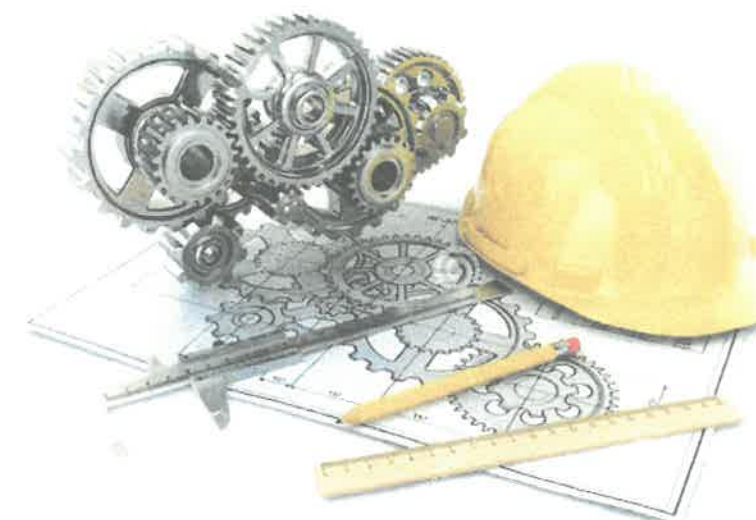




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2022

PAPER 2

MARKS: 200
TIME: 3 HOURS

FOR OFFICIAL USE ONLY

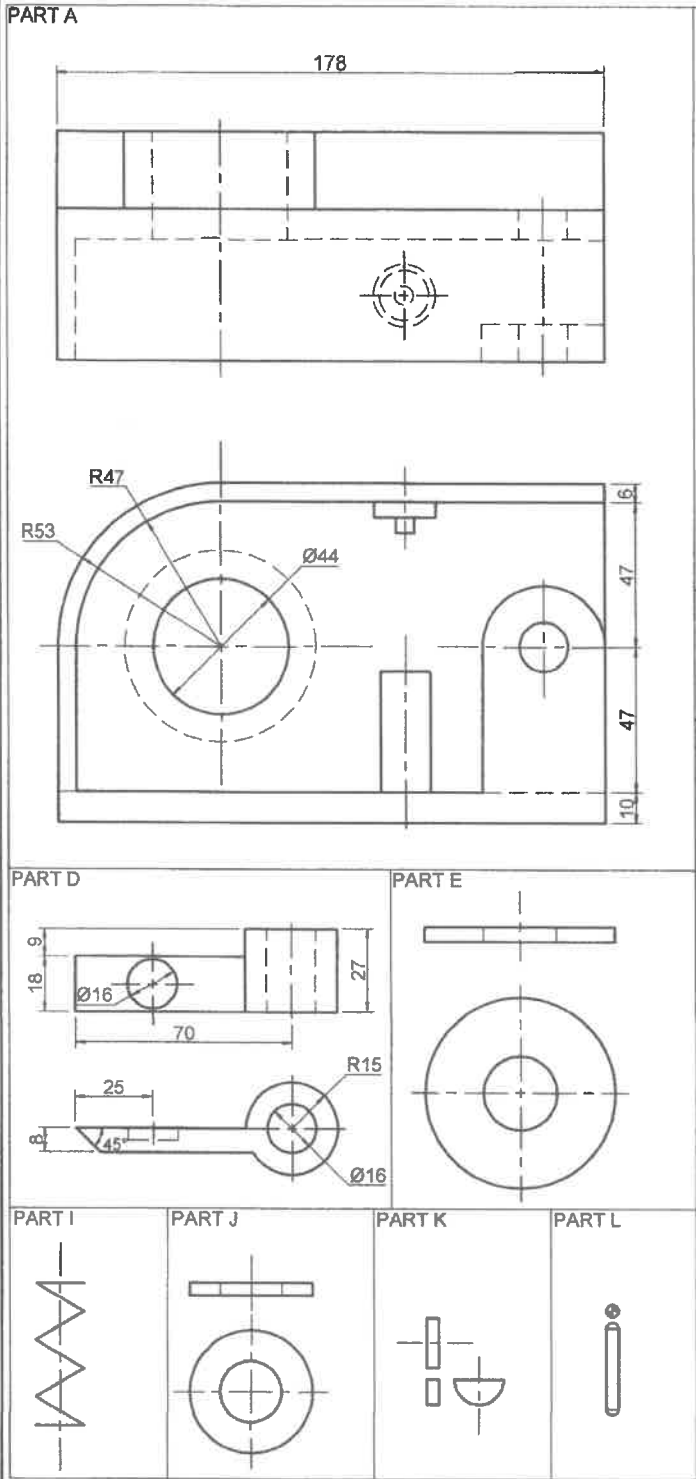
QUESTION	SECTION	MARK			MODERATED			MAXIMUM	CODE
1	MECHANICAL ANALYTICAL							20	
2.1	LOC1 MECHANISM							15	
2.2	LOC1 CAM							25	
3	ISOMETRIC DRAWING							40	
4	MECHANICAL ASSEMBLY							100	
	TOTAL							200	

