



SUBJECT:	Engineering Drawing/Graphical Communication
PAPER NUMBER:	I
DATE:	5 th July 2021
TIME:	9:00 a.m. to 12:05 p.m.

Directions to Candidates

Write your index number where indicated at the top of all drawing sheets.

Attempt any **FIVE** questions.

Programmable calculators **cannot** be used.

Unless otherwise stated:

- drawings should conform to B.S. or equivalent (ISO) standards;
- all dimensions are in millimetres;
- all answers are to be accurately drawn with instruments;
- all construction lines must be left in each solution;
- drawing aids may be used.

Dimensions not given should be estimated.

Careful layout and presentation are important.

Marks will be awarded for accuracy, clarity and appropriateness of constructions.

Question 1.

An illustration of a cube with an elliptical hole, cut by the oblique plane VTH, is given in Figure 1a. Dimensioned, orthographic views of the cube and the oblique cutting plane VTH are given in Figure 1b. The upper part of the truncated cube is to be removed.

You are requested to:

- a) copy faintly Figure 1b; (5)
- b) project an auxiliary view of the cube to determine the true inclination of the cutting plane to the horizontal plane; (4)
- c) complete the truncated plan; (1)
- d) complete the truncated front elevation; (4)
- e) project the true shape of cut. (6)

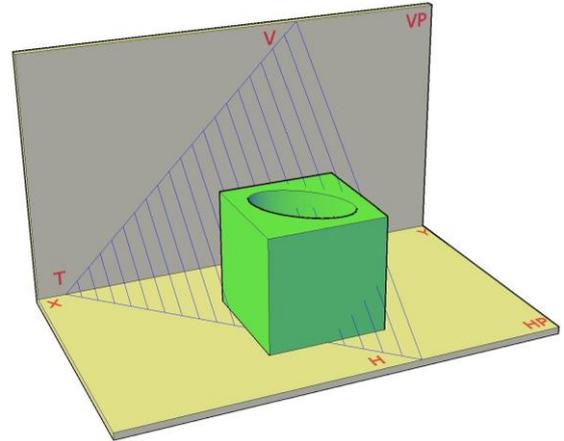


Figure 1a

(Total: 20 marks)

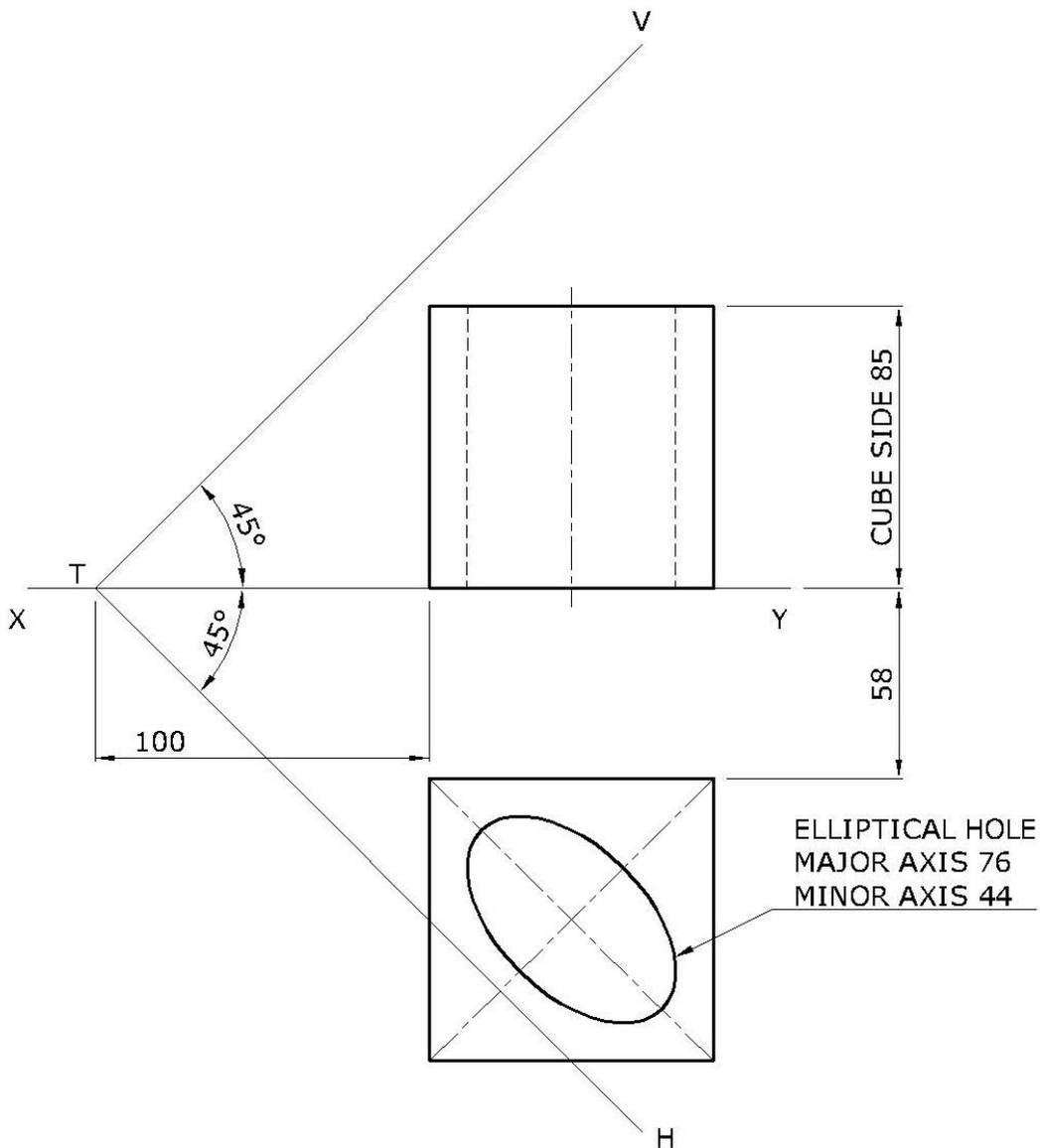


Figure 1b



Question 2.

The illustration in Figure 2a shows a right cone which has been truncated by an inclined plane. The two spheres inside the cone are both tangent to the cone and to the plane that intersects the cone. The larger sphere is also tangent to the base of the cone.

The dimensioned front elevation of the cone and the two focal spheres is given in Figure 2b.

You are requested to:

- a) construct the given elevation; (4)
- b) construct a line tangential to the two spheres to represent the cutting plane; (3)
- c) state the name of the resulting conic section; (1)
- d) locate, by construction, the vertices, the foci and the directrices of the conic section; (3)
- e) state the ratio of eccentricity; (1)
- f) use the ratio of eccentricity to construct the conic section by using the locus of a point method. (8)

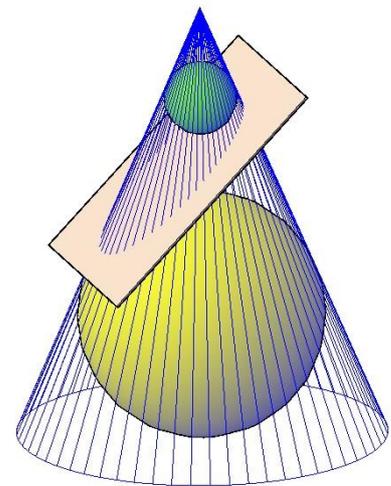


Figure 2a

Note: Leave all constructions visible.

