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# basic education

Department:  
Basic Education  
REPUBLIC OF SOUTH AFRICA

NATIONAL  
SENIOR CERTIFICATE

GRADE 12

ENGINEERING GRAPHICS AND DESIGN P2

NOVEMBER 2015

MARKS: 100

TIME: 3 hours

This question paper consists of 6 pages.

## INSTRUCTIONS AND INFORMATION

1. This question paper consists of FOUR questions.
2. Answer ALL the questions.
3. ALL drawings are in third-angle orthographic projection, unless otherwise stated.
4. ALL drawings must be completed using instruments, unless otherwise stated.
5. ALL answers must be drawn accurately and neatly.
6. ALL the questions must be answered on the QUESTION PAPER as instructed.
7. ALL the pages, irrespective of whether the question was attempted or not, must be re-stapled in numerical sequence in the TOP LEFT-HAND CORNER ONLY.
8. Time management is essential in order to complete all the questions.
9. Print your examination number in the block provided on every page.
10. Any details or dimensions not given must be assumed in good proportion.

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|-----------------------|----------------|---|---|---------------|------|-----------|---|---|---------------|------|------------|
| QUESTION              | MARKS OBTAINED |   |   | $\frac{1}{2}$ | SIGN | MODERATED |   |   | $\frac{1}{2}$ | SIGN | RE-MARKING |
| 1                     |                |   |   |               |      |           |   |   |               |      |            |
| 2                     |                |   |   |               |      |           |   |   |               |      |            |
| 3                     |                |   |   |               |      |           |   |   |               |      |            |
| 4                     |                |   |   |               |      |           |   |   |               |      |            |
| TOTAL                 |                |   |   |               |      |           |   |   |               |      |            |
|                       | 2              | 0 | 0 |               |      | 2         | 0 | 0 |               |      | 2 0 0      |

FINAL CONVERTED MARK

CHECKED BY

100

COMPLETE THE FOLLOWING:

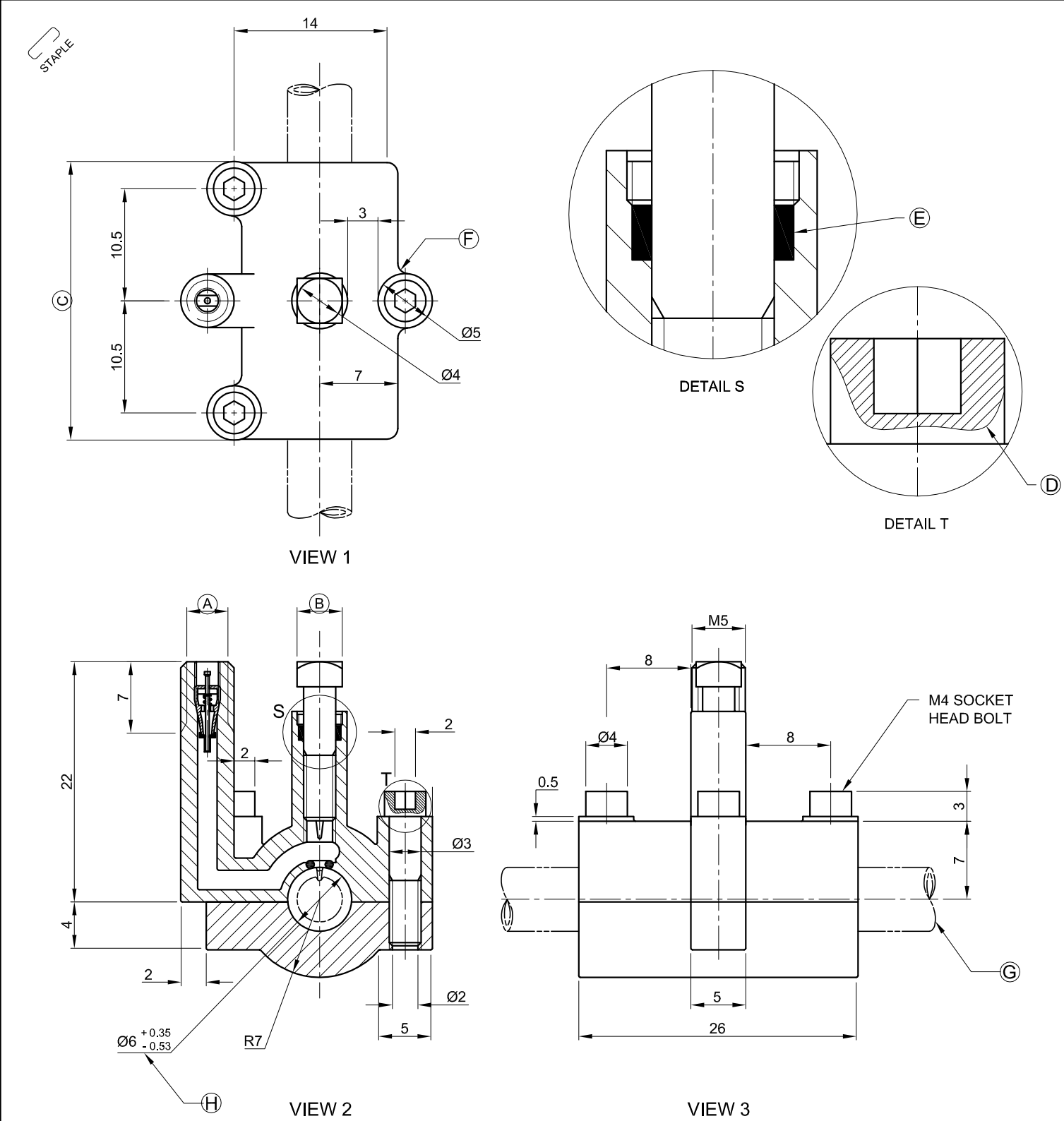
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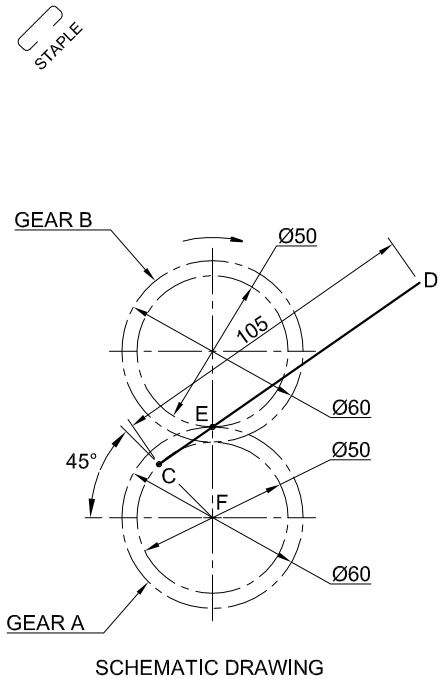
QUESTION 1: ANALYTICAL (MECHANICAL)