CHECKED BY

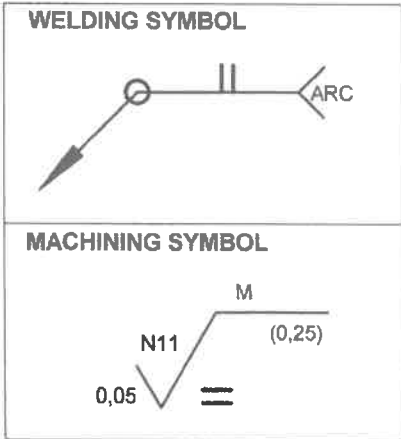
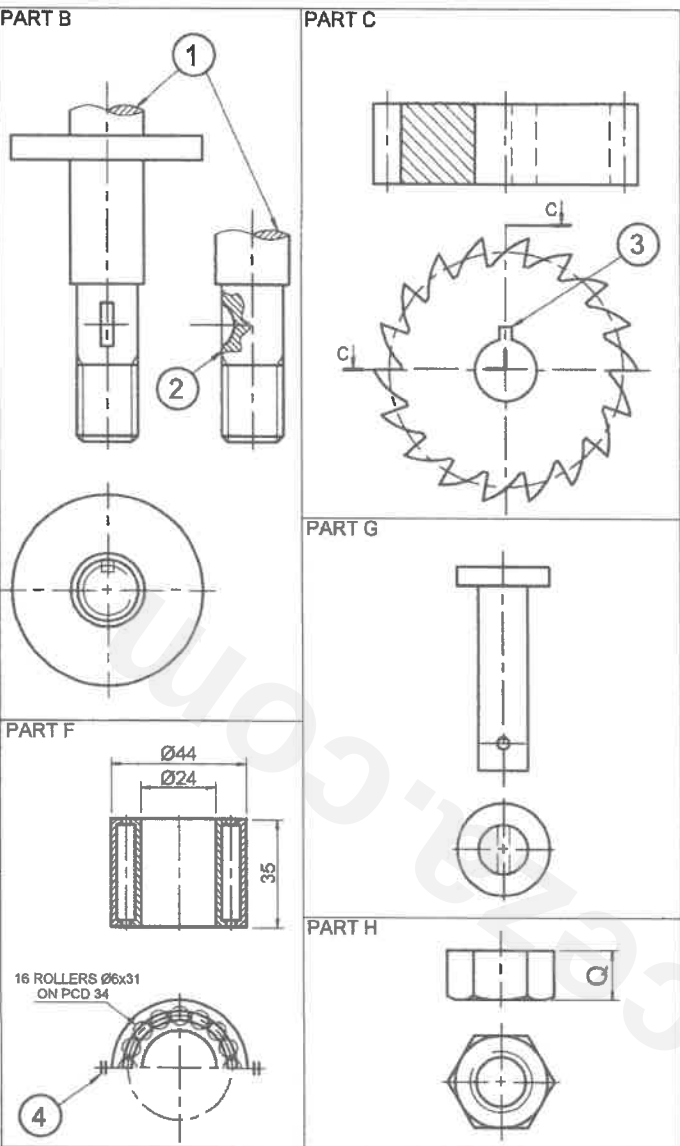
Please paste the barcoded
label here

EXAMINATION NUMBER

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**.



