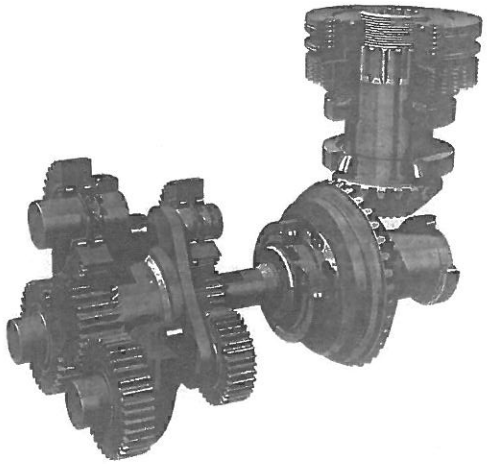
NATIONAL SENIOR CERTIFICATE EXAMINATION

2017

ENGINEERING GRAPHICS AND DESIGN

PAPER 2



MARKS:	200
TIME:	3 HOURS

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of **7 pages** including the cover page and **4 questions.**
2. **All** the 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 **stapled** in **numerical** order and handed in, even unattempted/blank 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. Any dimensions or detail not given may be **assumed** in **good proportion.**
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.**

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

FINAL CONVERTED MARK	CHECKED BY
100	

EXAMINATION NUMBER

QUESTION 1

MECHANICAL ANALYTICAL

Figure A

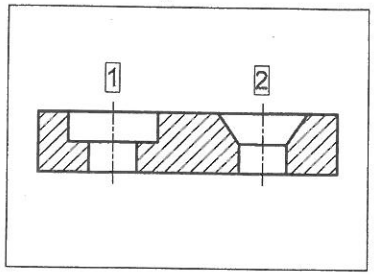


Figure B

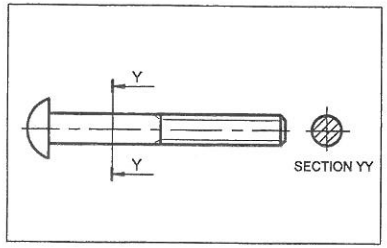


Figure C

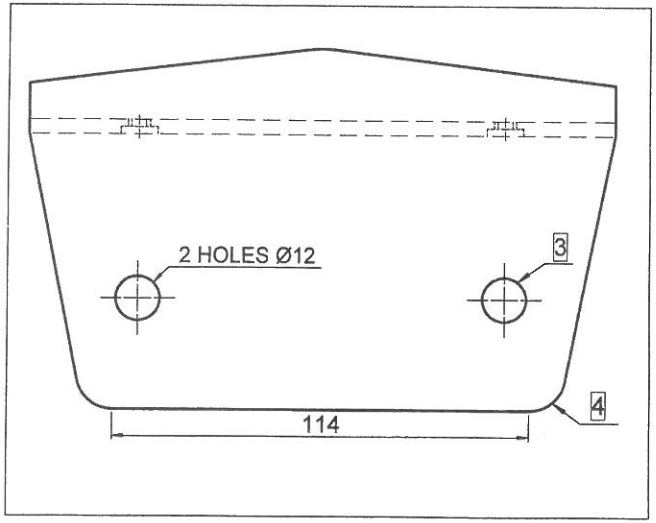


Figure D

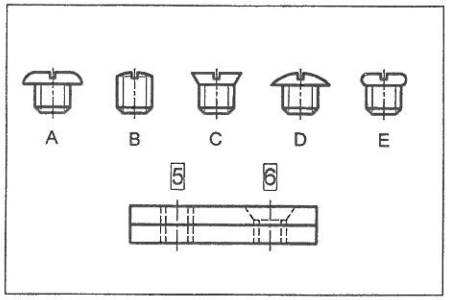


Figure E

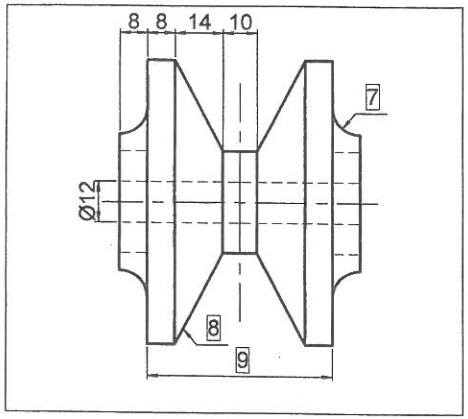


Figure F

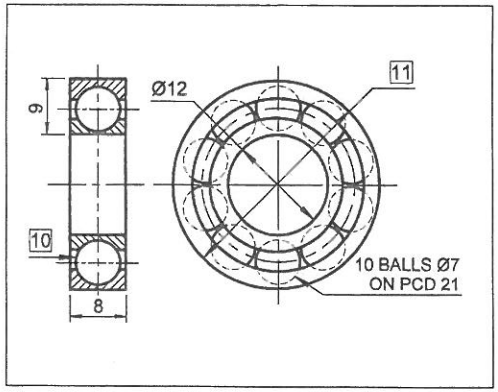


Figure G

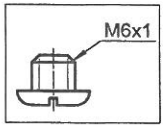
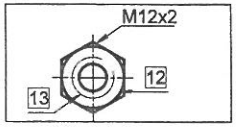


Figure H



Answer the following questions neatly and legibly in the space provided:

1.1 Name the type of hole shown at 1 in Figure A. _____ (1)

1.2 Name the type of hole shown at 2 in Figure A. _____ (1)

1.3 What type of sectioning is shown in Figure B? _____ (1)

1.4 Calculate the radius 3 in Figure C. _____ (1)

1.5 What is feature 4 in Figure C called? _____ (1)

1.6 Which screw in Figure D would fit completely into hole 5 and produce a near flush top surface? _____ (1)

