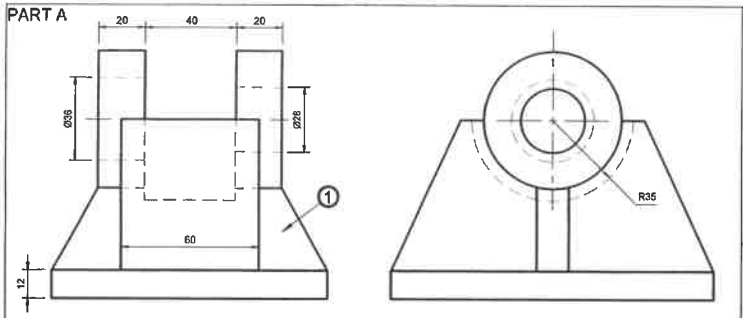
PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of **7 pages**, including the cover page and **5 questions**.
2. **All** questions must be answered.
3. Unless specified otherwise, all questions are in **third-angle orthographic projection.**
4. Unless specified otherwise, all questions are to be completed to a **scale of 1:1**.
5. **All** answer sheets must be re-stapled in numerical order and handed in, including unanswered questions.
6. All **construction work** must be shown, even if a **stencil** was used.
7. Print your **examination number** neatly on each page.
8. Use only the **answer sheets** provided.
9. Your drawings should be **well presented** and reflect **neatness** and **accuracy**. Marks will be **deducted** for untidy and inaccurate work.
10. All dimensions or detail not given must be **assumed** in **good proportion**. with the rest of the drawing.
11. **Stencils** and **calculators** may be used.
12. **All** drawings must adhere to the SANS 10111-1.
13. In order to save time, **detailed assembly parts** must be **drawn to convention**.

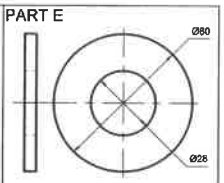
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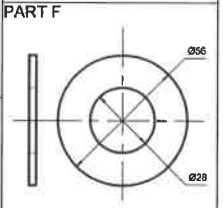
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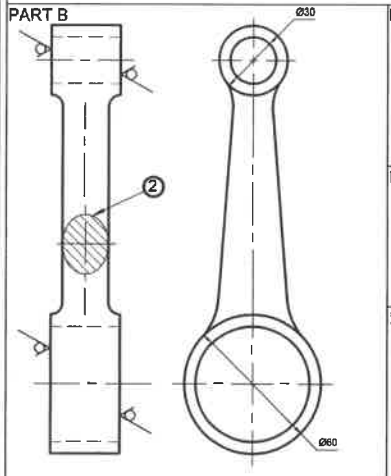
PART E



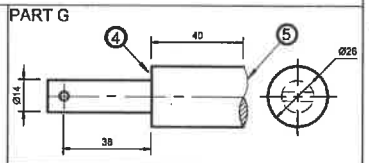
PART F



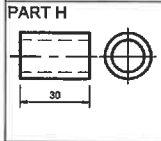
PART B



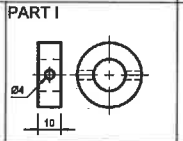
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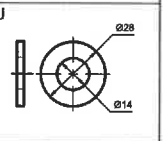
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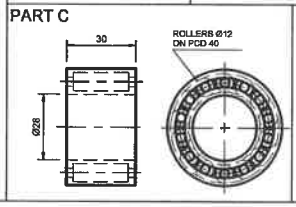
PART I