(Total: 20 marks)

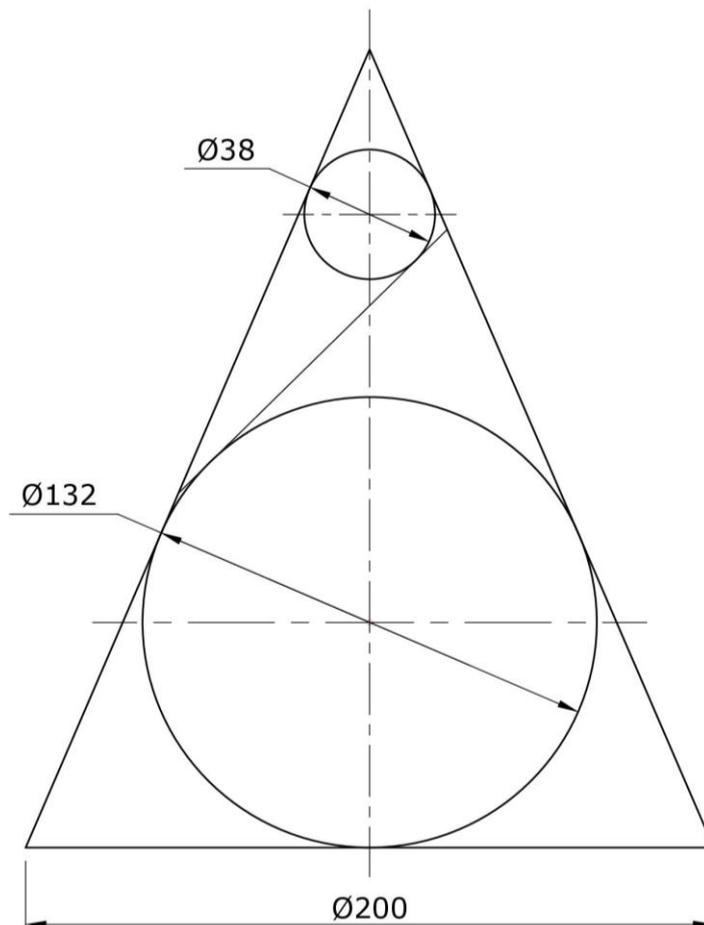


Figure 2b

Question 3.

A 3-D illustration of a modern outdoor fireplace is shown in Figure 3a. The fireplace consists of a right cone which has a truncated top and a front hole resulting from the intersection of an inclined cylinder. The four legs of the fireplace are formed by vertical cuts of the cone.

Figure 3b shows incomplete orthographic views of the fireplace. You are requested to:

- a) copy the given orthographic views; (2)
- b) complete the leg in the front elevation and name the curve; (3)
- c) project a half auxiliary plan to be able to plot the curve of intersection in the front elevation; (3)
- d) complete the front elevation; (4)
- e) project the curve of intersection to the plan; (3)
- f) project an end elevation as seen from the direction of arrow 'A'. (5)

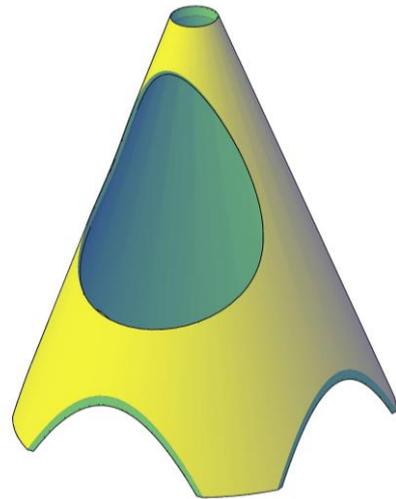


Figure 3a

Notes:

- Do **not** show the intersecting cylinder in the end elevation.
- In the other views, the cylinder is to be shown for construction purposes only.

(Total: 20 marks)

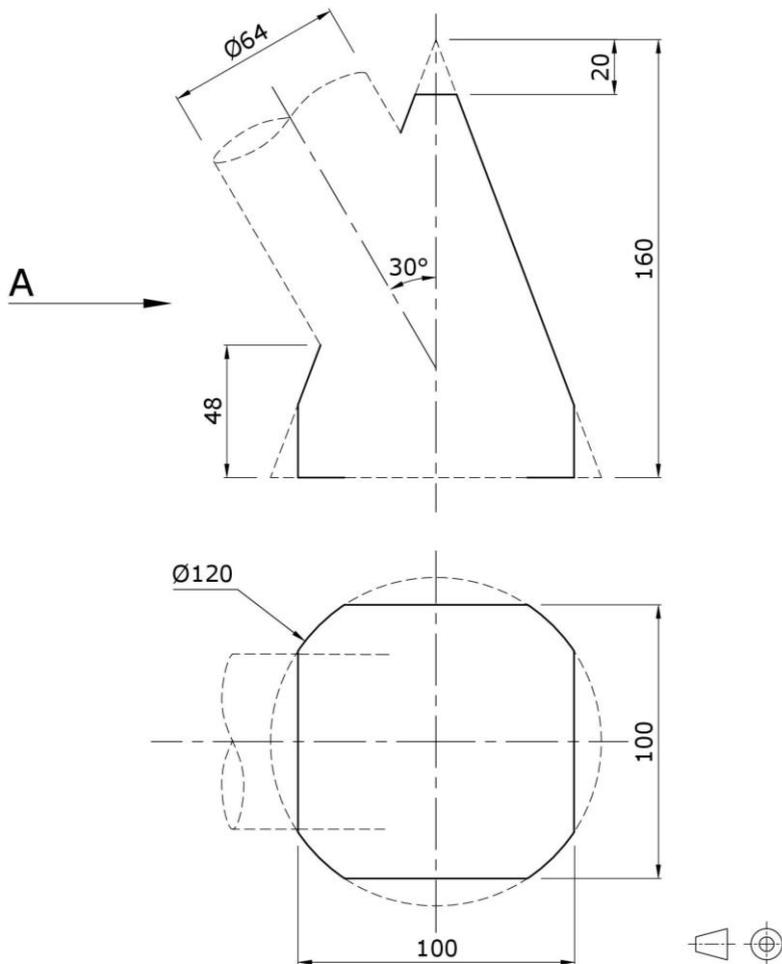


Figure 3b

Question 4.

An illustration of a machined component is shown in Figure 4a. Two orthographic views of the component are given in Figure 4b.

You are requested to:

- a) copy the given views; (2)
- b) project an auxiliary elevation from the direction of arrow **A** to show an edge view of slope **S**; (8)
- c) project a second auxiliary view of the whole component to show the true shape of face **S**. (10)

(Total 20 marks)