1.7 Which screw in Figure D would fit completely into hole 6 and produce a near flush top surface? _____ (1)

1.8 What is feature 7 in Figure E called? _____ (1)

1.9 What is feature 8 in Figure E called? _____ (1)

1.10 Calculate the dimension 9 in Figure E. _____ (1)

1.11 Calculate the diameter 10 of the ball in Figure F. _____ (1)

1.12 Calculate the diameter 11 in Figure F. _____ (1)

1.13 What is the thickness of the thread in Figure G? _____ (1)

1.14 Is the thread in Figure G external or internal? _____ (1)

1.15 Calculate the diameter 12 of the circle in Figure H. _____ (1)

1.16 Calculate the diameter 13 of the circle in Figure H. _____ (1)

1.17 The ***machining symbol*** in Figure I shows the following information: (2)

Select and circle the correct option.

Option	Machine allowance	Roughness value	Direction of lay	Finish
A	0.2	0.5	Circular	Plating
B	0.5	0.2	=	Plating
C	0.2	0.5	Parallel	Plating
D	=	0.2	Perpendicular	Plating

1.18 The ***welding symbol*** in Figure J shows the following information: (2)

Select and circle the correct option.

Option	Weld type	Site weld	Weld all around	Process
A	Bead	No	Yes	Flame
B	Fillet	Yes	No	Arc
C	Bevel	No	No	Flame
D	Fillet	Yes	Yes	Arc

Figure I

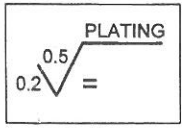
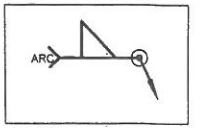


Figure J



20 MARKS

EXAMINATION NUMBER

ANSWER SHEET 1

QUESTION 2.1

LOCUS CAM

Given is the incomplete ***graph*** of ***displacement*** of a ***wedge-ended*** follower as well as the centre of the camshaft as shown by the given centre lines.