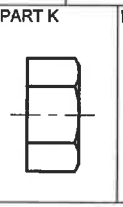
PART J



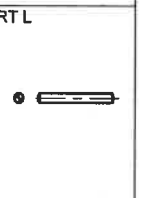
PART C



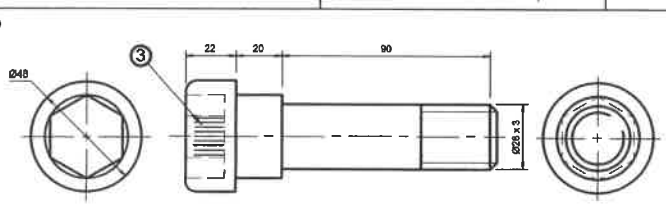
PART K



PART L

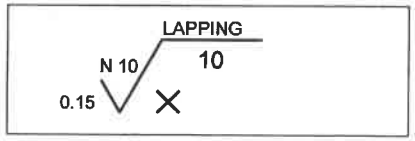


PART D

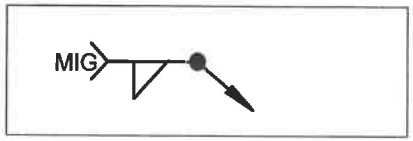


COMPONENT LIST			
NO	PART	QUANTITY	MATERIAL
A	BASE	1	CAST IRON
B	ROCKER ARM	1	FORGED STEEL
C	ROLLER BEARING	1	HIGH-TENSILE STEEL
D	ALLEN HEAD SHAFT	1	HIGH-TENSILE STEEL
E	SPACER	2	PHOSPHOR BRONZE
F	WASHER	1	MILD STEEL
G	SPINDLE	1	HIGH-TENSILE STEEL
H	BUSH	1	PHOSPHOR BRONZE
I	COLLAR	1	MILD STEEL
J	WASHER	1	MILD STEEL
K	M28 NUT	1	HIGH-TENSILE STEEL
L	PIN	1	MILD STEEL

MACHINING SYMBOL



WELDING SYMBOL



QUESTION 1

MECHANICAL ANALYTICAL

Choose the correct answer and write down its corresponding LETTER in the space provided.	ANSWER	
1.1 How many parts make up this assembly? **A.** Eleven **B.** Twelve **C.** Thirteen **D.** Fourteen	C	1
1.2 From what material is the rocker arm (Part B) manufactured? **A.** Cast iron **B.** Forged steel **C.** Mild steel **D.** High-tensile steel	B	1
1.3 In which SI unit are the dimensions presented? **A.** Centimeters **B.** Inches **C.** Millimeters **D.** Metres	C	1
1.4 The total length for the Allen-head shaft (Part D) is: **A.** 90 **B.** 93 **C.** 132 **D.** 135	D	1
1.5 Feature *1* on the base (Part A) is a/an: **A.** Reinforcement **B.** Rib **C.** Elbow **D.** Shackle	B	1
1.6 What type of sectioning is shown at **2** on the rocker arm (Part B)? **A.** Revolved section **B.** Full section **C.** Part section **D.** Removed section	A	1
1.7 Feature *3* on the Allen-head shaft (Part D) indicates: **A.** Parallel grip **B.** Diamond knurling **C.** Straight knurling **D.** Square on a shaft	C	1
1.8 Feature *4* on the spindle (Part G) is a: **A.** Square on a shaft **B.** Shoulder on a shaft **C.** Taper on a shaft **D.** Chamfer	B	1
1.9 Feature **5** on the spindle (Part G) is a/an: **A.** Revolved view **B.** Interrupted view **C.** Extended view **D.** Removed view	B	1
1.10 How many rollers are in the bearing (Part C)? **A.** 12 **B.** 14 **C.** 16 **D.** 40	B	1
1.11 The exact calculated thickness for the nut (Part K) is: **A.** 11.2 **B.** 19.6 **C.** 22.4 **D.** 28	C	1
1.12 What is the metric value for the nut (Part K)? **A.** 42 **B.** 22.4 **C.** M28 **D.** 19.7	C	1
1.13 How many surfaces need to be machined? **A.** 0 **B.** 2 **C.** 4 **D.** 8	A	1
1.14 The machining symbol has a maximum roughness value of: **A.** 0,015 **B.** 0,15 **C.** 10 **D.** N10	D	1
1.15 The machining symbol has an allowance of: **A.** 0,015 **B.** 0,15 **C.** 10 **D.** N10	B	1
1.16 The direction of the lay on the machining symbol is: **A.** Equal **B.** Crossed **C.** Perpendicular **D.** Parallel	B	1
1.17 What does the welding symbol indicate? **A.** Site weld **B.** Weld all around **C.** Gas weld **D.** Square weld	A	1
1.18 What type of welding is shown by the welding symbol? **A.** Single U butt weld **B.** Single V butt weld **C.** Single J butt weld **D.** Fillet weld	D	1
1.19 What welding process is shown by the welding symbol? **A.** Arc welding **B.** TIG welding **C.** MIG welding **D.** Gas flame welding	C	1
1.20 The correct symbol for third angle orthographic projection is: **A.**  **B.**  **C.**  **D.** 	C	1