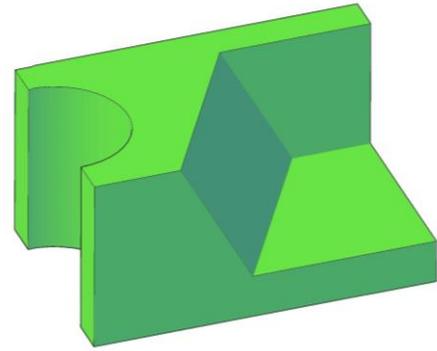


Figure 4a

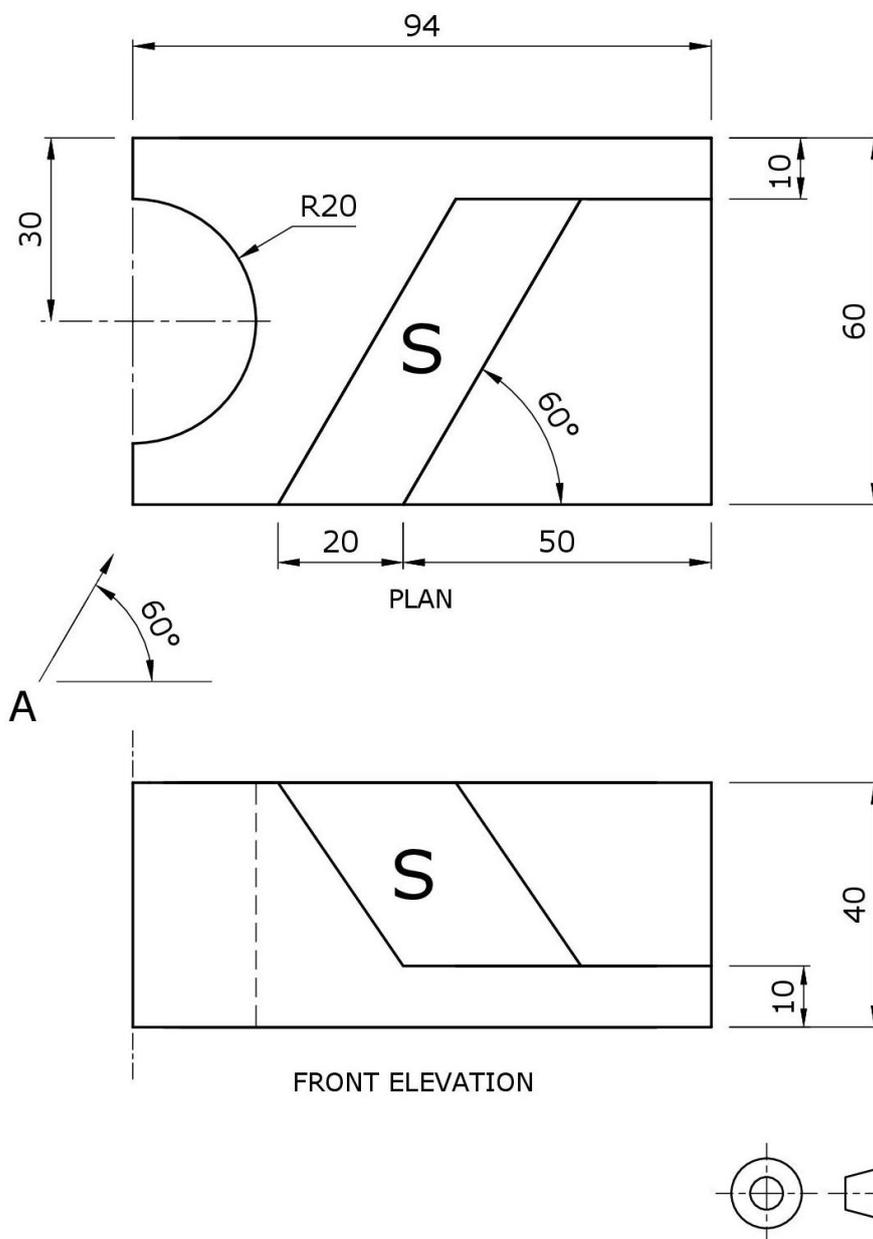


Figure 4b

Question 5.

An illustration of a rotary pump lobe is given in Figure 5a. The profile of the lobe is produced by means of two generating circles, rolling without slipping, inside and outside a directing circle as shown in Figure 5b.

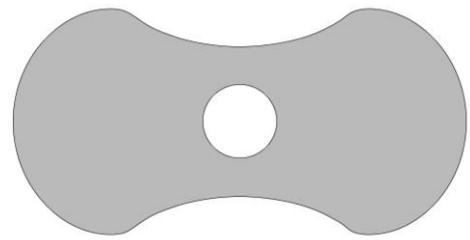


Figure 5a

- Point P_1 , on the circumference of the $\text{Ø}60$ outer circle 'A', generates a curve as it rotates anticlockwise for one revolution, outside the $\text{Ø}240$ directing circle.
- Point P_2 , on the circumference of the $\text{Ø}60$ inner circle 'B', generates another curve as it rotates anticlockwise for one revolution, inside the $\text{Ø}240$ directing circle.

You are requested to:

- copy the drawing shown in Figure 5b; (3)
- plot the locus of P_1 as the circle rolls outside quadrant 1 and name the curve; (6)
- plot the locus of P_2 as the circle rolls inside quadrant 2 and name the curve; (6)
- reflect the **TWO** curves in quadrants 3 and 4. (5)

(Total: 20 marks)

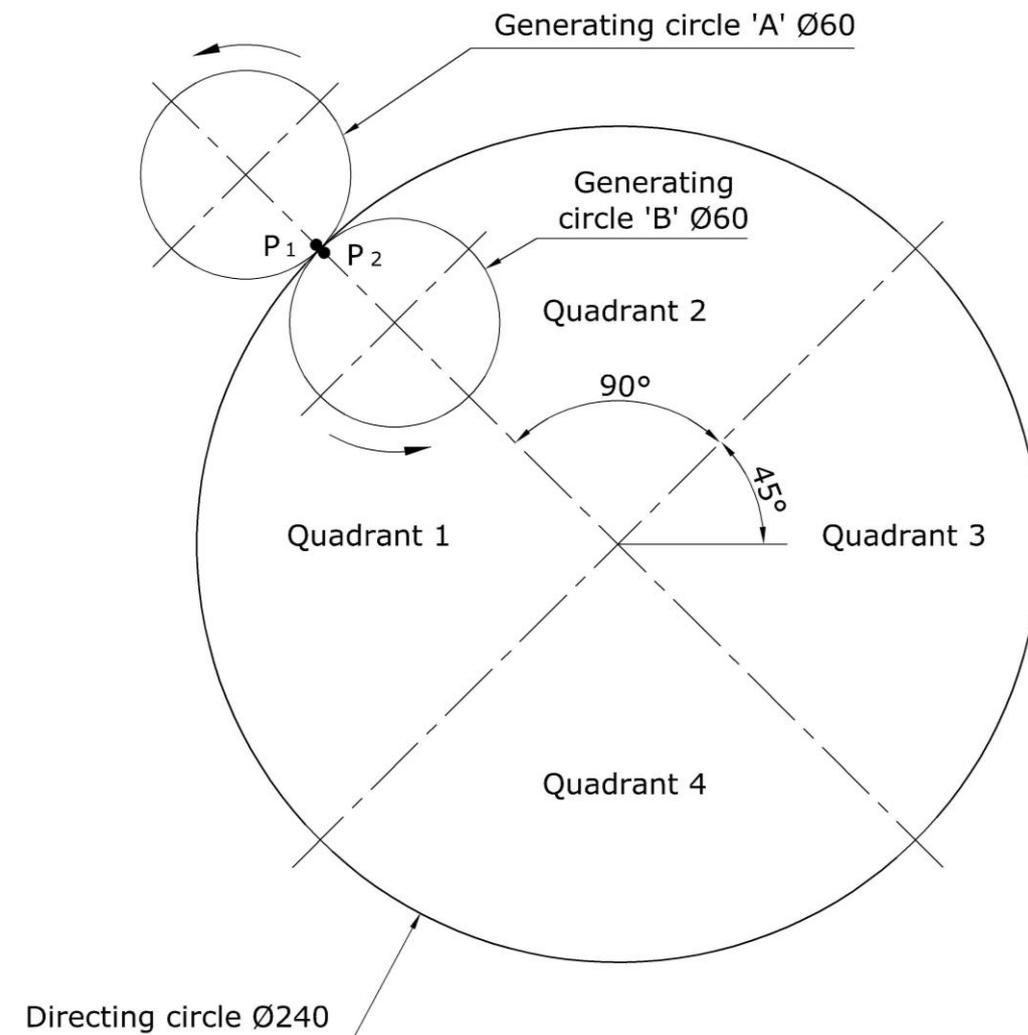


Figure 5b

Question 6.