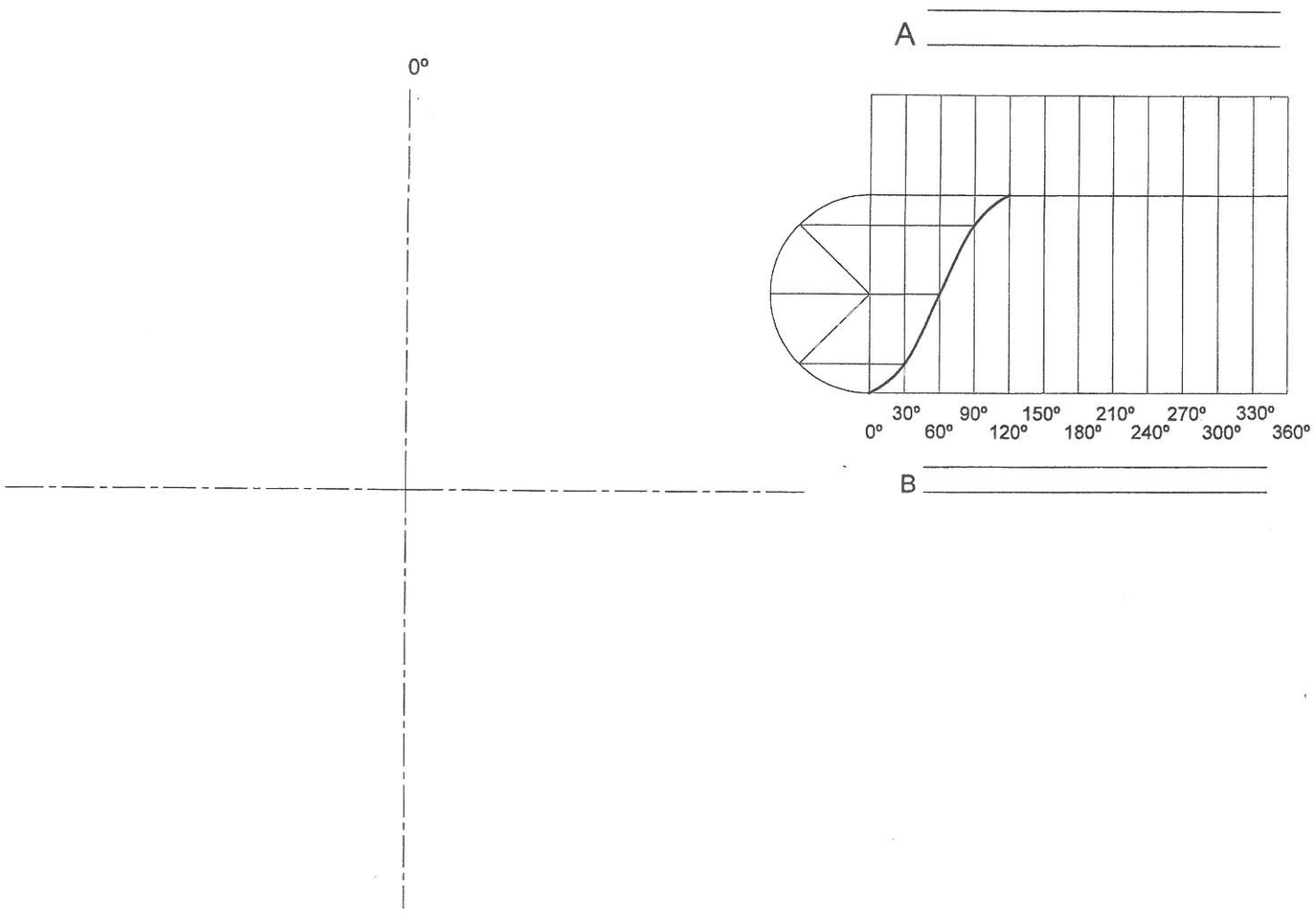
The graph of displacement has the following motion:

- ✓ 0°—120° the follower ***rises*** 40 mm with **simple harmonic motion**. (Given)
- ✓ 120°—150° the follower is at ***rest***. **(Uniform motion)**
- ✓ 150°—180° the follower ***rises 20 mm***. **(Uniform motion)**
- ✓ 180°—360° the follower ***returns to its original position*** with ***uniform*** **acceleration and retardation**.

The cam profile has the following specifications:

- ➢ The direction of turn is ***anti-clockwise***.
- ➢ The ***camshaft*** has a radius of 9 mm.

2.1.1 Draw the complete graph of displacement.
2.1.2 Draw the cam profile.
2.1.3 Draw the camshaft with hatching.
2.1.4 Draw the wedge-ended follower (to your own appropriate size and measurements).
2.1.5 Draw the direction of rotation.
2.1.6 Print, in capitals, the required ***label*** at A and the applicable ***scale*** at B.
2.1.7 Show all constructions.



