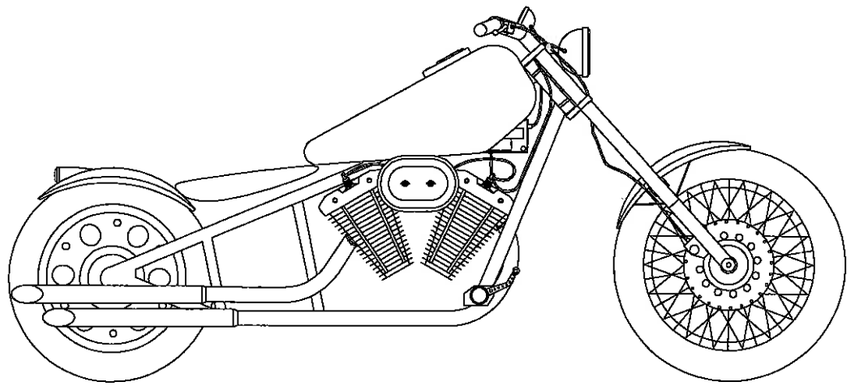
# NATIONAL SENIOR CERTIFICATE EXAMINATION

## 2013

## ENGINEERING GRAPHICS AND DESIGN

## PAPER 2

MARKS: 200
TIME: 3 HOURS



| FOR OFFICIAL USE ONLY | | | | |
|---|---|---|---|---|
| QUESTION | SECTION | MARK | MODERATED | MAXIMUM | CODE |
| 1 | MECHANICAL ANALYTICAL | | | 15 | |
| 2a | CAM | | | 30 | |
| 2b | MECHANISM | | | 15 | |
| 3 | ISOMETRIC PROJECTION | | | 40 | |
| 4 | MECHANICAL ASSEMBLY | | | 100 | |
| SYMBOL | TOTAL | | | 200 | |
| | TOTAL | | | 100 | |

| FINAL CONVERTED MARK | CHECKED BY |
|---|---|
| 100 | |

**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, even questions that are not attempted/blank.
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 **drawing 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.

EXAMINATION NUMBER

QUESTION 1

MECHANICAL ANALYTICAL

Figure A

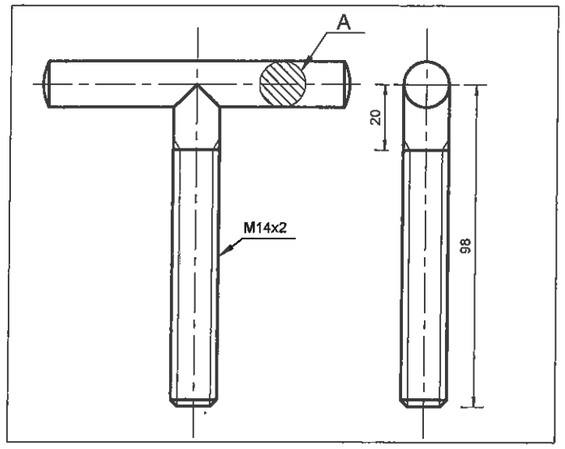
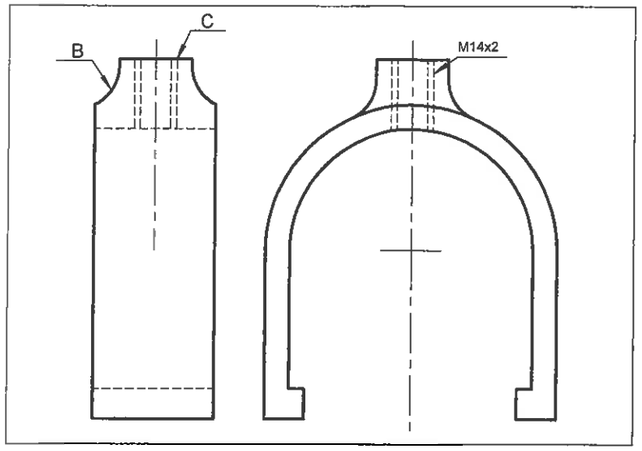



Figure B




Complete the following questions by writing the correct answer in the space provided.