The illustration in Figure 6a shows an arrangement of two unequal pipes connected by means of a transition piece.

Details of the transition piece are given in the orthographic views in Figure 6b.

You are requested to:

- a) copy the given views; (4)
- b) carefully triangulate the plan and project the crease lines to the front elevation; (2)
- c) construct the necessary true lengths; (4)
- d) construct the true shape of the top part of the transition piece which connects to the $\text{Ø}56$ pipe; (2)
- e) construct one half surface development of the transition piece. (8)

Note: take the seam lines along JJ

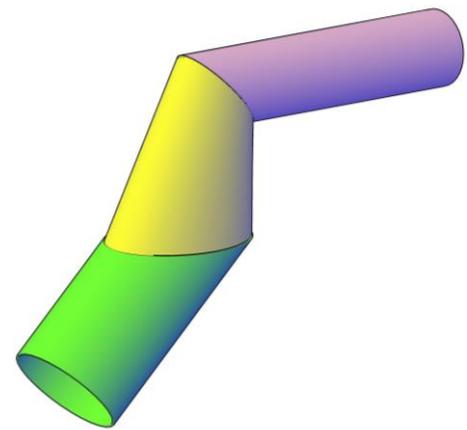


Figure 6a

(Total: 20 marks)

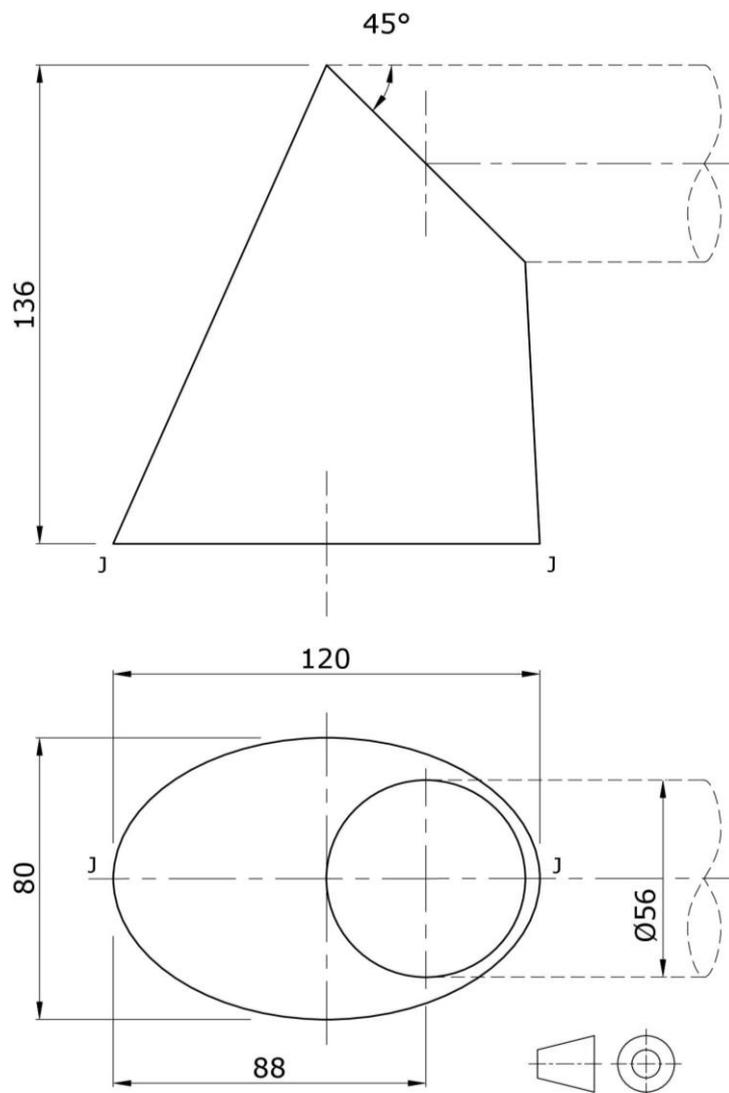


Figure 6b

Question 7.

Figure 7a shows an illustration of a radial arm disc cam which rotates and imparts the motion to an oscillating roller-ended follower. Details of the cam centre and the follower are given in Figure 7b. The cam causes the follower to rise and fall about a mean horizontal position.

You are requested to:

- a) copy figure 7b; (2)
- b) construct the displacement diagram by using the data given in Figure 7c; (8)
- c) lay out the cam profile. (10)

Notes:

- The rotation of the cam is anti-clockwise.
- The minimum radius of the cam is 40 mm.

(Total: 20 marks)

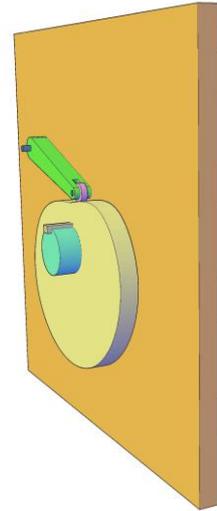


Figure 7a

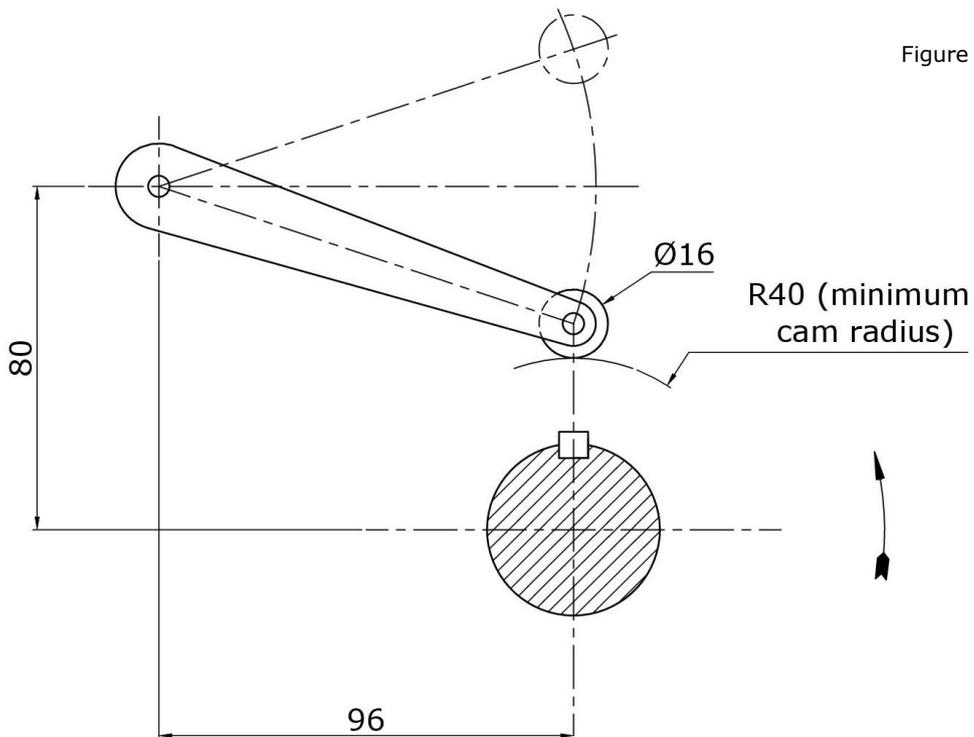


Figure 7b

Cam Displacement	Follower Displacement
0° to 90°	Rise of 50 mm with simple harmonic motion
90° to 180°	Rise of 14 mm with uniform velocity
180° to 210°	Dwell
210° to 360°	Fall of 64 mm with uniform acceleration and retardation

Figure 7c

Question 8.