ANSWER SHEET 2.1

ASSESSMENT CRITERIA		
☑	Graph 12/2	6
☑	Setup/Plot Points	12
☑	Locus	2
☑	Shaft and hatch	1
☑	Follower	1
☑	Direction	1
☑	Label/Scale	2

GRPH 6	
PLOT 12	
LOC 2	
SHFT 1	
FOL 1	
DIR 1	
LBL 2	
25 MARKS	

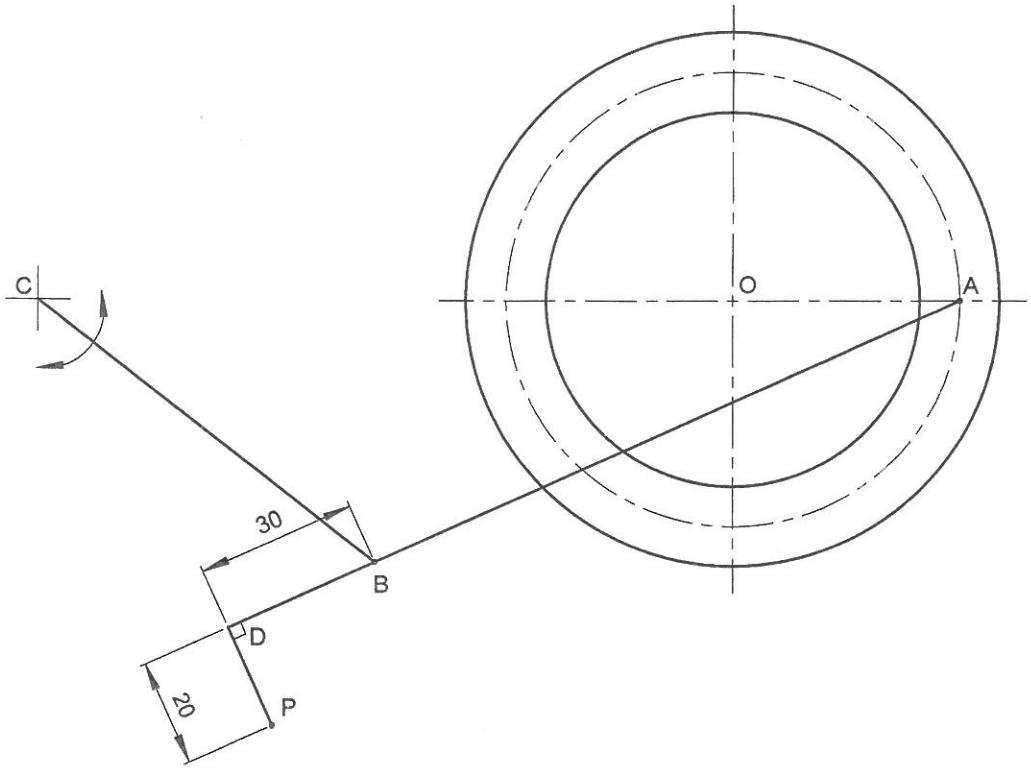
EXAMINATION NUMBER

QUESTION 2.2

LOCUS MECHANISM

The given figure shows a wheel, rotating around the centre O, with a ***rod AD*** attached to it at point A. ***Rod BC*** is pin-jointed at point B and free to move about its anchor point C. ***Rods AD*** and ***DP*** are fixed at 90°. ***Rod BC*** rocks back and forth as the wheel rotates. Construct and draw the locus of ***point P*** if the direction of rotation is ***clockwise***.

Show all ***constructions*** and indicate the ***direction*** correctly.