20 MARKS

EXAMINATION NUMBER

ANSWER SHEET 1

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QUESTION 2.1

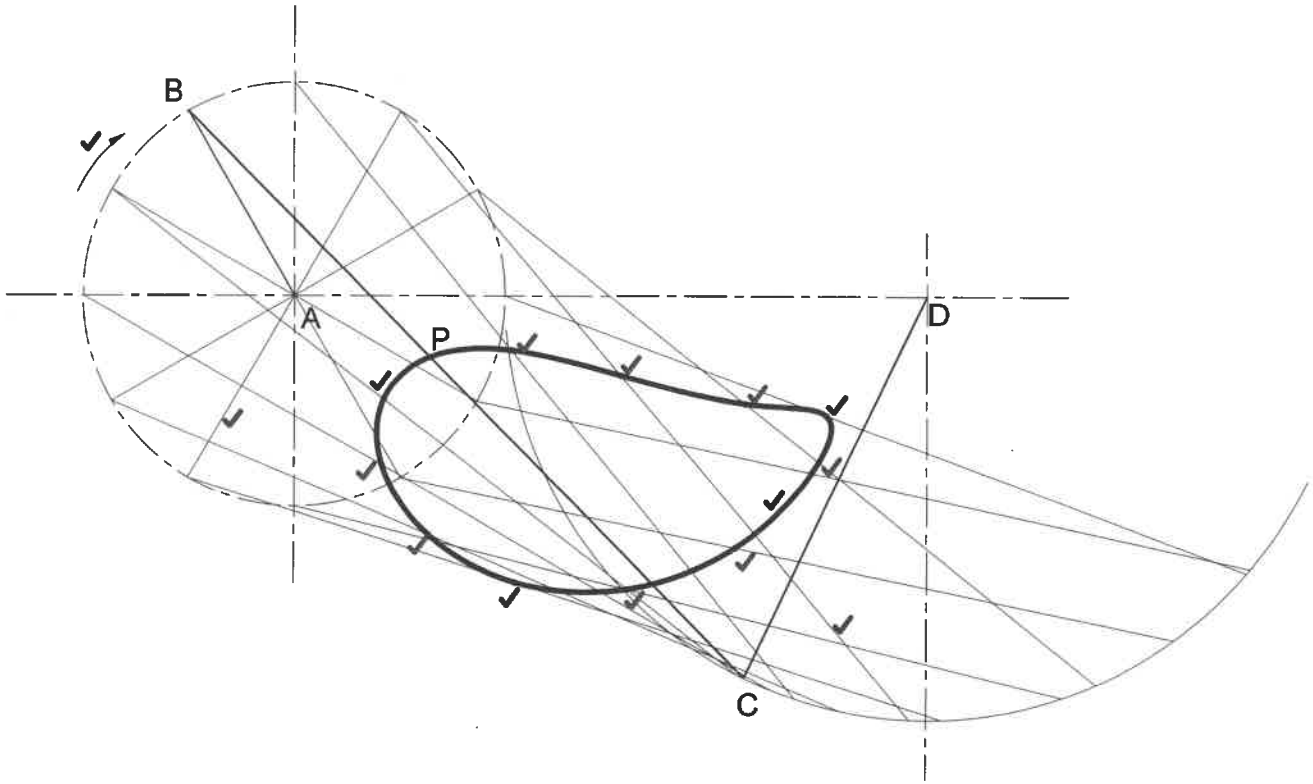
LOCI MECHANISM

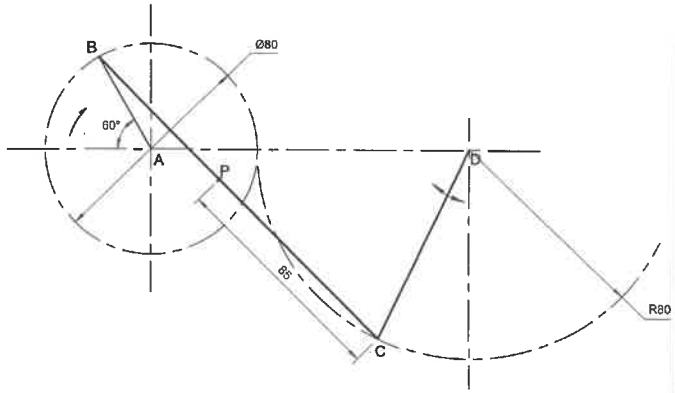
The schematic figure below shows a mechanism consisting of a crank **AB**, with connecting rods **BC** and **CD** joined at point **C**.
P is a point on rod **BC**.

The crank **AB** rotates **clockwise** around centre **A** and rod **BC** pivots at **C** and **D** during rotation.

Use the given centre lines to construct and draw the locus of ***point P*** for one full rotation of the mechanism.

- The length of rod **BC** is 150.
- Draw the direction arrow.
- Show all ***constructions***.