An illustration of two identical gears in mesh is given in Figure 8a. Details of a conventional arrangement of the two spur gear wheels are given in Figure 8b.

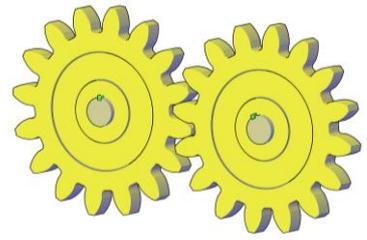


Figure 8a

The gear teeth are of the true involute form, having a standard pressure angle of 20° and a module 20 mm. The number of teeth on each gear is 16. Use the given data to:

- a) calculate the pitch circle diameter, the addendum, the dedendum, the circular pitch, the tooth thickness, and the fillet radius; (3)
- b) construct the base circle; (1)
- c) construct an involute to determine the profile of the tooth flank face; (4)
- d) draw **TWO** complete gear wheel teeth on gear 'A' and **THREE** complete gear wheel teeth on gear 'B'; (10)
- e) indicate, on the drawing, the diameter of the base circle, the addendum, the dedendum and the tooth thickness. (2)

Notes:

- All necessary calculations must be clearly shown and tabulated.
- The flank faces of gear 'A' must be of the true involute form. The opposite tooth flank faces (gear 'B') are to be drawn by using the approximate compass method.

(Total: 20 marks)

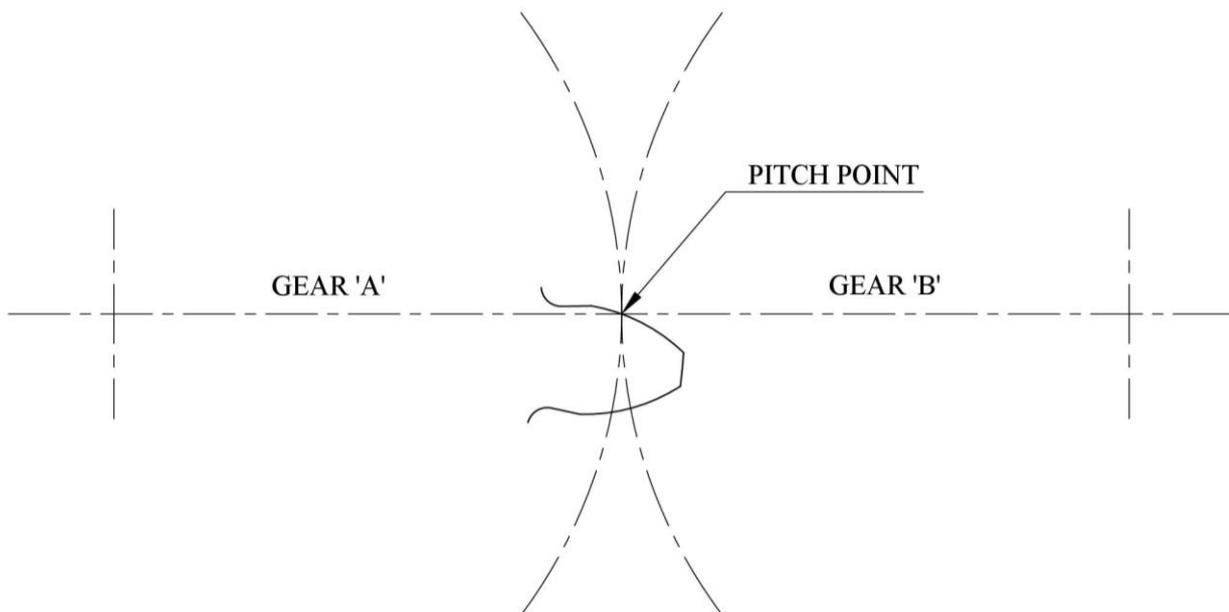


Figure 8b



SUBJECT:	Graphical Communication
PAPER NUMBER:	II
DATE:	5 th July 2021
TIME:	4:00 p.m. to 7:05 p.m.

Directions to Candidates

Write your index number where indicated at the top of all drawing sheets.

Attempt question 1 and any other **THREE** questions.

Programmable calculators **cannot** be used.

Unless otherwise stated:

- drawings should conform to B.S. or equivalent (ISO) standards;
- all dimensions are in millimetres;
- answers are to be accurately drawn with instruments;
- all construction lines must be left on each solution;
- drawing aids may be used.

Dimensions not given should be estimated.

Careful layout and presentation are important.

Marks will be awarded for accuracy, clarity, and appropriateness of constructions.

Colour/shading should be used where appropriate.

Mark allocations are shown in brackets.

Question 1 carries 34 marks. Questions 2, 3, 4 and 5 carry 22 marks **each**.

Question 1.

Figure 1b shows three orthographic views of a mobile phone sales and repair shop. The presented orthographic views detail the proportions of each listed item and how these are configured inside the shop’s space. Use this information to construct a **two-point** estimated perspective drawing of the shop. The viewing direction is indicated by the arrows on the plan.

- a. Using **THREE** preliminary sketches, explore alternative positions of the horizon line and identify the one which, in your opinion, best describes the spaciousness of the entire area. (3)
- b. Based on the choice made in part (a), use a suitable scale to produce the required illustration on a single side of an A2-size paper, making the best use of the space available. (26)
- c. Enhance your drawing by colouring small areas of the different items appearing in your illustration. (5)

Notes:

- The flooring is covered in Parquet (timber) slabs.
- The fixed furniture is covered in Melamine sheets (plastic).
- The display cabinets are made of postform (glued and pressed wood laminate) with transparent glass doors.
- The ceiling lighting is **not** shown on the plan.
- Pictorial views of one of the display cabinets and the ceiling lighting are given in Figure 1a below.

(Total: 34 marks)