ASSESSMENT CRITERIA		
☑	Setup	2
☑	Plot Points	11
☑	Direction	1
☑	Locus	1

SET 2

PTS 11

DIR 1

LOC 1

15 MARKS

EXAMINATION NUMBER

ANSWER SHEET 2.2

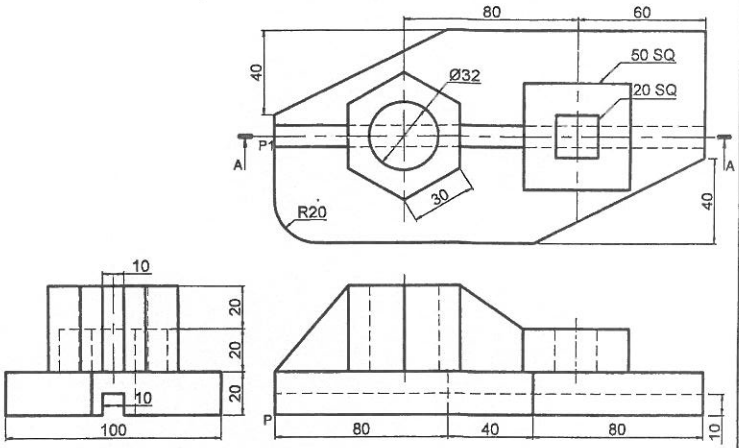
CONSTRUCTION AREA

QUESTION 3

ISOMETRIC DRAWING

The figure below shows the top view, front view and left view of a heavy duty **CASTING**. The **CASTING** has been cut by a ***cutting plane A-A.***

3.1 Draw a neat **Sectioned Isometric** on the cutting plane A-A.
3.2 Show the construction for the hexagon.
3.3 Draw the centre lines for the circle.
3.4 Make point P the lowest part of your drawing.
3.5 Start your drawing on the given crosshairs.



P

ASSESSMENT CRITERIA

☑	Construction	2
☑	Iso points 44/2	22
☑	Iso circles	4
☑	Centre lines	3
☑	Hatching	5
☑	Non-hatching	2
☑	Positioning	2

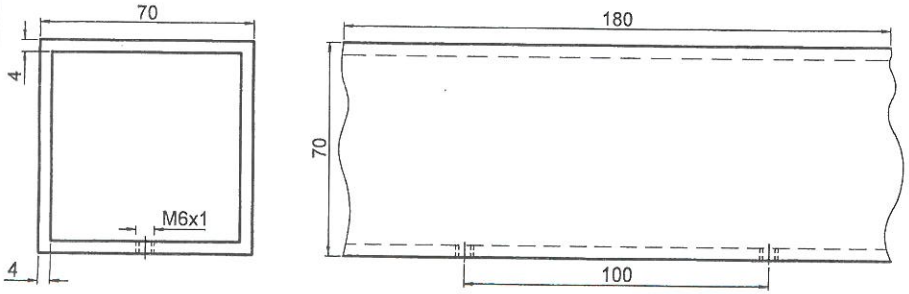
CON 2	
ISOM 22	
CIRC 4	
CLS 3	
HAT 5	
NON 2	
POS 2	
40 MARKS	