ASSESSMENT CRITERIA	
• Construction	2
• Plot Points	11
• Direction	1
• Locus	1

CON 2	✓	
PTS 11	✓	
DIR 1	✓	
LOC 1	✓	
15 MARKS		

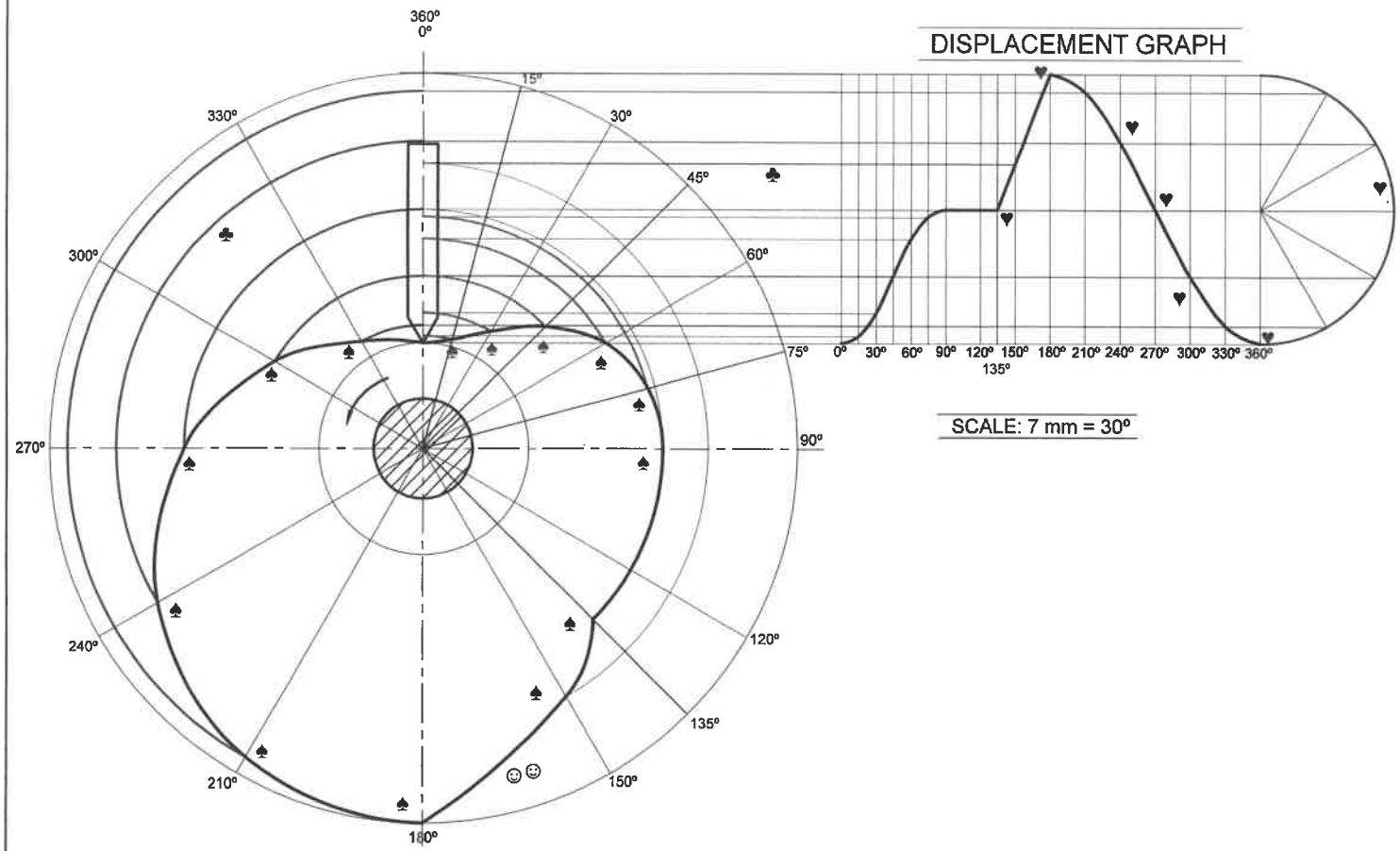
EXAMINATION NUMBER

ANSWER SHEET 2.1

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QUESTION 2.2

LOCI CAM



DISPLACEMENT GRAPH

SCALE: 7 mm = 30°

The following are given in the adjacent drawing:

- the incomplete ***graph of displacement*** of a ***wedge-ended*** follower
- the centre of the camshaft
- the shaft and follower detail at the starting position.

The cam imparts the following motion to the follower:

- 0°– 90° the follower ***rises*** 27 mm with ***uniform acceleration and retardation.*** (given)
- 90°–135° the follower is at ***rest.***
- 135°–180° the follower ***rises*** a further 27 mm with ***uniform motion***.
- 180° – 360° the follower **returns** to its original position with ***simple harmonic motion***.