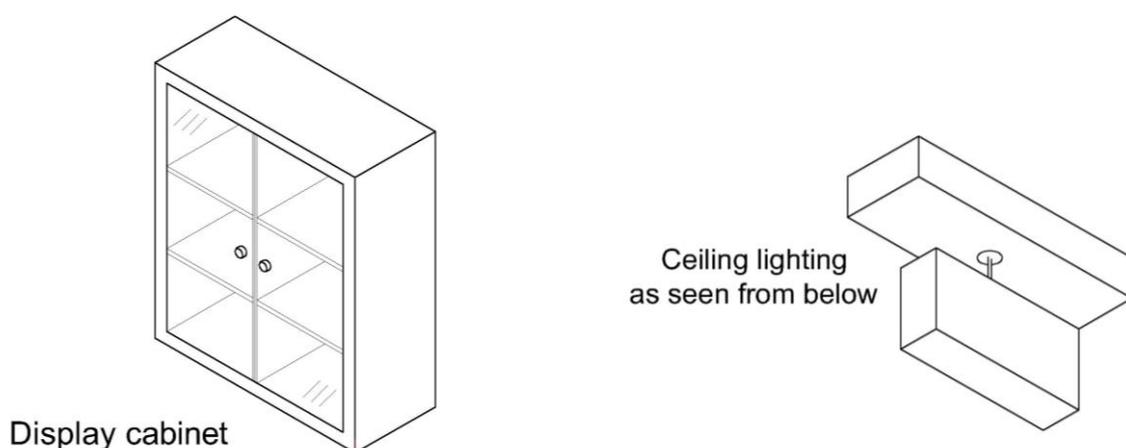


Figure 1a

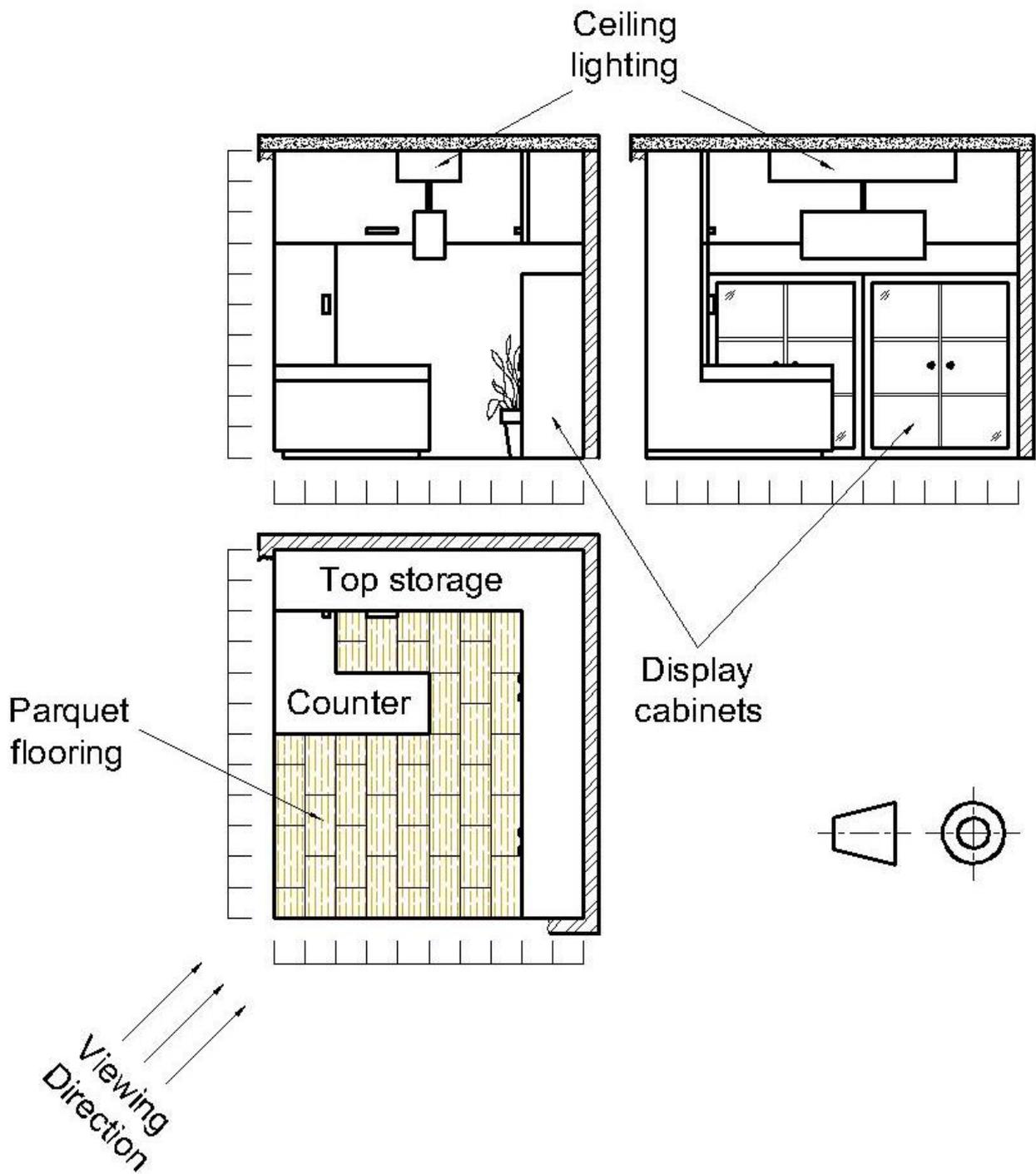


Figure 1b

Question 2.

A company that manufactures Pod Coffee Machines needs to design a two-page leaflet to be inserted inside the machine's packaging. This leaflet needs to express, by graphical means, eight consecutive steps showing the operation of the same machine.

Figures 2a and 2b show pictorial freehand sketches of the machine, indicating all the parts referred to in the eight operational steps.

These sketches are to be used only as reference when producing the graphical representations of each step. There is no need to draw the whole coffee machine for each step, but only focus on that particular area mentioned in each instruction.

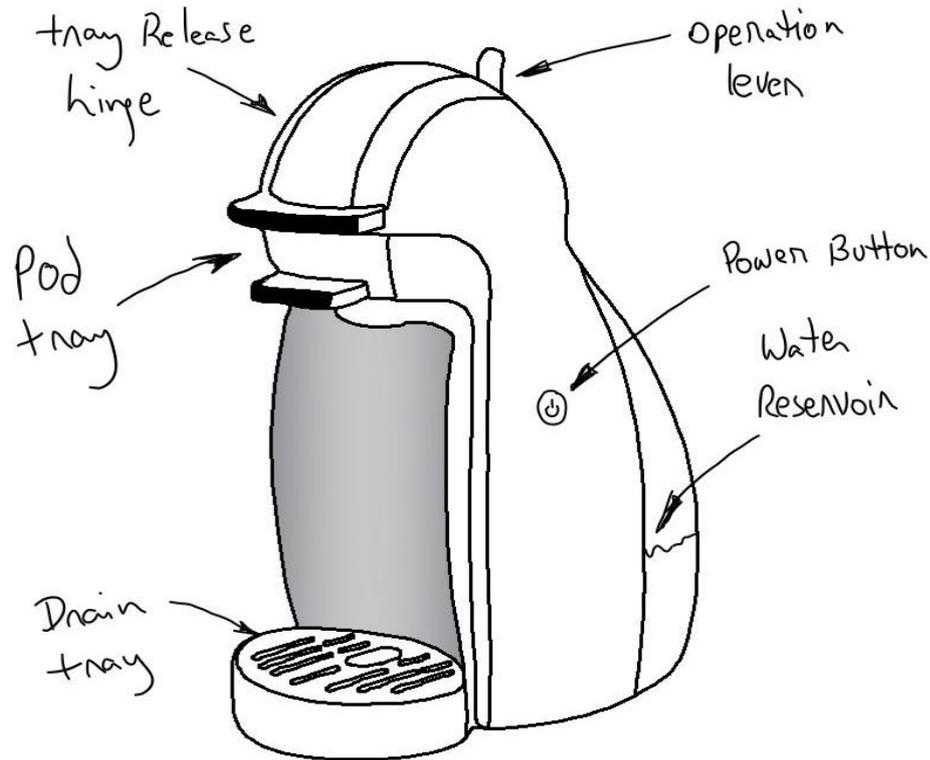


Figure 2a

The eight operational steps are as follows:

- b. Fill the water reservoir; (2)
- c. Elevate the tray release hinge; (2)
- d. Insert the coffee pod inside the pod tray; (3)
- e. Place the cup on the drain tray; (3)
- f. Switch on the power button (this will flash in red for a couple of seconds until the water heats up); (3)
- g. When the power button turns green, move the operation lever either to the left (for cold beverages) or to the right (for hot beverages); (3)
- h. Reposition the lever to the centre when you want to stop the water flow; (3)
- i. Elevate the tray release hinge, open the pod tray, and dispose of the used pod in the proper waste bin. (3)

You are requested to design the two-page leaflet that will replace the textual with the graphic instructions.