PARTS LIST			
NO	PART	QUANTITY	MATERIAL
A	BASE	1	MILD STEEL
B	RATCHET GEAR SHAFT	1	CARBON STEEL
C	RATCHET GEAR	1	STAINLESS STEEL
D	PAWL	1	STAINLESS STEEL
E	SPACER	1	MILD STEEL
F	ROLLER BEARING	1	CHROME STEEL
G	PAWL SHAFT	1	MILD STEEL
H	M20 NUT	1	STEEL
I	SPRING	1	STAINLESS STEEL
J	WASHER	1	MILD STEEL
K	WOODRUFF KEY	1	ALLOY STEEL
L	PIN	1	MILD STEEL



QUESTION 1						
MECHANICAL ANALYTICAL						
The adjacent figures show the parts of a ratchet gear and pawl. The questions below are based on these figures. Choose the correct answer and write down its corresponding LETTER in the space provided.						
ANSWER						
1.1	How many parts are manufactured from stainless steel?	A. One	B. Three	C. Five	D. Ten	1
1.2	From what material is the Woodruff key (Part K) manufactured?	A. Carbon steel	B. Mild steel	C. Alloy steel	D. High-tensile steel	1
1.3	What does Feature 1 on the ratchet gear shaft (Part B) represent?	A. Symmetry	B. Revolved section	C. Part section	D. Interrupted view	1
1.4	What does Feature 2 on the ratchet gear shaft (Part B) represent?	A. Half-section	B. Revolved section	C. Part section	D. Removed section	1
1.5	What type of sectioning (C-C) is shown on the ratchet gear (Part C)?	A. Half-section	B. Full section	C. Part section	D. Top section	1
1.6	What does Feature 3 on the ratchet gear (Part C) represent?	A. Key	B. Keybase	C. Keylock	D. Keyway	1
1.7	What is the total length of the pawl (Part D)?	A. 47	B. 55	C. 70	D. 85	1
1.8	How many rollers are in the roller bearing (Part F)?	A. 16	B. 17	C. 18	D. 20	1
1.9	What is the length of the rollers in the roller bearing (Part F)?	A. 16	B. 24	C. 31	D. 34	1
1.10	What is the exact dimension of Q of the nut (Part H)?	A. 14,8	B. 15	C. 16	D. 16,2	1
1.11	Which part would prevent the ratchet gear (Part C) from slipping on the ratchet gear shaft (Part B)?	A. Nut	B. Roller bearing	C. Woodruff key	D. Pin	1
1.12	How many teeth are shown on the ratchet gear (Part C)?	A. 16	B. 18	C. 20	D. 22	1
1.13	What symbol does Feature 4 represent on the bearing (Part F)?	A. Symmetrical	B. Square	C. Equal to	D. Parallel	1
1.14	What does the circle on the welding symbol indicate?	A. Site weld	B. Weld all around	C. Gas weld	D. Fillet weld	1
1.15	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. Square butt weld	1
1.16	What welding process is shown by the welding symbol?	A. Arc welding	B. TIG welding	C. MIG welding	D. Gas flame welding	1
1.17	What is the roughness value on the machining symbol?	A. 0,25	B. 0,05	C. N11	D. N12	1
1.18	What is the machining allowance on the machining symbol?	A. 0,25	B. 0,05	C. N11	D. N12	1
1.19	What is the direction of the lay on the machining symbol?	A. Equal	B. Crossed	C. Perpendicular	D. Parallel	1
1.20	What is the correct symbol for third-angle orthographic projection?	A.	B.	C.	D.	1