The cam profile has the following specifications:

- The direction of rotation is ***anti-clockwise***.

2.2.1 Draw the complete graph of displacement.
2.2.2 Draw the cam profile from the displacement graph.
2.2.3 Show all constructions.

ASSESSMENT CRITERIA

• Graph	7
• Plot Points	14
• Locus	2
• Constructions	2

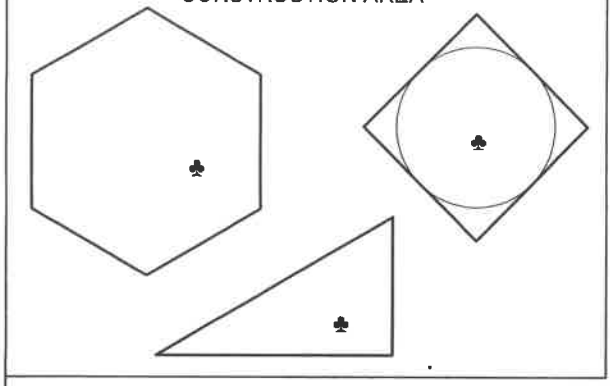
GRPH 7	♥	
PTS 14	♠	
LOC 2	☺	
CON 2	♣	
25 MARKS		

EXAMINATION NUMBER

ANSWER SHEET 2.2

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CONSTRUCTION AREA

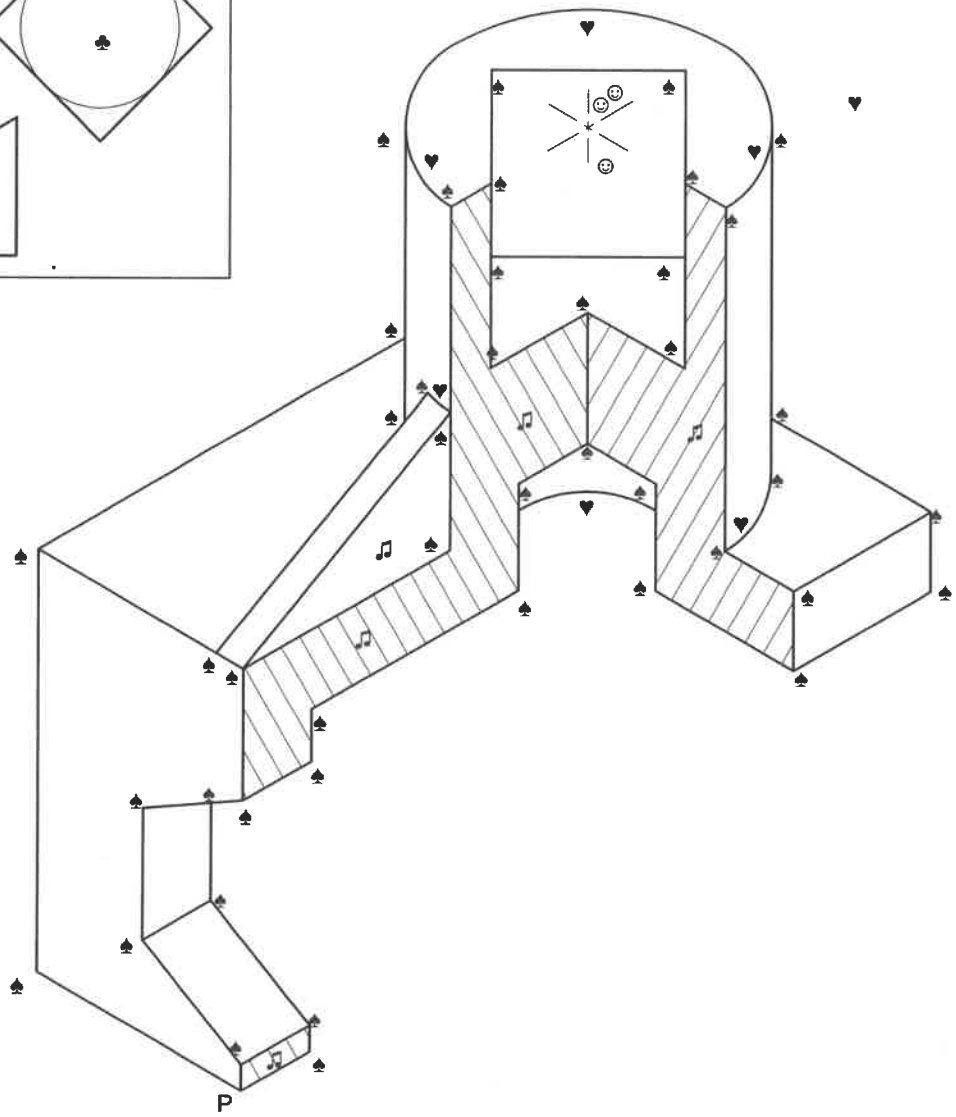