**Given:**  
Three views and two detailed enlargements of a tapping valve assembly, a title block and a table of questions. The drawings have not been prepared to the indicated scale.

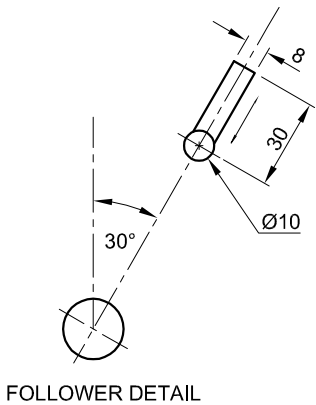
**Instructions:**  
Complete the table below by neatly answering the questions, which all refer to the accompanying drawings and the title block. [30]

| QUESTIONS |                                                                                                 | ANSWERS |    |  |
|-----------|-------------------------------------------------------------------------------------------------|---------|----|--|
| 1         | What is the title of the assembly?                                                              |         | 1  |  |
| 2         | On what date was the drawing drawn?                                                             |         | 1  |  |
| 3         | What is the drawing number?                                                                     |         | 1  |  |
| 4         | What scale is indicated for the drawing?                                                        |         | 1  |  |
| 5         | Which drawing program was used?                                                                 |         | 1  |  |
| 6         | Who approved the drawing?                                                                       |         | 1  |  |
| 7         | What material is used to manufacture the main base?                                             |         | 1  |  |
| 8         | What would VIEW 2 be called?                                                                    |         | 1  |  |
| 9         | How many socket head bolts are there in the assembly?                                           |         | 1  |  |
| 10        | Give the complete dimensions at: A : B : C :                                                    |         | 3  |  |
| 11        | Name the feature at F.                                                                          |         | 1  |  |
| 12        | Name the type of section at D.                                                                  |         | 1  |  |
| 13        | Why is the component at E filled in solid?                                                      |         | 1  |  |
| 14        | What is the total height of the assembly?                                                       |         | 1  |  |
| 15        | What is the purpose of the two enlarged detailed views?                                         |         | 2  |  |
| 16        | What is indicated by the convention at G?                                                       |         | 1  |  |
| 17        | With reference to the tolerance, determine the maximum dimension at H?                          |         | 2  |  |
| 18        | With reference to the tolerance, determine the minimum dimension at H?                          |         | 2  |  |
| 19        | Insert the cutting plane on VIEW 3 and label it A-A.                                            |         | 3  |  |
| 20        | In the space provided below, draw, in neat freehand, the symbol for the projection system used. |         | 4  |  |
| TOTAL     |                                                                                                 |         | 30 |  |