QUESTION 2.1

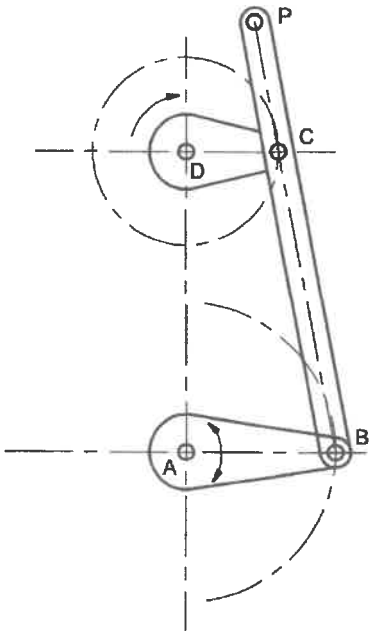
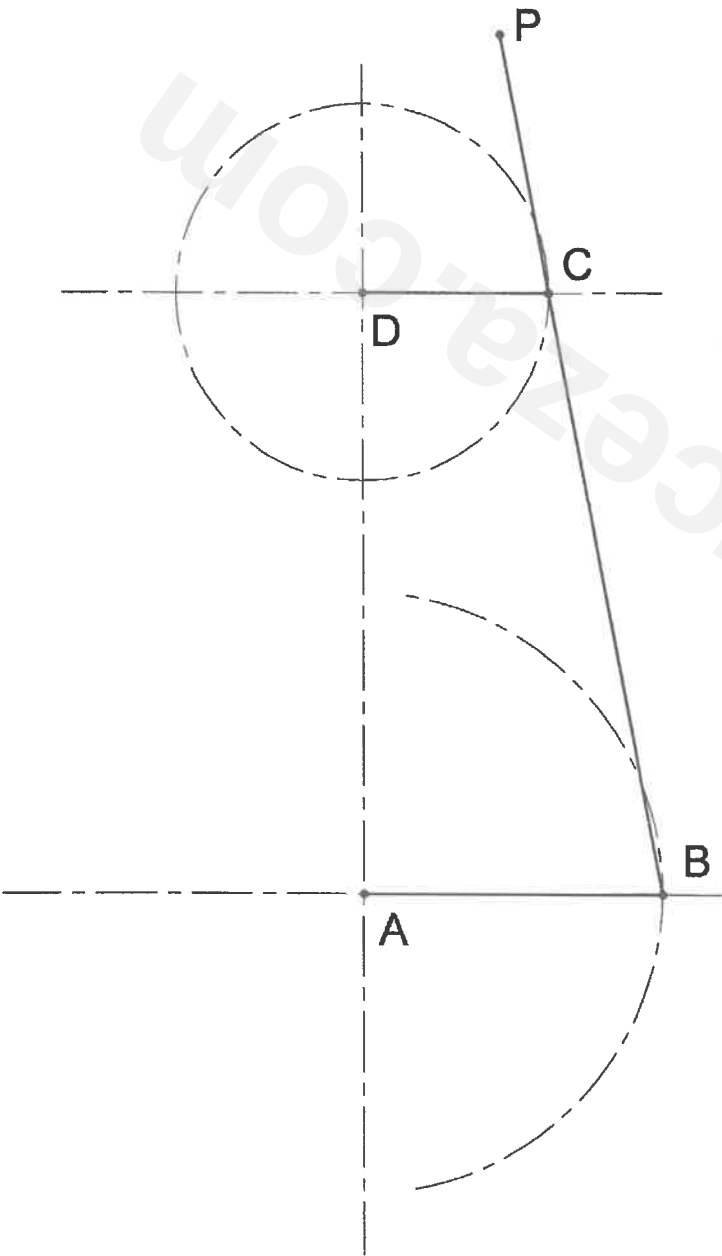
LOCI
MECHANISM

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

The crank **CD** rotates **clockwise** around centre **D** and rod **AB** pivots at **A** and **B** 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 **BP** is 116.
- 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

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ANSWER SHEET 2.1

QUESTION 2.2

LOCI

CAM

- The following are given in the adjacent drawing:
- the incomplete **graph of displacement** of a **roller-ended** follower in position.
 - the vertical and horizontal centre lines of the camshaft.
 - the shaft and follower detail at the starting position.
 - direction of turn.
- The cam imparts the following motion to the follower:
- 0° – 60° the follower **falls** 10 mm with **uniform motion**. (Given)
 - 60° – 240° the follower **falls** a further 48 mm with **uniform acceleration and retardation**.
 - 240° – 360° the follower **rises** 58 mm with **simple harmonic motion** back to its original position.