1.1 The feature 'A' in Figure A represents a _____(1)

1.2 The length of the thread in Figure A is _____(1)

1.3 The feature 'B' in Figure B represents a _____(1)

1.4 What type of hole is shown at 'C' in Figure B? _____(1)

1.5 What is the dimension 'M' in figure C? _____(1)

1.6 The feature 'D' on the shaft (Figure C) is a _____(1)

1.7 What type of machine part is shown in Figure D? _____(1)

1.8 The feature 'E' on Figure E represents a _____(1)

1.9 The feature 'F' on Figure E represents a _____(1)

1.10 What type of key is shown in Figure F? _____(1)

1.11 Calculate the thickness 'X' of the nut (Figure G) _____(1)

1.12 How many surfaces must not be machined on Figure H? _____(1)

1.13 What is the roughness value of the parts milled in a circular pattern lay on Figure H? _____(1)

1.14 Will the machine part (Figure I) be welded on site or off site? _____(1)

1.15 With which process will the weld be finished (Figure I)? _____(1)

Figure C

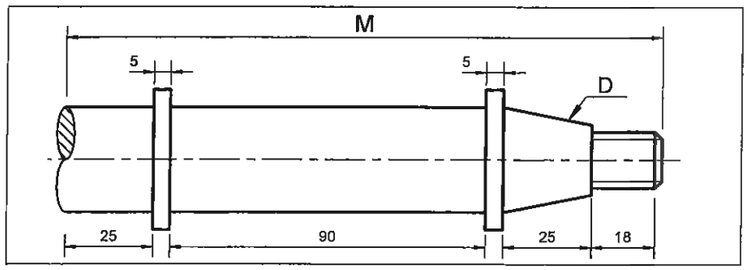



Figure D

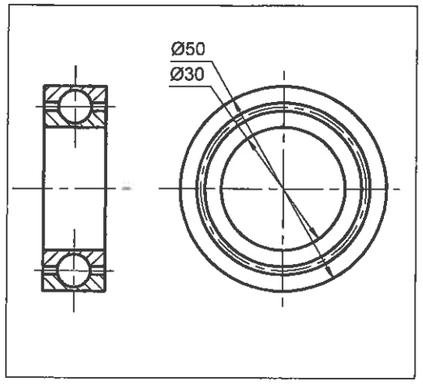



Figure E

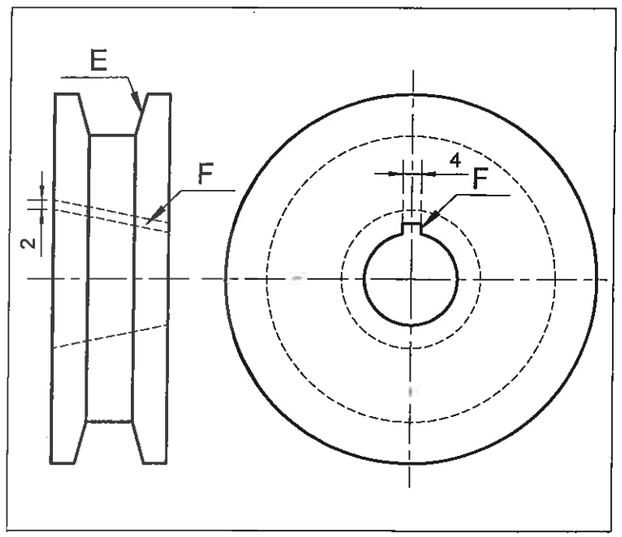



Figure H

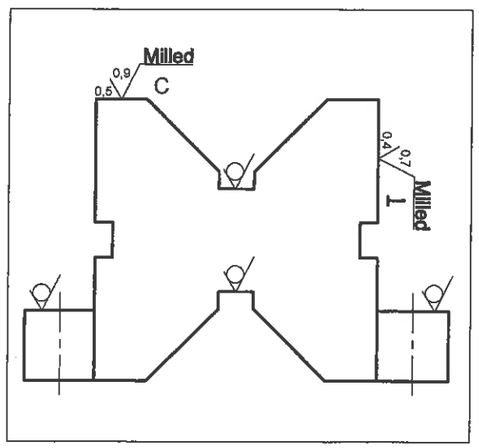



Figure F

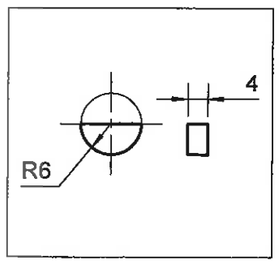



Figure G

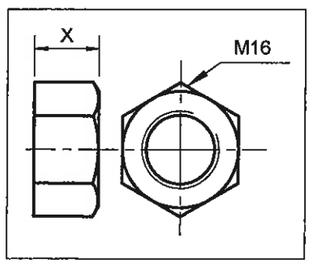
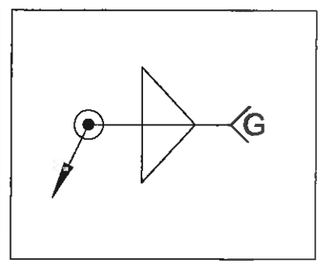