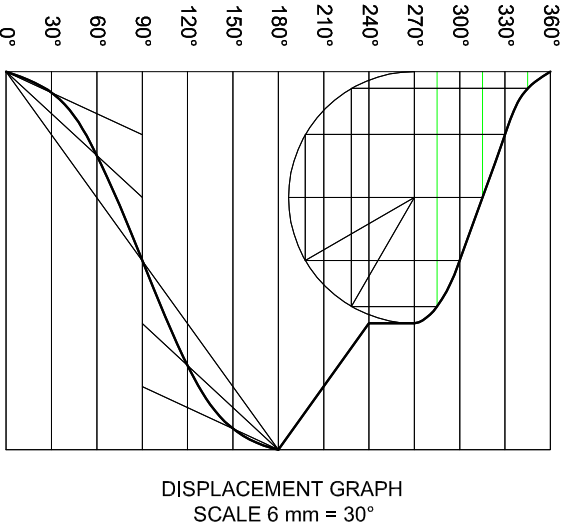
| PARTS LIST |                        |          |                       | FILE NAME: RCO/VK 0002.dwg                                                            | TITLE<br>TAPPING VALVE |               |                                           | ANSWER 20 |                    |                                                                                                      |   |  |
|------------|------------------------|----------|-----------------------|---------------------------------------------------------------------------------------|------------------------|---------------|-------------------------------------------|-----------|--------------------|------------------------------------------------------------------------------------------------------|---|--|
| PART       |                        | QUANTITY | MATERIAL              | DRAWING No. 2015 - A - 005                                                            |                        |               |                                           |           |                    |                                                                                                      |   |  |
| 1          | VALVE ASSEMBLY         | 1        | REF: DETAILED DRAWING | ALL DIMENSIONS ARE IN MILLIMETRES.                                                    | APPROVED:              | ANDREW BRAND  | 2015/01/23                                |           |                    |                                                                                                      |   |  |
| 2          | SOCKET HEAD BOLT       | 3        | TOOL STEEL            | DRAWING PROGRAM: AUTOCAD 2015                                                         | CHECKED:               | SOON DENTON   | 2015/01/16                                |           |                    |                                                                                                      |   |  |
| 3          | SQUARE BOLT WITH PUNCH | 1        | TOOL STEEL            | MATERIALS: STEEL, PEWTER AND RUBBER                                                   | DRAWN:                 | CHRISTI GREEF | 2015/01/05                                | SYMBOL    |                    |                                                                                                      |   |  |
| 4          | MAIN BASE              | 1        | PEWTER                | ReCO REFRIGERATION                                                                    |                        |               | 15 EDISON BLVD<br>INDUSTRIAL PARK<br>1911 |           |                    | TAP VALVE TO BE USED FOR<br>TAPPING OF 134a, R11, R22 AND<br>501 REFRIGERANTS IN COPPER<br>PIPE ONLY |   |  |
| 5          | CAP                    | 1        | PEWTER                |                                                                                       |                        |               |                                           |           |                    |                                                                                                      |   |  |
| 6          | O-RING                 | 1        | RUBBER                |  |                        |               | SCALE 2 : 1                               |           | EXAMINATION NUMBER |                                                                                                      |   |  |
| 7          | O-SEAL                 | 1        | RUBBER                |                                                                                       |                        |               |                                           |           | EXAMINATION NUMBER |                                                                                                      | 2 |  |



- QUESTION 2: LOCI**  
**NOTE:** Answer QUESTIONS 2.1 and 2.2.
- 2.1 MECHANISM**  
**Given:**
- A schematic drawing of a mechanism consisting of gear A and gear B as well as a slotted bar CD, attached at C to gear A
  - The position of pin E on gear B
  - The position of centre point F
- Motion:**  
As gear A rotates in an anti-clockwise direction, it drives gear B in a clockwise direction. The slotted bar CD slides over pin E during the rotation.
- Instructions:**
- Draw, to scale 1 : 1, the given schematic drawing of the mechanism.
  - Trace the locus generated by point D for ONE complete revolution of the mechanism.
  - Show ALL necessary construction.
- [19]