The roller diameter is 14 mm.

Do the following:

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

ASSESSMENT CRITERIA	
• Graph	12
• Plot Points	11
• Locus	1
• Label Divisions	1

GRPH	12		
PTS	11		
LOC	1		
DIV	1		

25 MARKS

EXAMINATION NUMBER

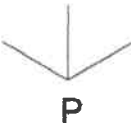
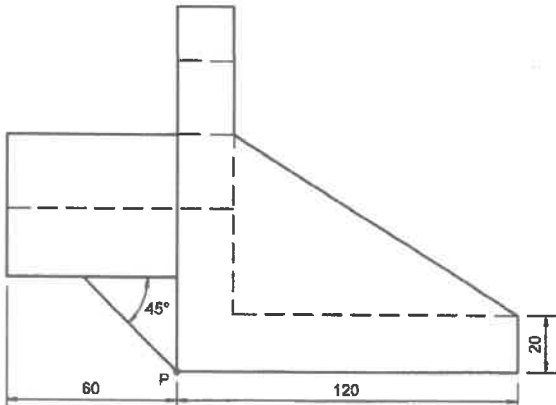
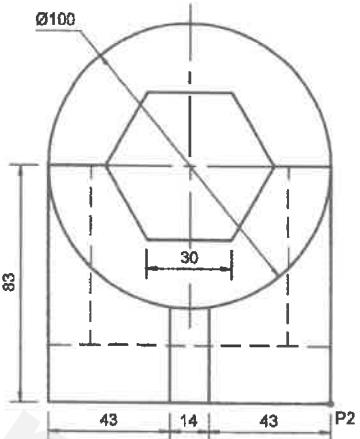
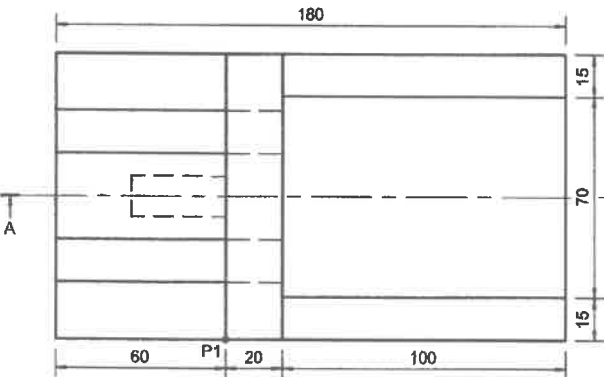
ANSWER SHEET 2.2

QUESTION 3

ISOMETRIC
DRAWING

The figures below show the front view, top view and left view of a **HEAVY-DUTY CASTING**. The **CASTING** is cut by **cutting-plane A-A**.

- 3.1 Draw a neat **full-sectioned isometric** drawing of the **CASTING** on **cutting-plane A-A**.
- 3.2 Draw the auxiliary view of the hexagon and the triangle in the construction area.
- 3.3 Draw the centre lines and show all the constructions for the circle.
- 3.4 Make point **P** the starting point of your drawing.



