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| SUBJECT: | Engineering Drawing/Graphical Communication |
| PAPER NUMBER: | I |
| DATE: | 30 th May 2019 |
| 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;
- unless otherwise stated, 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.

1. A right cylinder with a hexagonal hole is placed resting on its circular base on a horizontal plane. The traces VTH of an oblique plane are shown passing through the cylinder cutting off the upper portion as illustrated in Figure 1a.

Draw, full size:

- the traces VTH and the complete plan of the solid as shown in Figure 1b; (2)
- an auxiliary elevation showing the oblique plane as an inclined section plane passing through the solid; (4)
- project a front elevation of the sectioned solid; (4)
- from the first auxiliary view drawn in part (b), construct a second auxiliary view showing the true shape of the sectioned face; (6)
- project an end elevation of the sectioned solid as seen from the right-hand side. (4)

(Total: 20 marks)

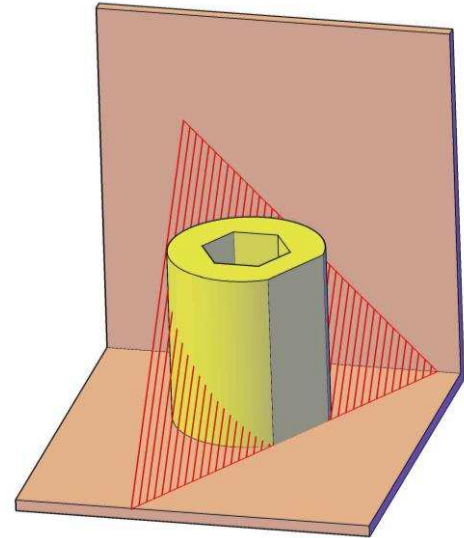


Figure 1a

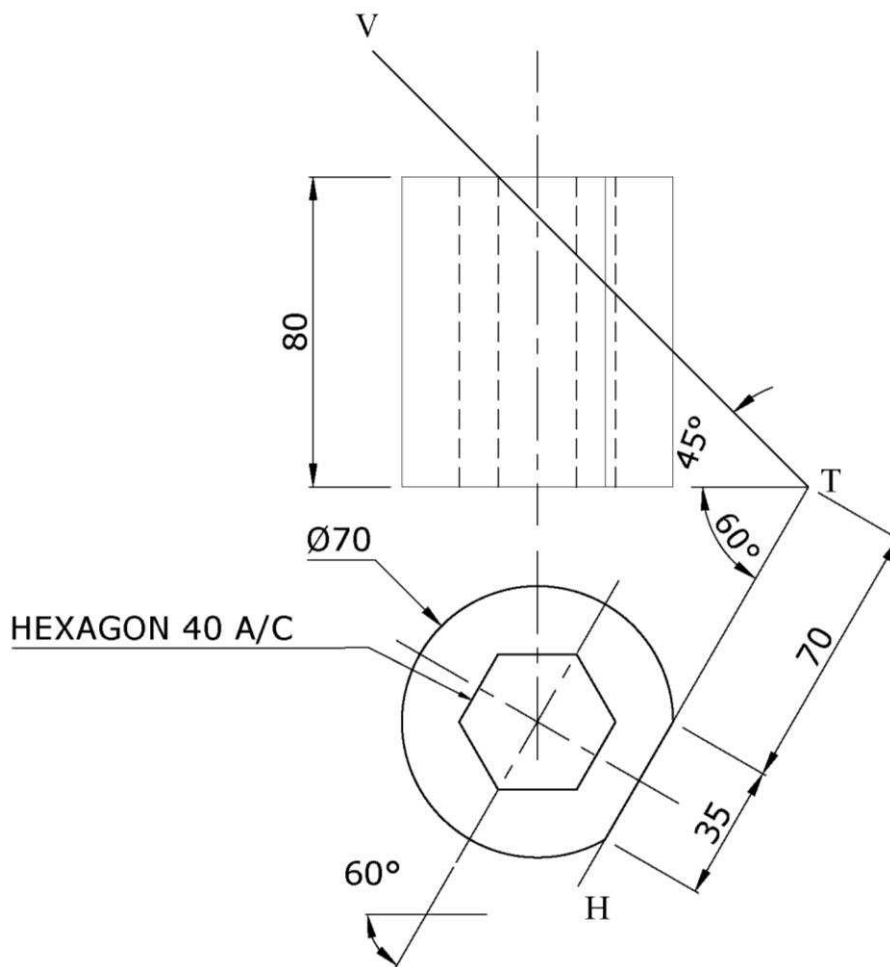
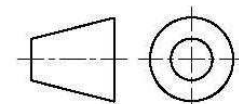


Figure 1b



2. A flanged wheel having an inner and outer circumference, is constrained to roll without slipping on its inner circumference, for two complete revolutions. Figure 2a shows an arrangement of the flanged wheel and the track on which the wheel is to roll. From the initial position shown in Figure 2b, and to a scale of 1:1, construct:

- the locus generated by the point P as the wheel rolls for one complete revolution on its inner circumference round the fixed directing curve. State the name of the locus generated. (9)
- the locus generated by the point P as the wheel rolls a further revolution on its inner circumference along the inclined track. State the name of the locus generated. (6)
- the instantaneous radius of curvature of the locus drawn in part (a) when the wheel has rotated 240° from the initial position. State the value of this radius of curvature. (3)
- a normal and a tangent to the locus drawn in part (b) when the wheel has rotated 240° on the inclined track. (2)