EXAMINATION NUMBER

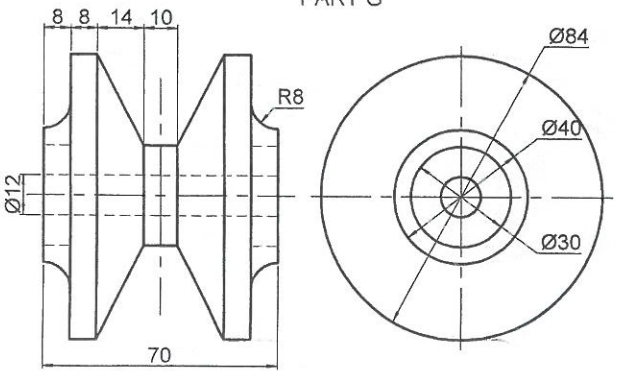
ANSWER SHEET 3

FIGURE 1

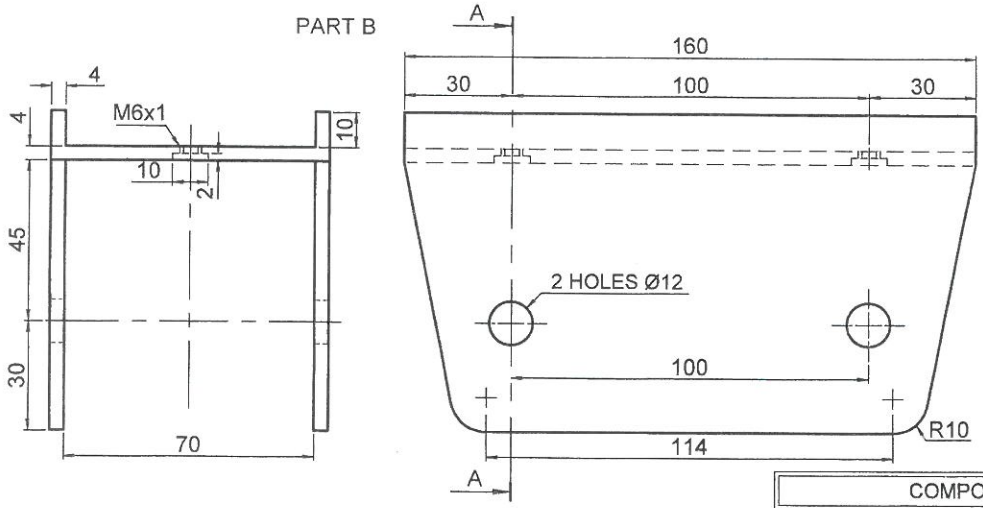
PART A



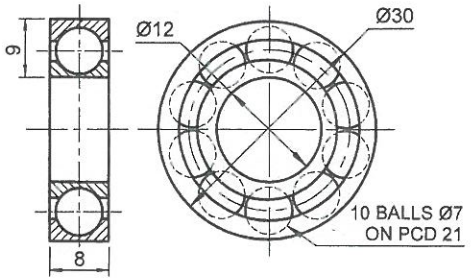
PART G



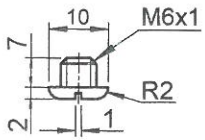
PART B



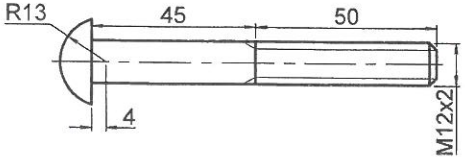
PART H



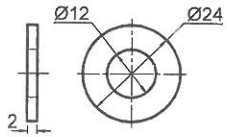
PART C



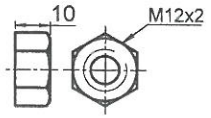
PART D



PART E



PART F



COMPONENT LIST			
NO.	PART	QUANTITY	MATERIAL
A	GATE FRAME	1	MILD STEEL
B	CRADLE	1	MILD STEEL
C	M6 SCREW	2	MILD STEEL
D	M12 BOLT	2	MILD STEEL
E	WASHER	2	MILD STEEL
F	M12 NUT	2	MILD STEEL
G	WHEEL	2	MILD STEEL
H	BEARING	4	STEEL

FIGURE 2

QUESTION 4

MECHANICAL ASSEMBLY

Figure 2 shows a series of pictures of a sliding ***GATE WHEEL*** assembly, as well as an exploded view of how the components of a similar, simplified system are assembled. A list of components is also shown.

Figure 1 shows the different components (not drawn to scale) that need to be assembled.

Complete the following on answer sheet 4 to a ***SCALE*** of ***1:1***:

4.1 A full sectional ***Front View*** of the assembled components on the cutting plane ***A-A.***

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

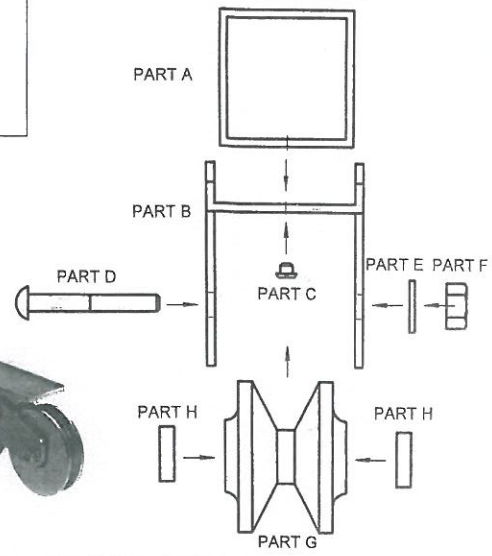
4.3 Please note the following:

Show ***3 faces*** for the ***hexagonal nut*** on the front view.

4.4 Show ***hidden detail*** on the ***right view*** of only the ***Gate Frame*** (Part A) without the holes for the screws, and on only ONE of the two ***Wheels*** (Part G).