CONSTRUCTION AREA

ASSESSMENT CRITERIA

- | | |
|---------------------------|----|
| • Construction | 2 |
| • Isometric Points | 28 |
| • Isometric Circles | 5 |
| • Hatching / Non-Hatching | 4 |
| • Centre lines | 1 |

CON 2		
ISOM 28		
CIRC 5		
HAT 4		
CL 1		

40 MARKS

EXAMINATION NUMBER

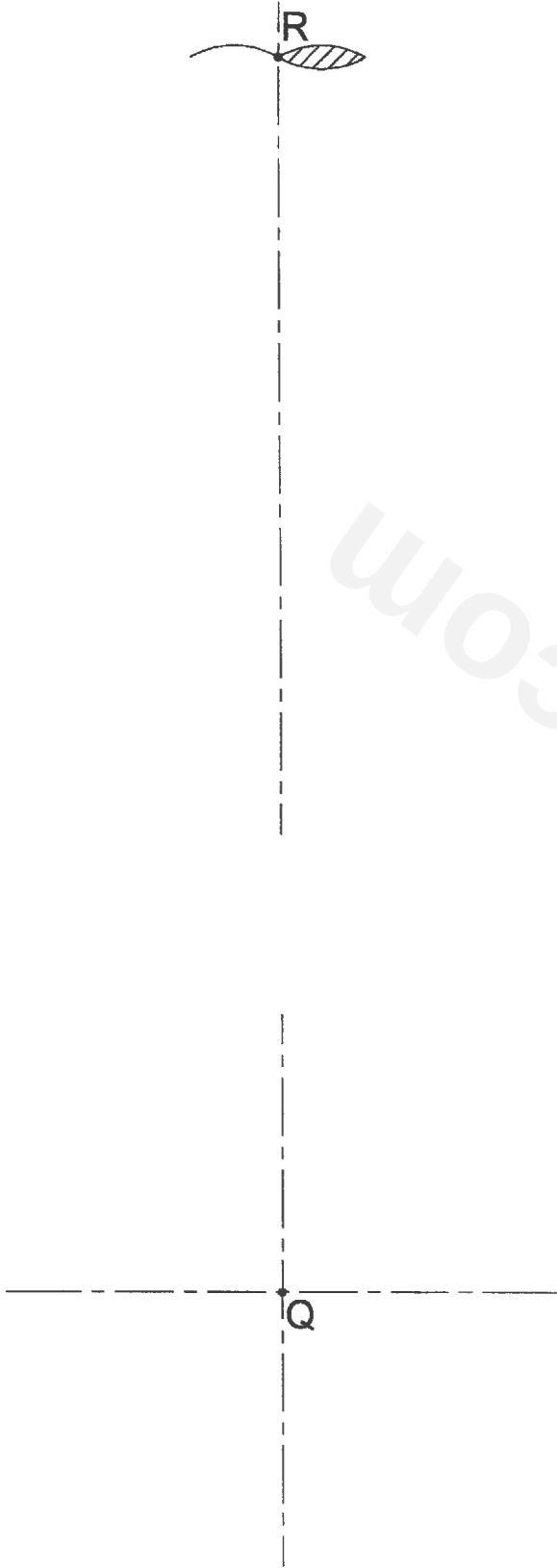
ANSWER SHEET 3

QUESTION 4

MECHANICAL ASSEMBLY



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QUESTION 4

MECHANICAL
ASSEMBLY

ASSESSMENT CRITERIA			
SECTIONED TOP VIEW			
A BASE	14		
B RATCHET GEAR SHAFT 12/2	6		
C RATCHET GEAR	6		
D PAWL	5		
E SPACER	2		
F ROLLER BEARING	2		
G PAWL SHAFT	2		
H M20 NUT	5		
J WASHER	2		
TOTAL	44		

OUTSIDE FRONT VIEW			
A BASE	16		
B RATCHET GEAR SHAFT	2		
C RATCHET GEAR	2		
D PAWL	2		
H M20 NUT	2		
I SPRING	3		
J WASHER	1		
HIDDEN DETAIL	7		
TOTAL	35		

ADDITIONAL			
CORRECT ASS.	3		
HATCHING 12/2	6		
NON-HATCHING 2/2	1		
CENTRE LINES 8/2	4		
DIMENSIONS	2		
CUTTING PLANE 6/2	3		
TITLE & SCALE	2		
TOTAL	21		
TOTAL	100		

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TITLE:

SCALE:

ANSWER SHEET 4

EXAMINATION NUMBER

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