- 2.2 CAM**  
**Given:**
- The detail of a roller-ended follower, drawn to a reduced scale
  - The displacement graph and the cam shaft, drawn to scale 1 : 1, in the correct position
- Specifications:**
- The follower reciprocates along the 30° centre line that runs through the centre of the cam shaft
  - Rotation = clockwise
- Instructions:**
- Draw, to scale 1 : 1, the roller-ended follower in its correct position.
  - Project and draw the cam profile from the given displacement graph.
  - Show the direction of rotation on the cam profile.
  - Show ALL necessary construction.
- [21]



| ASSESSMENT CRITERIA 2.1 |                                     |    |  |   |
|-------------------------|-------------------------------------|----|--|---|
| 1                       | GIVEN + CENTRE LINES                | 5  |  |   |
| 2                       | CONSTRUCTION                        | 6  |  |   |
| 3                       | POINTS + CURVE                      | 8  |  |   |
| SUBTOTAL 2.1            |                                     | 19 |  |   |
| ASSESSMENT CRITERIA 2.2 |                                     |    |  |   |
| 1                       | CONSTRUCTION + FOLLOWER + DIRECTION | 8  |  |   |
| 2                       | PLOTTING                            | 7  |  |   |
| 3                       | CAM PROFILE                         | 6  |  |   |
| SUBTOTAL 2.2            |                                     | 21 |  |   |
| PENALTIES (-)           |                                     |    |  |   |
| TOTAL                   |                                     | 40 |  |   |
| EXAMINATION NUMBER      |                                     |    |  |   |
| EXAMINATION NUMBER      |                                     |    |  |   |
|                         |                                     |    |  | 3 |



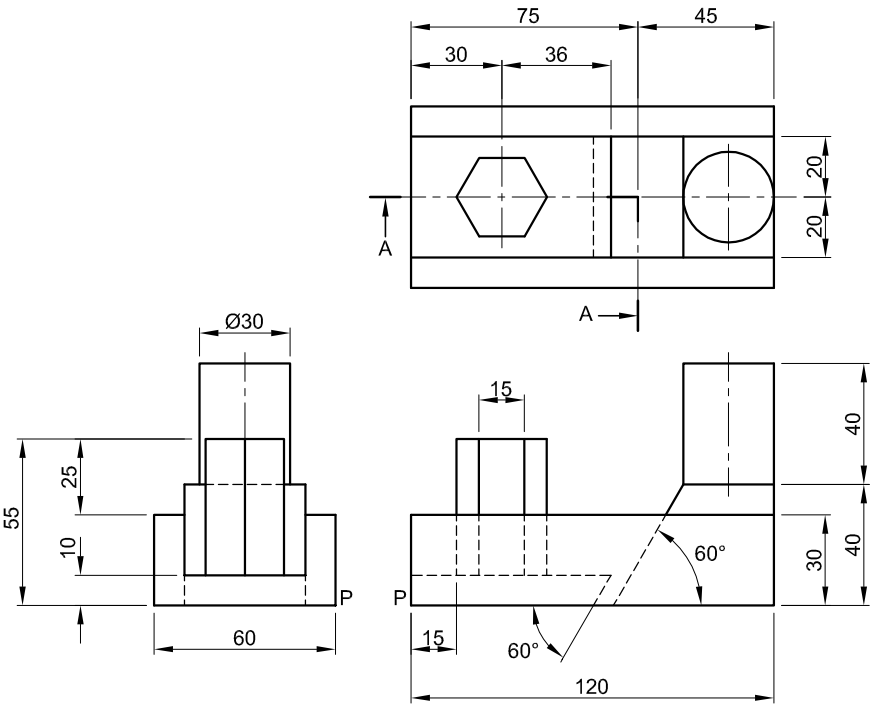


QUESTION 3: ISOMETRIC DRAWING

- Given:**
- The front view, top view and left view of a woodworking plane
  - The position of point P on the drawing sheet