Figure I



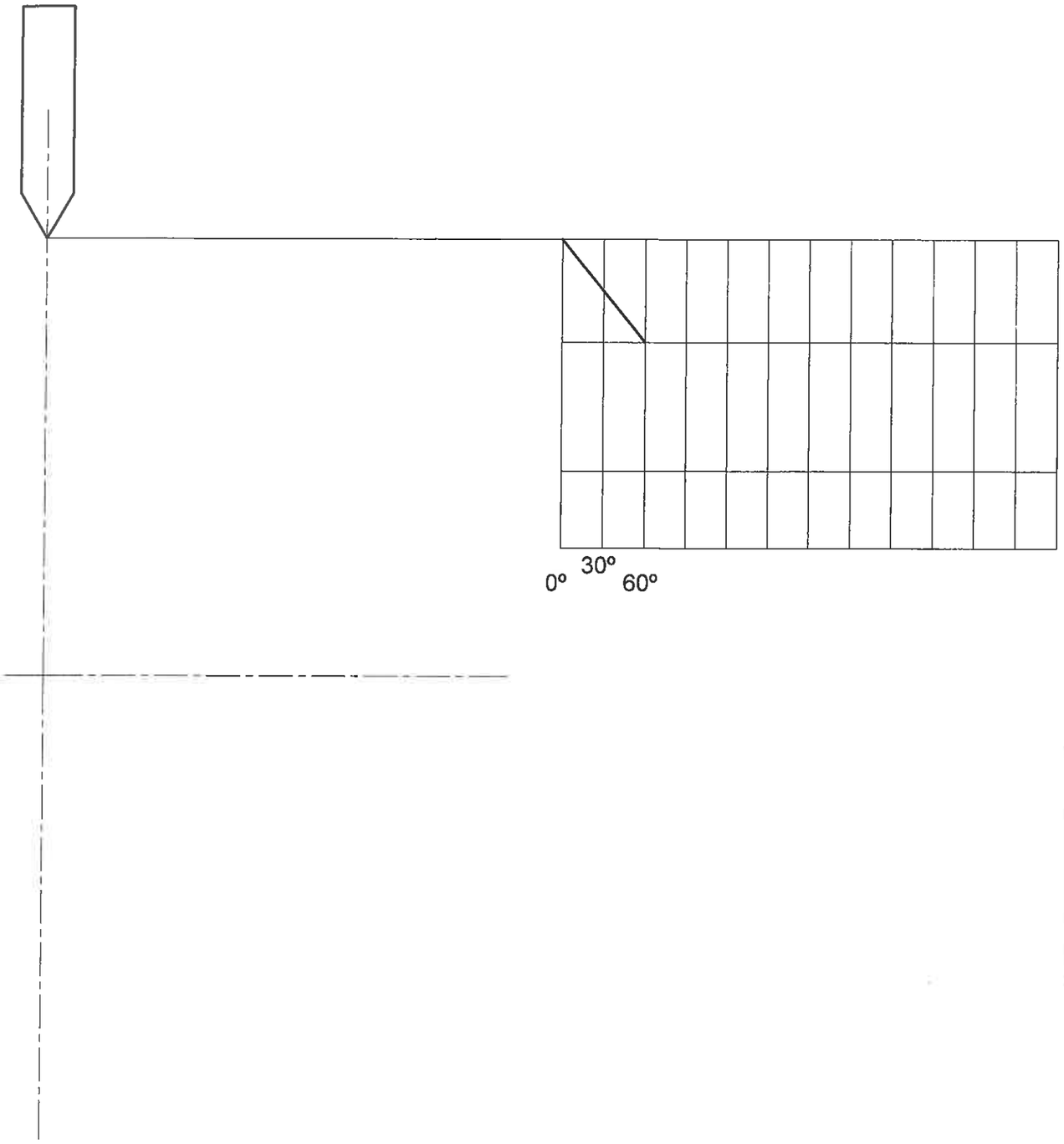

15 MARKS

EXAMINATION NUMBER

ANSWER SHEET 1

QUESTION 2a

LOCI
CAM




Given are the incomplete ***displacement graph*** (in position) and the starting point of a ***wedge-ended follower*** that reciprocates with ***uniform velocity***. ***Complete*** the graph and then draw the ***locus*** of the cam to the following specifications:

- The direction of turn is ***clockwise***.
- The ***camshaft*** has a diameter of 28 mm.
- For the first $60^0$ the follower ***falls*** 20 mm (given).
- For the next $60^0$ the follower is in ***dwell***.
- For the next $60^0$ the follower ***falls*** 25 mm.
- For the next $60^0$ the follower is in ***dwell***.
- For the next $30^0$ the follower ***falls*** 15 mm.
- For the next $30^0$ the follower ***rises*** 15 mm.
- For the next $15^0$ the follower is in ***dwell***.
- For the next $15^0$ the follower ***rises*** 25 mm.
- For the next $15^0$ the follower is in ***dwell***.
- During the last $15^0$ it ***returns*** to its ***original position***

Instructions:

- ***Label*** the ***Displacement Graph***, ***vertical*** scale and ***horizontal*** scale.
- ***Label*** the ***Cam Profile***.
- Indicate the ***Direction***.
- Show all ***constructions***.