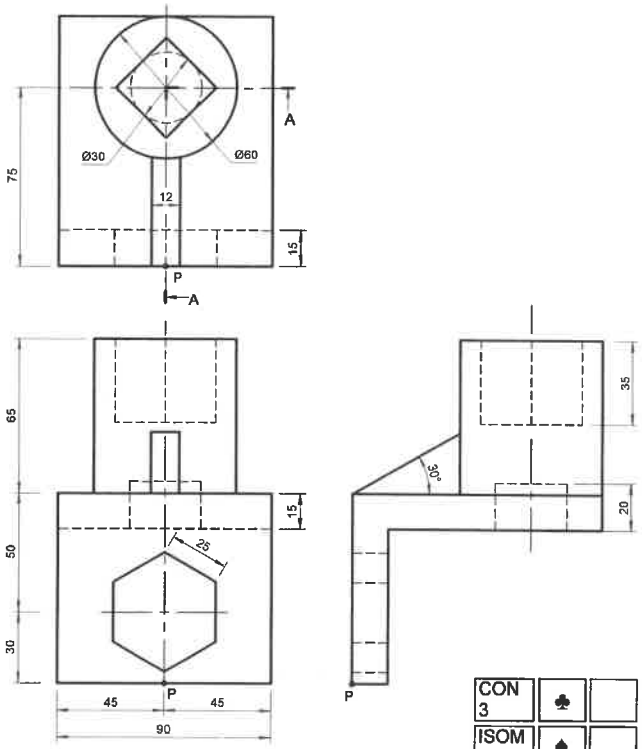
QUESTION 3

ISOMETRIC DRAWING

The figures below show the front view, top view and right view of a heavy duty ***CASTING***. The ***CASTING*** is cut by ***cutting-plane* A-A.**

3.1 Draw a neat ***half-sectioned isometric*** drawing of the ***CASTING*** on ***cutting-plane* A-A.**
3.2 Show all constructions.
3.3 Draw the centre lines for the circles.
3.4 Make point **P** the starting point of your drawing.





ASSESSMENT CRITERIA

• Constructions	3
• Isometric Points 44/2	22
• Isometric Circles	7
• Centre Lines	3
• Hatching	5