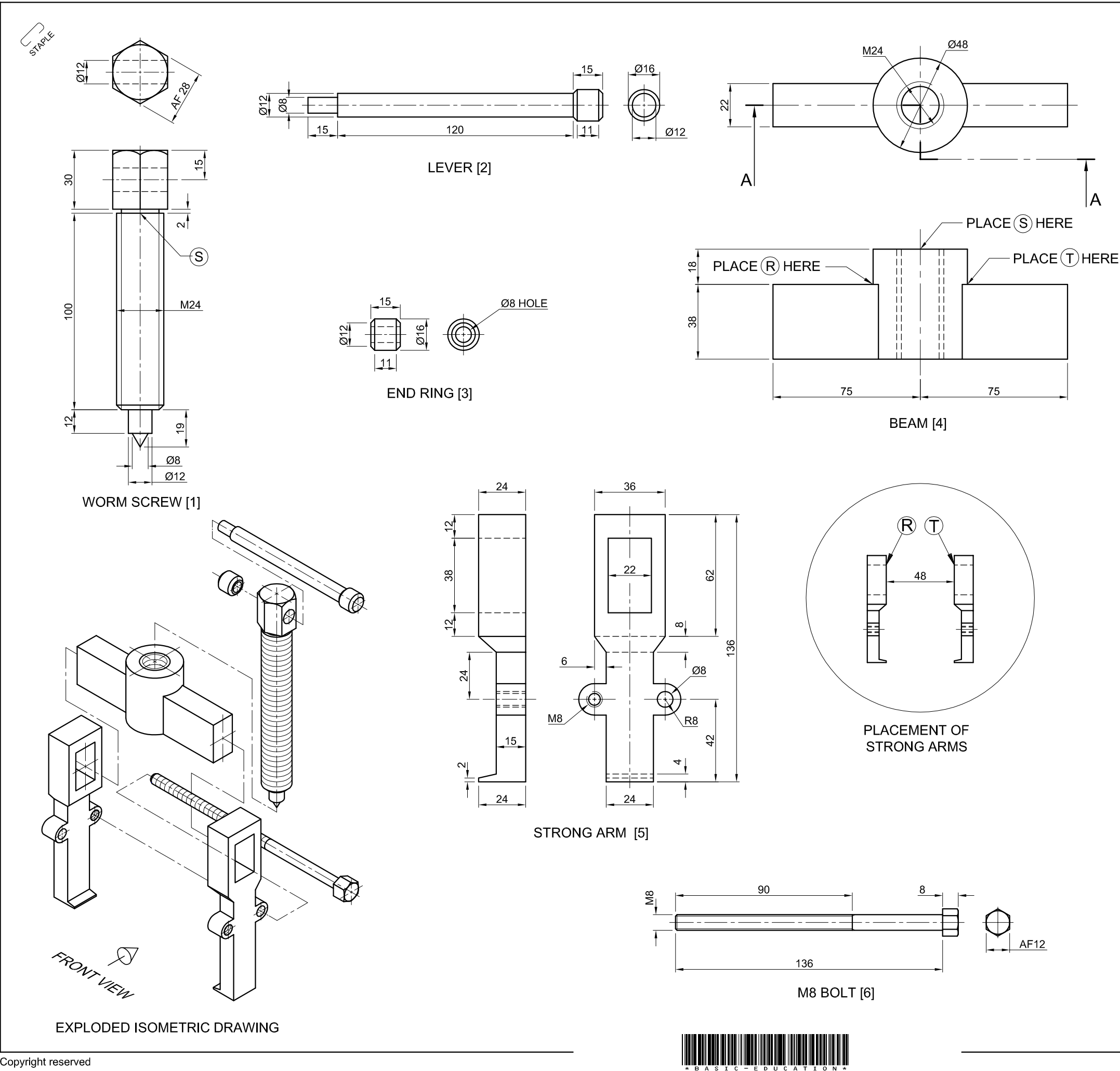
**Instructions:**  
Using scale 1 : 1, convert the orthographic views of the woodworking plane into a sectional isometric drawing on cutting plane A-A.

- Make P the lowest point of the drawing.
  - Show ALL necessary construction.
  - NO hidden detail is required.
- [34]



P

| ASSESSMENT CRITERIA |                             |      |  |  |   |
|---------------------|-----------------------------|------|--|--|---|
| 1                   | AUXILLIARY VIEW + PLACING   | 3    |  |  |   |
| 2                   | ISOMETRIC + NON-ISOMETRIC   | 12 ½ |  |  |   |
| 3                   | HEXAGON                     | 2 ½  |  |  |   |
| 4                   | CIRCLES + CONSTRUCTION + CL | 6    |  |  |   |
| 5                   | SECTION                     | 8    |  |  |   |
| 6                   | HATCHING                    | 2    |  |  |   |
| PENALTIES (-)       |                             |      |  |  |   |
| TOTAL               |                             | 34   |  |  |   |
| EXAMINATION NUMBER  |                             |      |  |  |   |
| EXAMINATION NUMBER  |                             |      |  |  |   |
| EXAMINATION NUMBER  |                             |      |  |  | 4 |