Answer the following related questions:

2a.1 What is the ***travel*** after $180^0$? _____
2a.2 What is the ***total travel***? _____
2a.3 What is the ***displacement*** after $300^0$? _____
2a.4 What is the ***maximum displacement***? _____

ASSESSMENT CRITERIA

| | | |
|---|---|---|
| ☑ | Complete graph | 8 |
| ☑ | Plot Points | 13 |
| ☑ | Locus | 1 |
| ☑ | Hatch shaft | 1 |
| ☑ | Direction | 1 |
| ☑ | Labels | 2 |
| ☑ | Answers | 4 |
| ☑ | Lw/Acc/Pr. | -2 |

| | |
|---|---|
| GPH | |
| PTS | |
| LOC | |
| HAT | |
| DIRE | |
| LAB | |
| ANS | |
| L/A/P | |
| 30 MARKS | |

EXAMINATION NUMBER

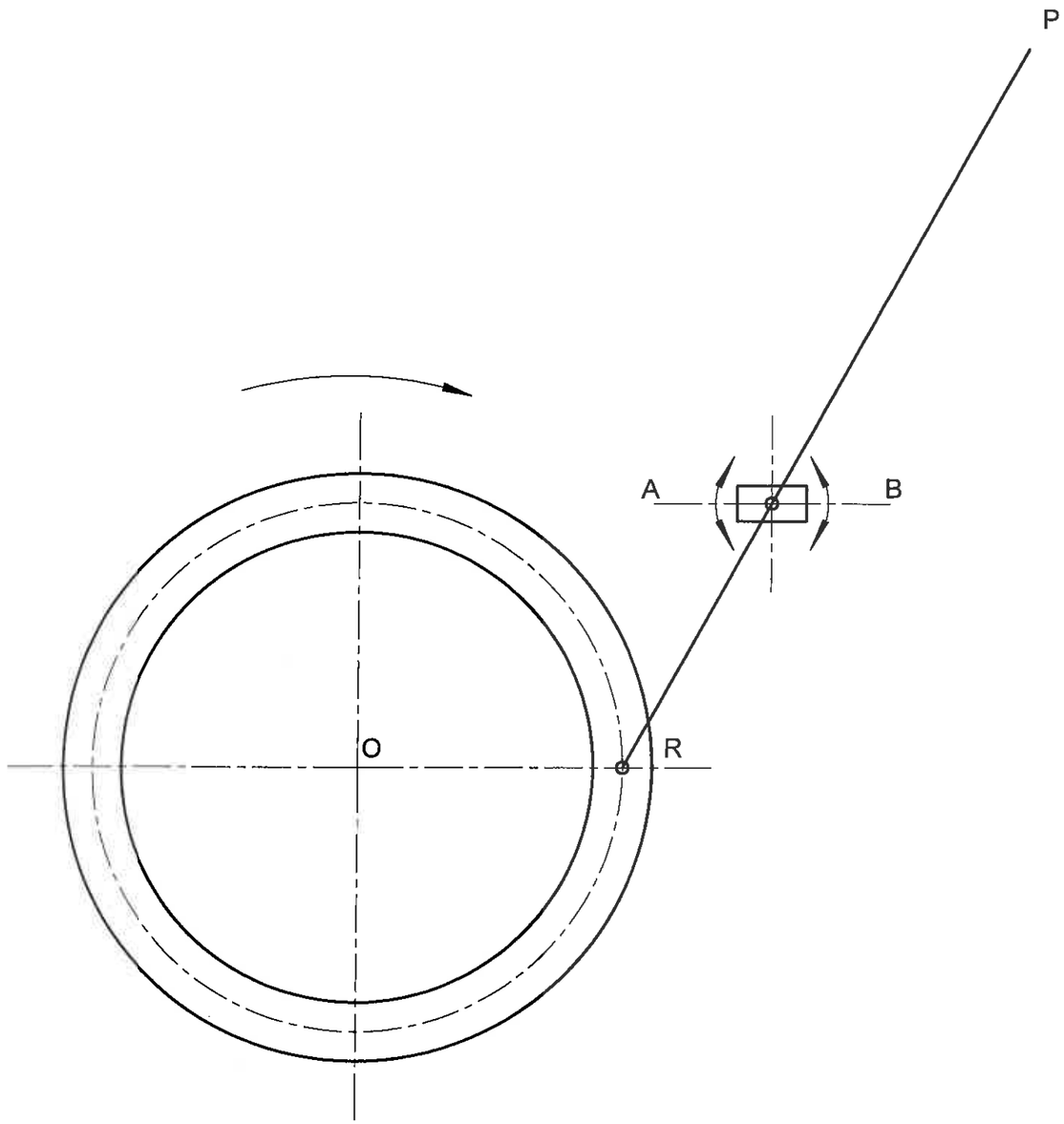
ANSWER SHEET 2a

QUESTION 2b

LOCI MECHANISM

The given figure shows a wheel, rotating around the centre O, with a ***rod*** attached to it at point R. The rod is free to slide through a ***pivoting mechanism*** between point A and B.
Construct and draw the locus of ***point P*** if:

- The direction of rotation is ***clockwise.***
- Show all ***constructions.***




ASSESSMENT CRITERIA

| | | |
|---|---|---|
| ☑ | Setup | 2 |
| ☑ | Plot Points | 11 |
| ☑ | Locus | 2 |
| ☑ | Lw/Acc/Pr. | -2 |

SET

PTS

LOC

L/A/P

15 MARKS

EXAMINATION NUMBER

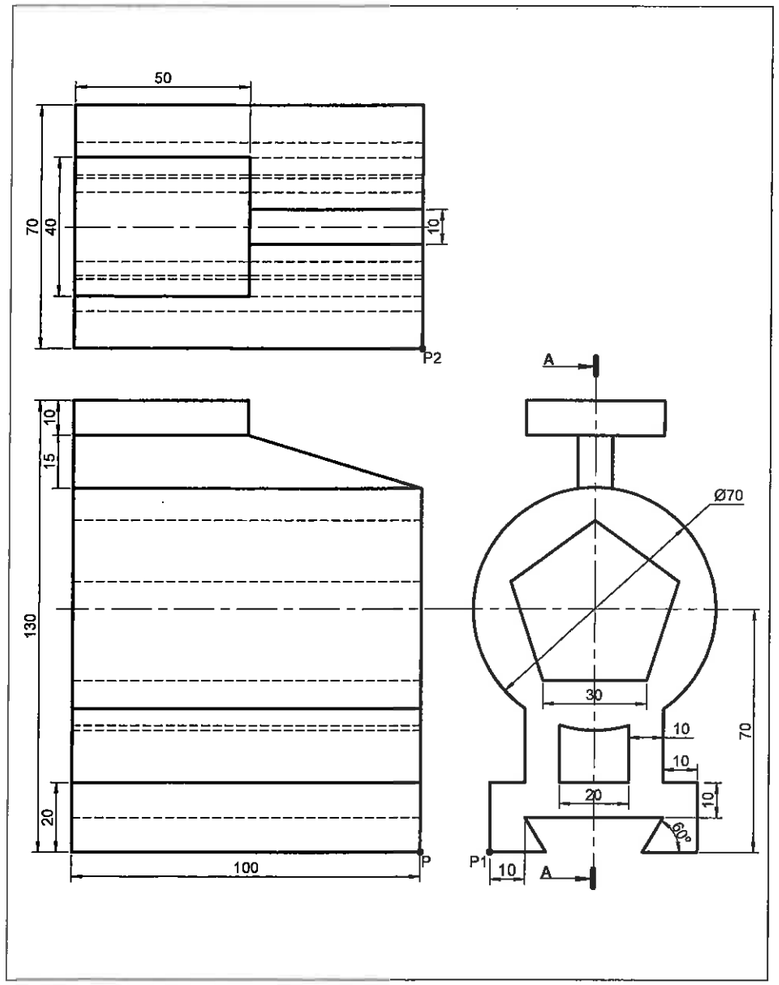
ANSWER SHEET 2b

## QUESTION 3

### ISOMETRIC DRAWING

The figure below shows 3 views of a heavy duty ***CASTING***.

- Complete a neat, sectioned ***Isometric*** drawing using the ***cutting plane A-A***.
- Show all ***constructions*** and ***centre lines***.
- Start your drawing on the given ***crosshairs***.
- The pentagon is centrally positioned ***in line*** with the circle.




| ASSESSMENT CRITERIA | | |
|---|---|---|
| ☑ | Constructions | 4 |
| ☑ | Iso Points 38/2 | 19 |
| ☑ | Iso circles | 5 |
| ☑ | Centrelines | 4 |
| ☑ | Hatching | 4 |
| ☑ | Non-Hatching 4/2 | 2 |
| ☑ | LW/Positioning | 2 |

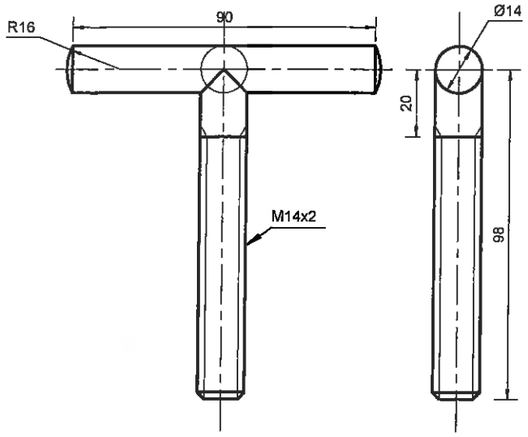
| | |
|---|---|
| CON | |
| ISOM | |
| CIRC | |
| CLS | |
| HAT | |
| No-H | |
| L/Pos | |
| 40 MARKS | |