Notes:

- It is suggested that you space your work on your A2 sheet as indicated in Figure 2c.
- Draw preparatory sketches if necessary.
- An illustration of a coffee pod, which is a small cup filled with pre-ground coffee is shown in Figure 2D.

(Total: 22 marks)

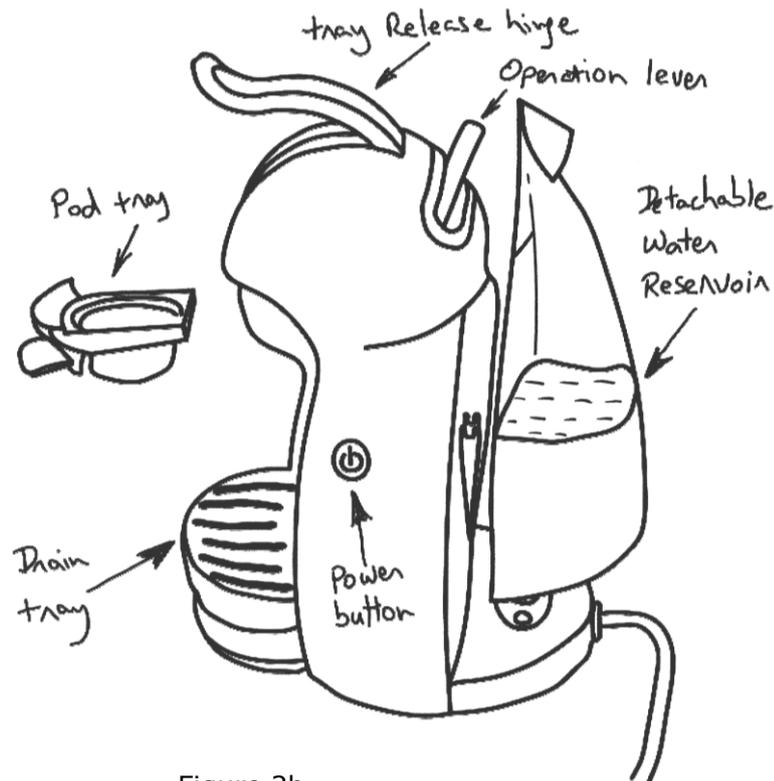


Figure 2b

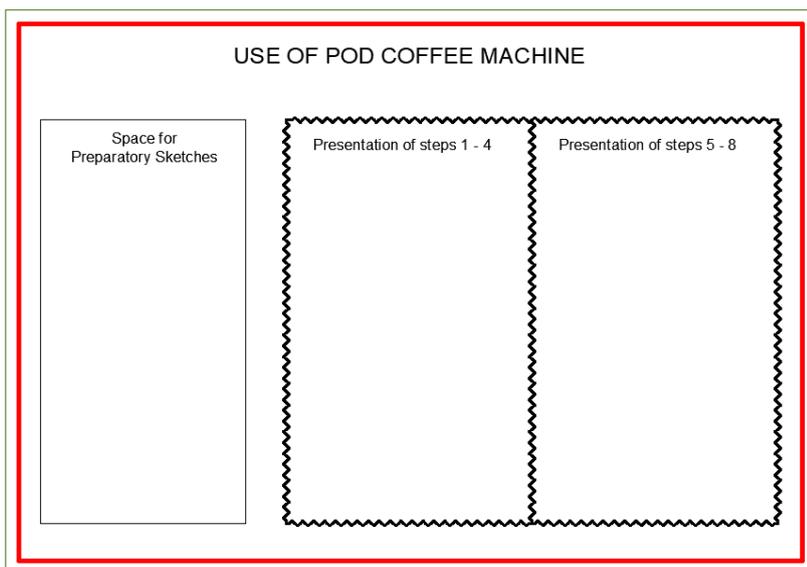


Figure 2c



Figure 2d

Question 3.

Figure 3 shows four orthographic views of a paper puncher. Basically, this tool punches holes in papers by pressing two cylindrical steel punches through the paper and into close-fitting holes in the base plate.

Use the information supplied in these views to:

- a. draw **TWO** preparatory pictorial sketches to identify a viewing position that clearly illustrates how this office tool operates; (2)
- b. draw a well-proportioned freehand pictorial drawing of the paper puncher, based on your response to your preparatory sketches; (14)
- c. colour and shade the sketch, focusing on the representation of different textures; (4)
- d. add arrows to indicate the movement of the lever arm and the cylindrical steel punch. (2)

Note: Make good use of the space on your A2 drawing sheet.

(Total: 22 marks)

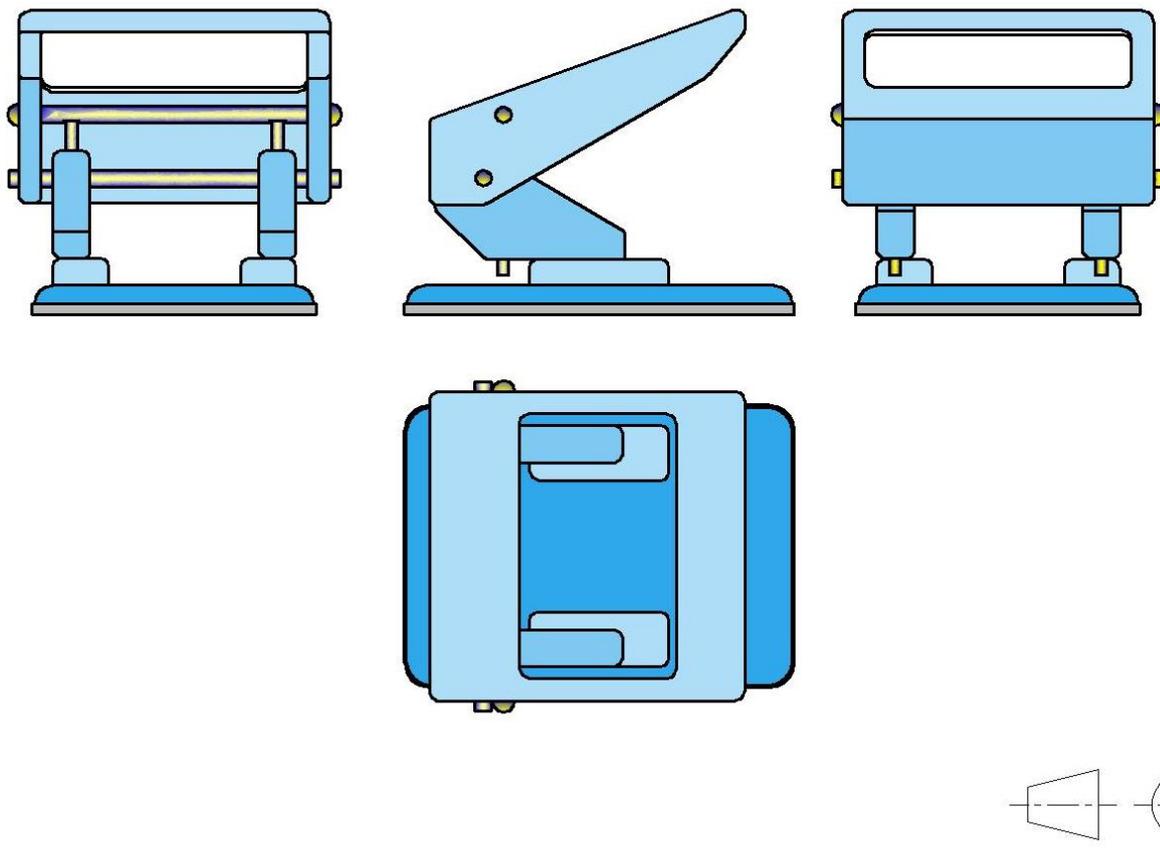


Figure 3

Question 4.