CON 3	♣	
ISOM 44/2	♠	
CIRC 7	♥	
CLS 3	☺	
HAT 5	♫	

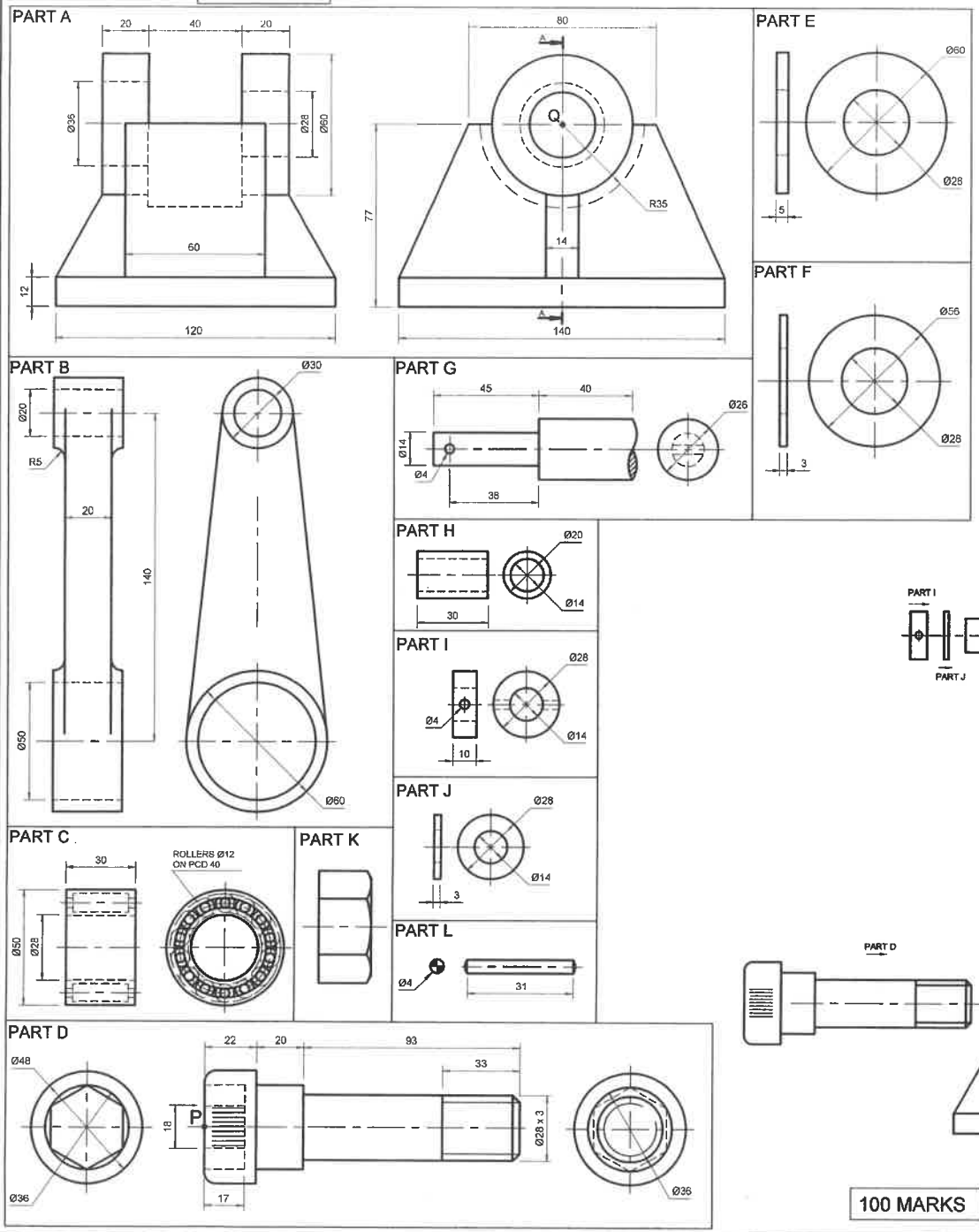
40 MARKS

EXAMINATION NUMBER

ANSWER SHEET 3

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FIGURE 1



QUESTION 4

MECHANICAL ASSEMBLY

Figure 1 shows the different components (not to scale) for a ***ROCKER*** that needs to be assembled.

The ***exploded front view*** of how the components are assembled is also shown.

Complete the following on Answer Sheet 4 to a ***scale of 1:1.*** Use the given centre lines and point **P** on the ***Allen head shaft*** (Part D) and point **Q** on the ***base*** (Part A) as reference to plan the drawing layout.

4.1 Draw a ***full-sectional Front View*** of the assembled components on cutting plane ***A-A*** (Part A).

4.2 Draw a ***Right View*** of the assembled components on the given centre lines.

4.3 Show the ***hidden detail*** on the ***right view*** of ***only*** the ***base*** (Part A) and the ***Allen head shaft*** (Part D) .

4.4 Draw the ***cutting plane A-A***.

4.5 Insert 3 functional ***dimensions*** in the ***front view***.

4.6 Print the ***title*** and ***scale*** in the space provided.

4.7 Correctly label the completed ***front view***.

4.8 Draw the ***roller bearing*** in convention.

COMPONENT LIST			
NO	PART	QUANTITY	MATERIAL
A	BASE	1	CAST IRON
B	ROCKER ARM	1	FORGED STEEL
C	ROLLER BEARING	1	HIGH-TENSILE STEEL
D	ALLEN-HEAD SHAFT	1	HIGH-TENSILE STEEL
E	SPACER	2	PHOSPHOR BRONZE
F	WASHER	1	MILD STEEL
G	SPINDLE	1	HIGH-TENSILE STEEL
H	BUSH	1	PHOSPHOR BRONZE
I	COLLAR	1	MILD STEEL
J	WASHER	1	MILD STEEL
K	M28 NUT	1	HIGH-TENSILE STEEL
L	PIN	1	MILD STEEL