EXAMINATION NUMBER

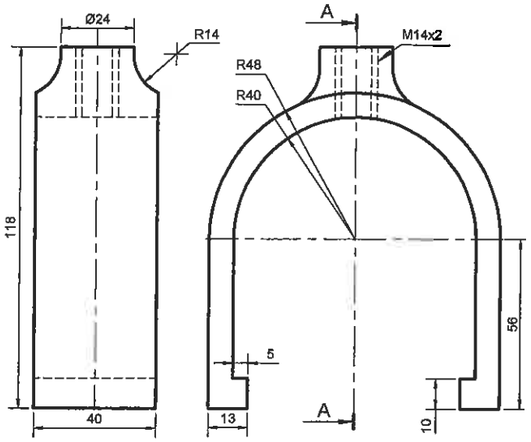
ANSWER SHEET 3

FIGURE 1

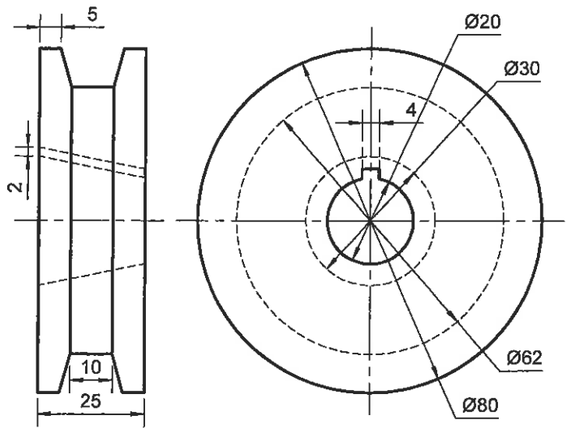
PART A



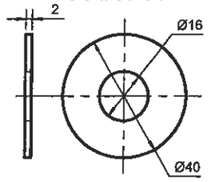

PART B



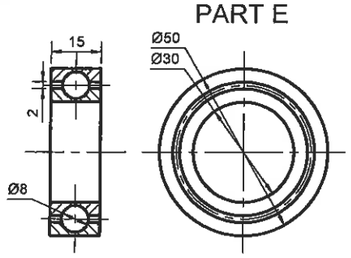

PART F



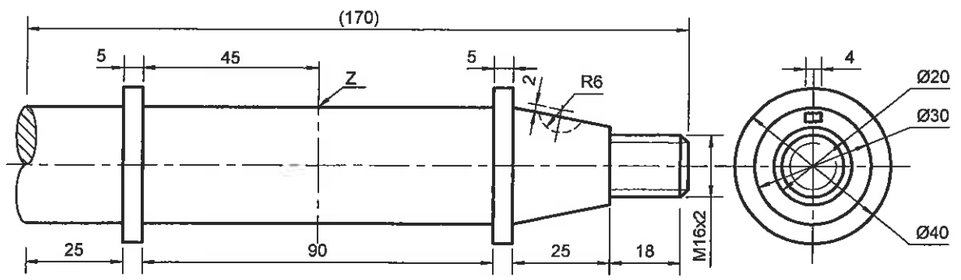

PART H



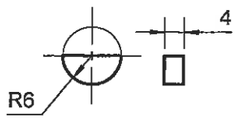

PART E



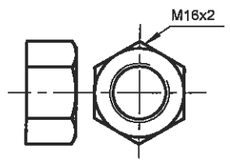

PART D



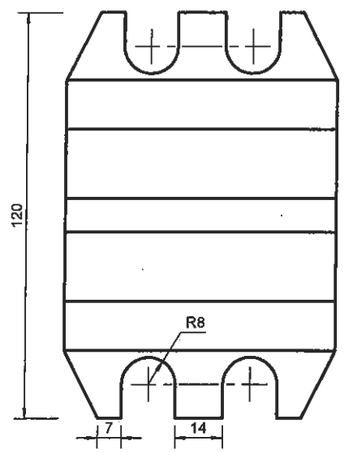

PART G

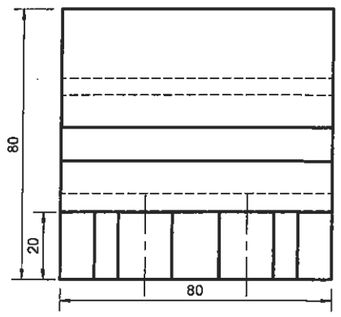


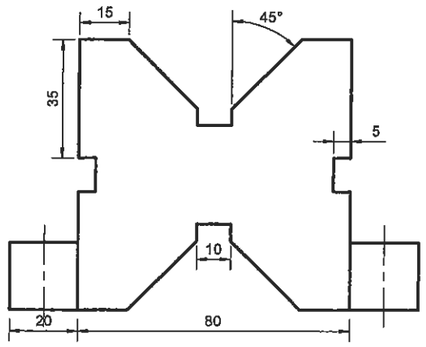

PART I




PART C




QUESTION 4

MECHANICAL ASSEMBLY

***Figure 2*** shows a series of pictures of a ***V–BLOCK and CLAMP***, as well as an exploded view of how the components of a similar, simplified system are assembled. Components D to I were removed from a vehicle as a sub–assembly and will be clamped in the V-Block to make a small modification on it.

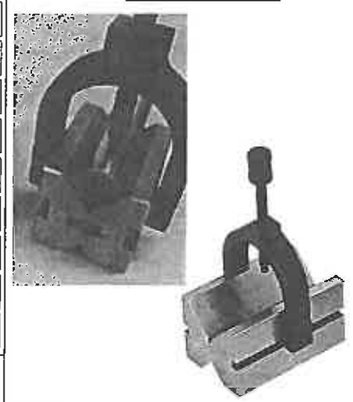
***Figure 1*** shows the different components that need to be assembled.

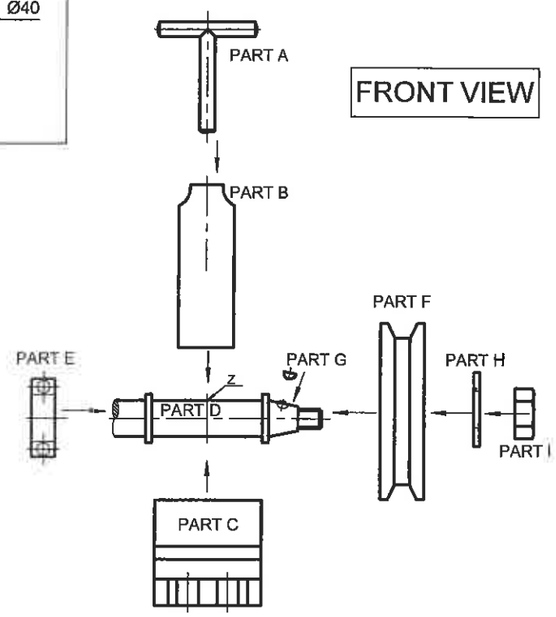
Complete the following to a ***SCALE*** of ***1:1:***