QUESTION 4: MECHANICAL ASSEMBLY

- Given:**
- The exploded isometric drawing of the parts of a bearing puller assembly, showing the position of each part relative to all the others
  - Orthographic views of each of the parts of the bearing puller assembly

- Instructions:**
- Answer this question on page 6.
  - Draw, to scale 1 : 1 and in third-angle orthographic projection, the following views of the assembled parts of the bearing puller assembly:
    - 4.1 A half sectional front view** according to cutting plane A-A. Show the left side in section, as seen from the direction of the arrow shown on the exploded isometric drawing. The cutting plane is shown on the top view of the beam (part 4).
    - 4.2 The top view.**
  - ALL drawings must comply with the guidelines as contained in the SANS 10111.

- NOTE:**
- The two strong arms (part 5) must be placed against the cylindrical part of the beam (part 4) so that points R and T will be at the indicated positions.
  - The worm screw (part 1) must be completely screwed into the beam (part 4) so that point S will be at the indicated position.
  - The lever (part 2) must be placed in the centre of the worm screw (part 1).
  - Draw only the rear M8 bolt, as indicated by the exploded isometric drawing.
  - Show THREE faces of the head of the M8 bolt in the front view.
  - Add the cutting plane A-A to the drawing
  - NO hidden detail is required.

[96]

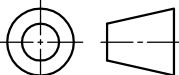
| PARTS LIST |            |          |                |
|------------|------------|----------|----------------|
| PARTS      |            | QUANTITY | MATERIAL       |
| 1          | WORM SCREW | 1        | HARDENED STEEL |
| 2          | LEVER      | 1        | HARDENED STEEL |
| 3          | END RING   | 1        | MILD STEEL     |
| 4          | BEAM       | 1        | HARDENED STEEL |
| 5          | STRONG ARM | 2        | HARDENED STEEL |
| 6          | M8 BOLT    | 2        | MILD STEEL     |

**WR**  
SN KING CC

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069 313 1574

**BEARING PULLER**

ALL DIMENSIONS ARE IN MILLIMETRES.



5



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|-------------------------|--|--|
| NOT IN THIRD ANGLE      |  |  |
| INCORRECT OVERALL SCALE |  |  |
| INCORRECT HATCHING      |  |  |
| PARTS NOT ASSEMBLED     |  |  |
| PARTS DRAWN FREEHAND    |  |  |
|                         |  |  |
|                         |  |  |
| TOTAL PENALTIES (-)     |  |  |

| ASSESSMENT CRITERIA  |               |          |          |      |           |
|----------------------|---------------|----------|----------|------|-----------|
| TOP VIEW             |               |          |          |      |           |
|                      |               | POSSIBLE | OBTAINED | SIGN | MODERATED |
| 1                    | WORM SCREW    | 3½       |          |      |           |
| 2                    | LEVER         | 4        |          |      |           |
| 3                    | END RING      | 3        |          |      |           |
| 4                    | BEAM          | 4½       |          |      |           |
| 5                    | STRONG ARM    | 10       |          |      |           |
| 6                    | M8 BOLT       | 7        |          |      |           |
| SUBTOTAL             |               | 32       |          |      |           |
| SECTIONAL FRONT VIEW |               |          |          |      |           |
| 1                    | WORM SCREW    | 15       |          |      |           |
| 2                    | LEVER         | 7        |          |      |           |
| 3                    | END RING      | 3        |          |      |           |
| 4                    | BEAM          | 5½       |          |      |           |
| 5                    | STRONG ARM    | 10½      |          |      |           |
| 6                    | M8 BOLT       | 9        |          |      |           |
| SUBTOTAL             |               | 50       |          |      |           |
| GENERAL              |               |          |          |      |           |
| 1                    | CENTRE LINES  | 3        |          |      |           |
| 2                    | ASSEMBLY      | 6        |          |      |           |
| 3                    | CUTTING PLANE | 5        |          |      |           |
| SUBTOTAL             |               | 14       |          |      |           |
| TOTAL                |               | 96       |          |      |           |
| TOTAL PENALTIES(-)   |               |          |          |      |           |
| GRAND TOTAL          |               |          |          |      |           |
| EXAMINATION NUMBER   |               |          |          |      |           |
|                      |               |          |          |      |           |
| EXAMINATION NUMBER   |               |          |          |      | 6         |