4.5 Draw the ***cutting plane*** and the ***centre lines.***
4.6 Draw 3 functional ***dimensions.***
4.7 Draw the projection ***symbol*** in the space provided.
4.8 Print the ***title*** and ***scale*** in the space provided.
4.9 Label the ***sectioned view.***

FRONT VIEW

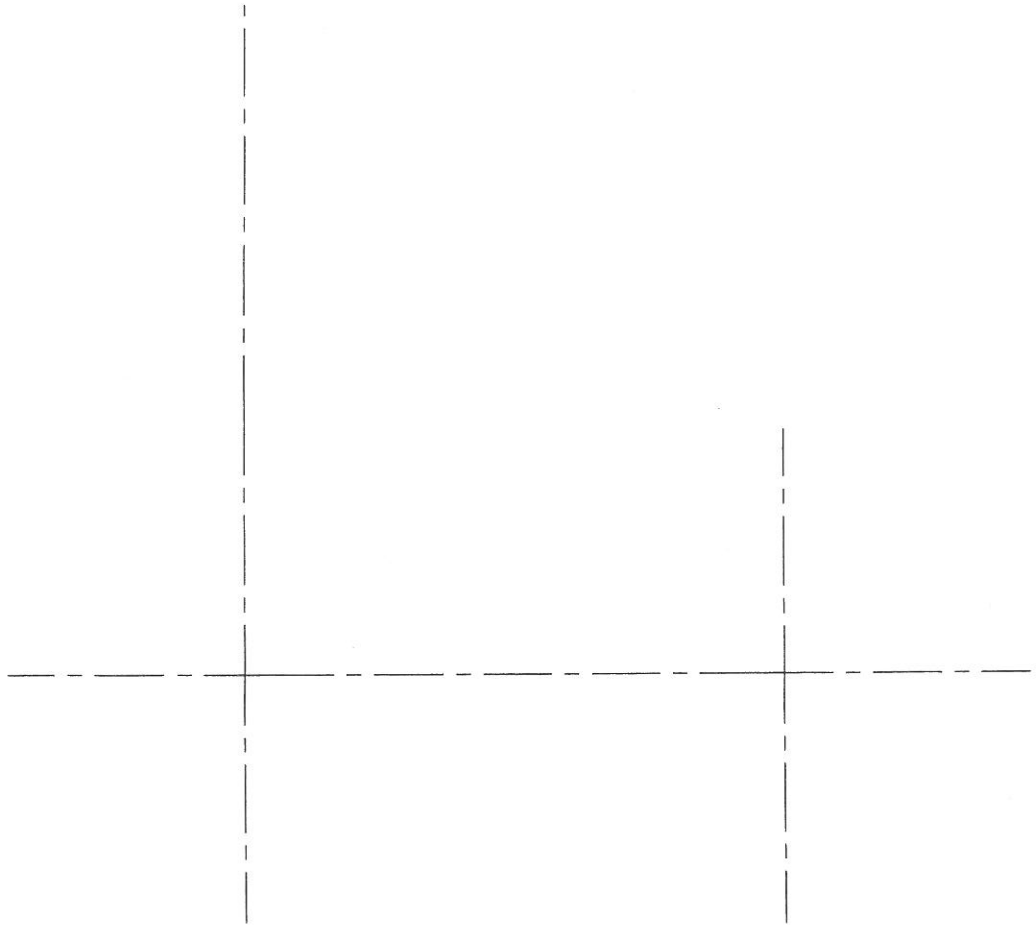


100 MARKS

EXAMINATION NUMBER

QUESTION 4

MECHANICAL ASSEMBLY



ASSESSMENT CRITERIA			
FRONT VIEW			
A	GATE FRAME 8/2	4	
B	CRADLE 12/2	6	
C	M6 SCREW	4	
D	M12 BOLT 12/2	6	
E	WASHER	2	
F	M12 NUT	5	
G	WHEEL 18/2	9	
H	BEARINGS	8	
TOTAL	44		
RIGHT VIEW			
A	GATE FRAME	5	
B	CRADLE 10/2	5	
E	WASHER	2	
D/F	M12 NUT/BOLT	8	
G	WHEEL	2	
	HIDDEN DETAIL	6	
TOTAL	28		
ADDITIONAL			
CORRECT ASS. 8/2		4	
HATCHING 14/2		7	
NON-HATCHING		3	
CENTRE LINES		3	
DIMENSIONS		3	
CUTTING PLANE		2	
SYMBOL		2	
TITLE/SCALE		2	
LABEL		2	
TOTAL	28		
TOTAL	100		

TITLE	
SCALE	

SYMBOL	

ANSWER SHEET 4

100 MARKS

EXAMINATION NUMBER