A new airline company by the name of 'BULLET-AIR INTERNATIONAL' needs an eye-catching logo. This logo needs to be placed, amongst others, on the aeroplanes' tail fin (technically called a Stabilizer with directional Rudder).

You have been commissioned to design this Logo, which needs to include the name of the company. You need to present your work broken down according to the following steps and as shown in Figure 4.

- a. Written analysis. Identify, using keywords/short phrases, the main parameters of the design brief. (2)
- b. Graphical analysis. Based on your response to the written analysis, produce a series of preparatory sketches that illustrate your developing ideas. (4)
- c. Design synthesis. Clearly identify those elements produced in your sketches that you intend to use in your final design. (2)
- d. Final realisation. Use colour and shading to produce your final realisation in the space shown in Figure 4. (14)

Notes:

- Use suitable typefaces for the name of the company.
- Details of the page layout are given in Figure 4. Dimensions not given are left to your discretion.
- Your entire design should span across both the stabilizer and rudder.

(Total: 22 marks)

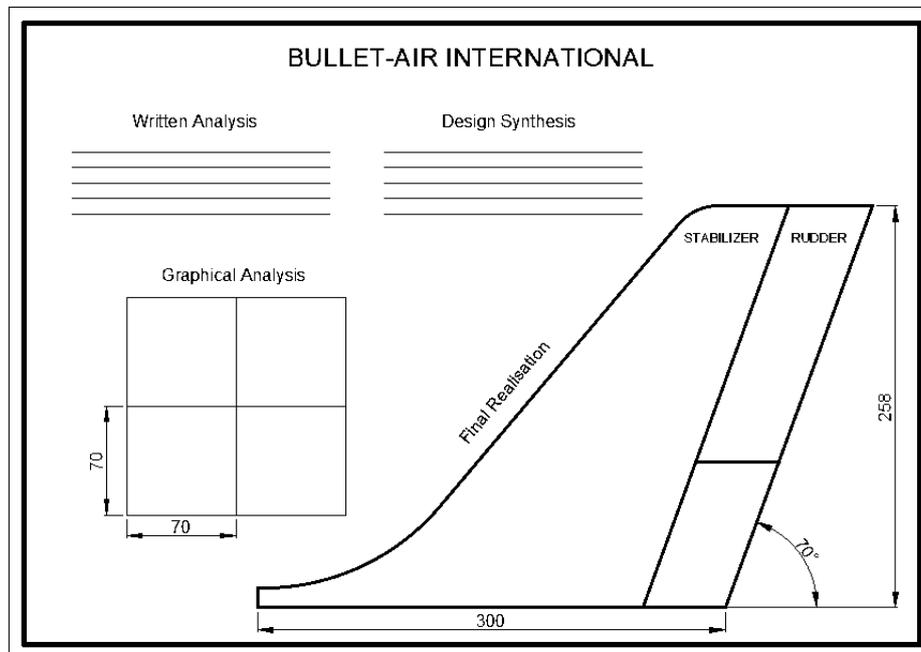


Figure 4

Question 5.

Figure 5a shows a three-dimensional sketch of a cordless drill.

You are requested to:

- a. draw a two-dimensional sketch of the cordless drill as seen from the direction indicated by the arrow (end elevation); (12)
- b. apply colour and shading to your sketch to express the volume of the drill. (10)

Notes:

- An example of a rendered two-dimensional sketch is given in Figure 5b.
- Choose an appropriate light direction to make the volume and the shape transitions more recognizable.
- Distinguish between textures of the different materials comprising the drill.

(Total: 22 marks)

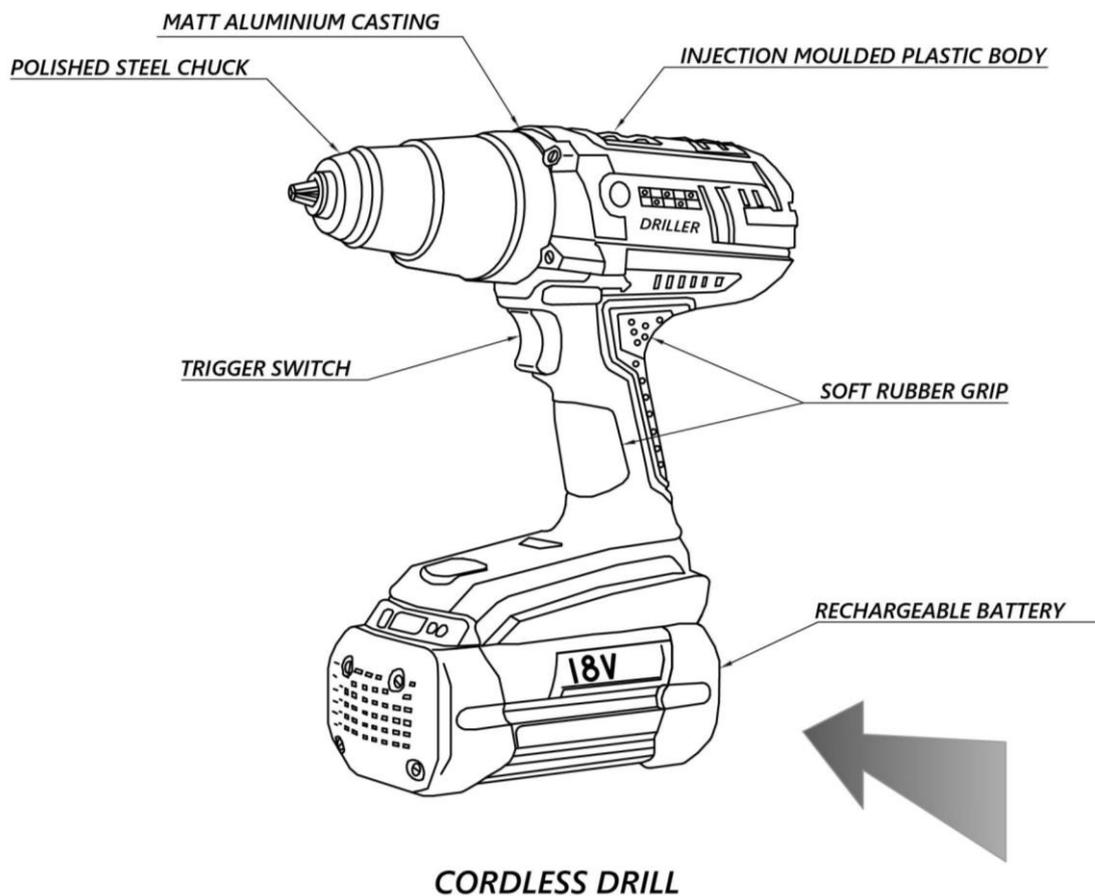


Figure 5a

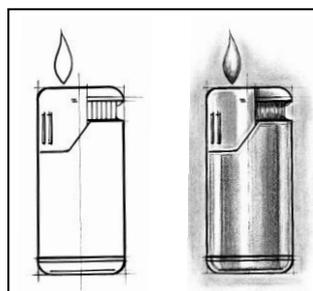


Figure 5b