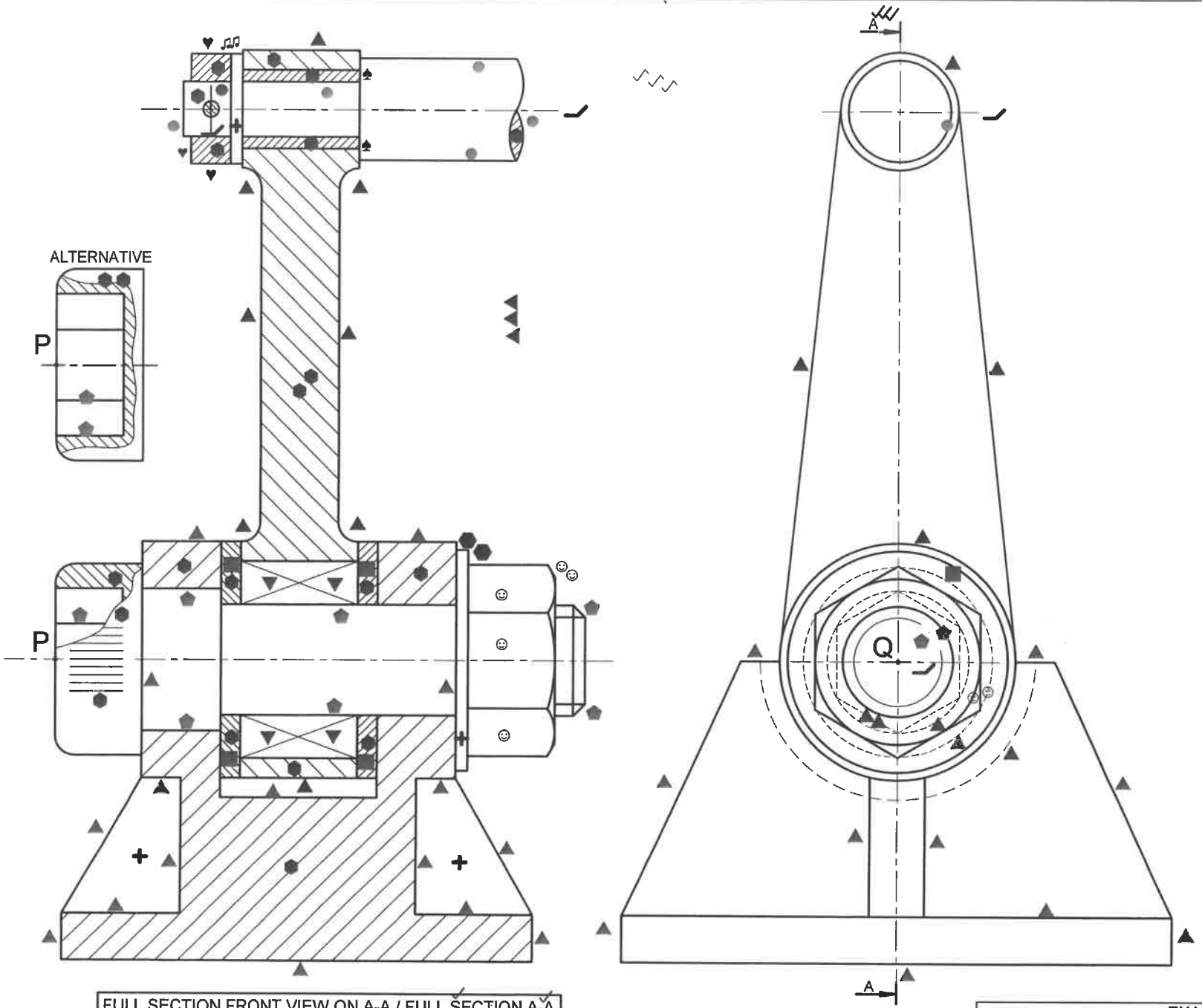
100 MARKS

EXAMINATION NUMBER

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QUESTION 4

MECHANICAL ASSEMBLY



ASSESSMENT CRITERIA SECTIONAL FRONT VIEW			
A BASE 16/2	8		
B ROCKER	8		
C BEARING	4		
D ALLEN HEAD SHAFT	7		
E SPACERS	4		
F WASHER	2		
G SPINDLE	5		
H BUSH	2		
I COLLAR	3		
J WASHER	2		
K M28 NUT	5		
L PIN	1		
TOTAL	51		

RIGHT VIEW			
A BASE 10/2	5		
B ROCKER	4		
D ALLEN HEAD SHAFT	2		
F WASHER	1		
G SPINDLE	1		
K M28 NUT	2		
HIDDEN DETAIL	5		
TOTAL	20		

ADDITIONAL			
CORRECT ASS.	3	✓	
HATCHING 20/2	10		
NON-HATCHING 4/2	2		
CENTRE LINES	4		
DIMENSIONS	3		
CUTTING PLANE	3	✓	
TITLE/SCALE/LABEL	4	✓	
TOTAL	29		
TOTAL	**100**		

FULL SECTION FRONT VIEW ON A-A / FULL SECTION A-A

TITLE:	ROCKER✓	SCALE:	SCALE 1:1

ANSWER SHEET 4

EXAMINATION NUMBER

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