1.1 A ***Right View*** of the assembled components.
1.2 A ***Sectioned Front View*** of the assembled components to the cutting plane ***A-A.***
***Point Z*** (on the shaft) indicates the contact point for the handle that clamps/holds the components down.
Draw the ***bearing*** using the correct SANS 111-1 drawing ***convention.***
1.3 Show ***Hidden Detail*** on the ***Right View*** of only the V-groove of the ***Pulley*** (Part F), and the ***Clamp*** (Part B).
1.4 Show the ***Cutting Plane*** and the ***Centre Lines.***
1.5 Insert 3 important, functional ***Dimensions.***
1.6 Draw the ***Projection Symbol.***
(In the space provided)
1.7 Add a suitable ***Title*** and indicate the ***Scale*** used.
(In the space provided)
1.8 Label the ***Sectioned View.***

| COMPONENT LIST | | | |
|---|---|---|---|
| NO. | PART | QUANTITY | MATERIAL |
| A | HANDLE | 1 | MILD STEEL |
| B | CLAMP | 1 | MILD STEEL |
| C | V-BLOCK | 1 | MILD STEEL |
| D | SHAFT | 1 | MILD STEEL |
| E | BEARING | 1 | STEEL |
| F | PULLEY | 1 | ALUMINIUM |
| G | KEY | 1 | PEWTER |
| H | WASHER | 1 | MILD STEEL |
| I | M16 NUT | 1 | MILD STEEL |

FIGURE 2



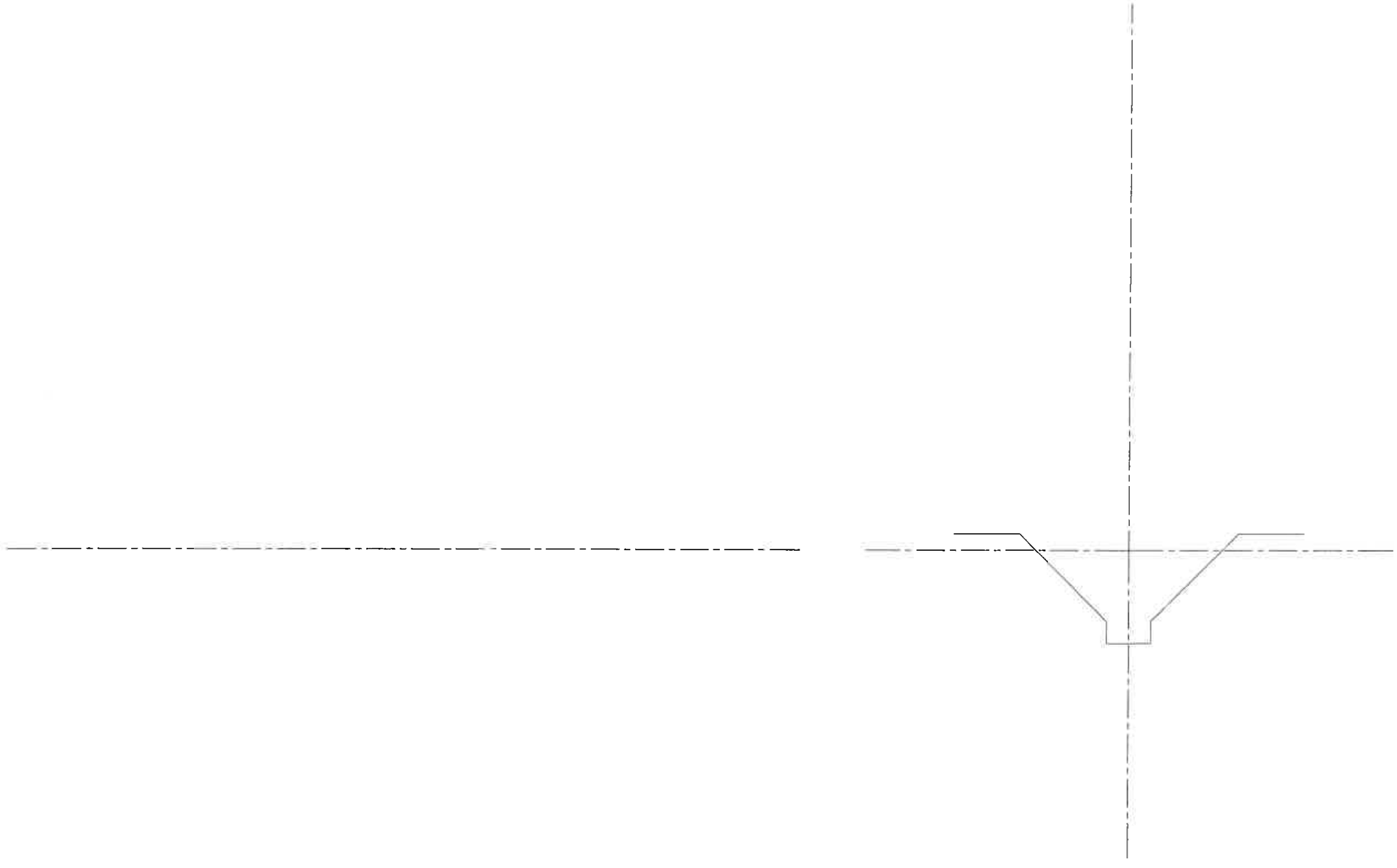



100 MARKS

EXAMINATION NUMBER

QUESTION 4

MECHANICAL ASSEMBLY



| ASSESSMENT CRITERIA | | | |
|---|---|---|---|
| **FRONT VIEW** | | | |
| A | HANDLE | 7 | |
| B | CLAMP | 6 | |
| C | V-BLOCK | 7 | |
| D | SHAFT | 7 | |
| E | BEARING | 3 | |
| F | PULLEY | 4 | |
| G | KEY | 1 | |
| H | WASHER | 1 | |
| I | M 16 NUT | 3 | |
| TOTAL | 39 | | |
| **RIGHT VIEW** | | | |
| A | HANDLE | 4 | |
| B | CLAMP | 7 | |
| C | V-BLOCK | 8 | |
| D | SHAFT | 2 | |
| F | PULLEY | 2 | |
| H | WASHER | 1 | |
| I | NUT | 3 | |
| | HIDDEN DETAIL | 4 | |
| TOTAL | 31 | | |
| **ADDITIONAL** | | | |
| | CORRECT ASS. | 5 | |
| | HATCHING | 7 | |
| | NON-HATCHING | 3 | |
| | CENTRE LINES | 5 | |
| | DIMENSIONS | 3 | |
| | SECTION LINE | 2 | |
| | SYMBOL | 2 | |
| | TITLE / SCALE | 2 | |
| | LABEL | 1 | |
| | LW / ACC / PRE | -2 | |
| TOTAL | 30 | | |
| TOTAL | 100 | | |

| TITLE | | SCALE | | SYMBOL | |
|---|---|---|---|---|---|

ANSWER SHEET 4

100 MARKS

EXAMINATION NUMBER