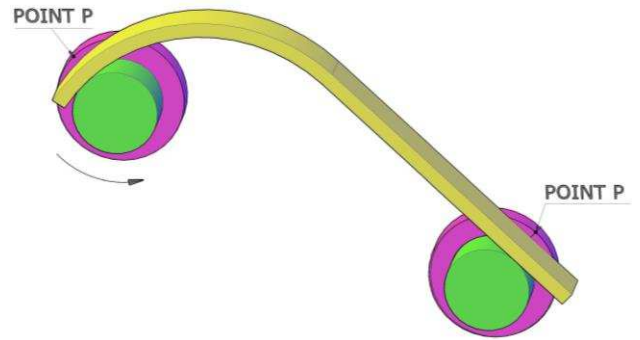


Figure 2a

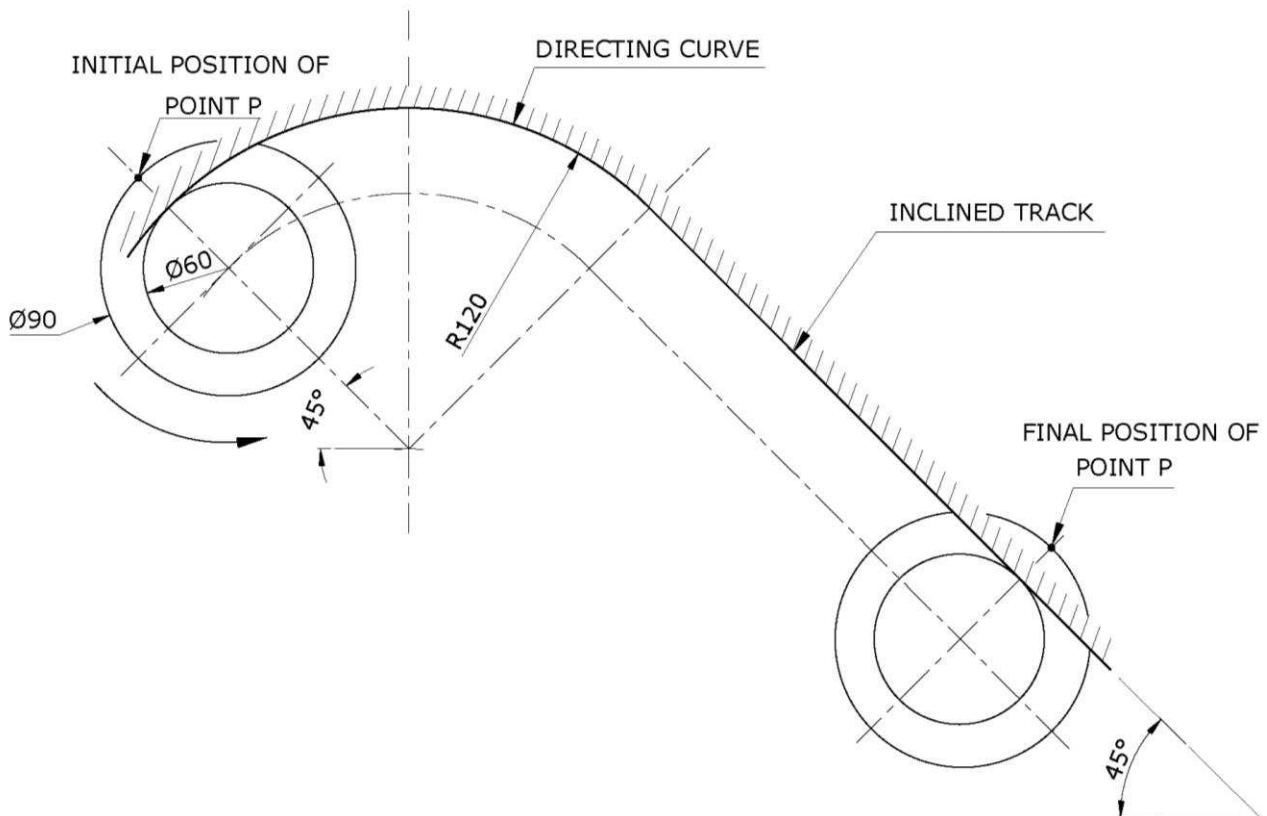


Figure 2b

3. The illustration, Figure 3a, shows a cone, a sphere and a cylinder joined together. Figure 3b shows a front elevation and an end elevation of the arrangement. The axis of the cone, the centre of the sphere and the axis of the cylinder are aligned on the same vertical plane.

- a) Copy, full size, the **TWO** elevations shown in Figure 3b and draw a plan. (3)
- b) Determine the curve of intersection between the cone, the sphere and the cylinder in the:
 - i) front elevation; (9)
 - ii) end elevation; (4)
 - iii) plan. (4)

Note: Show hidden detail.

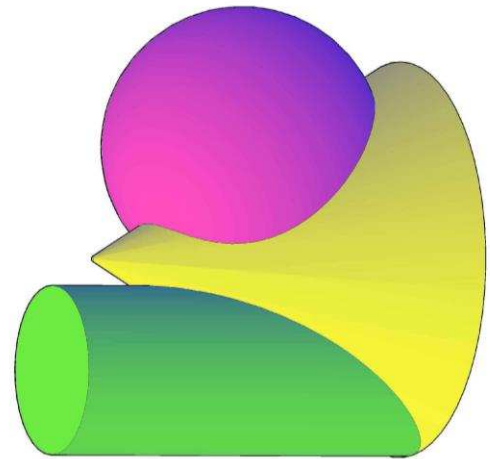


Figure 3a

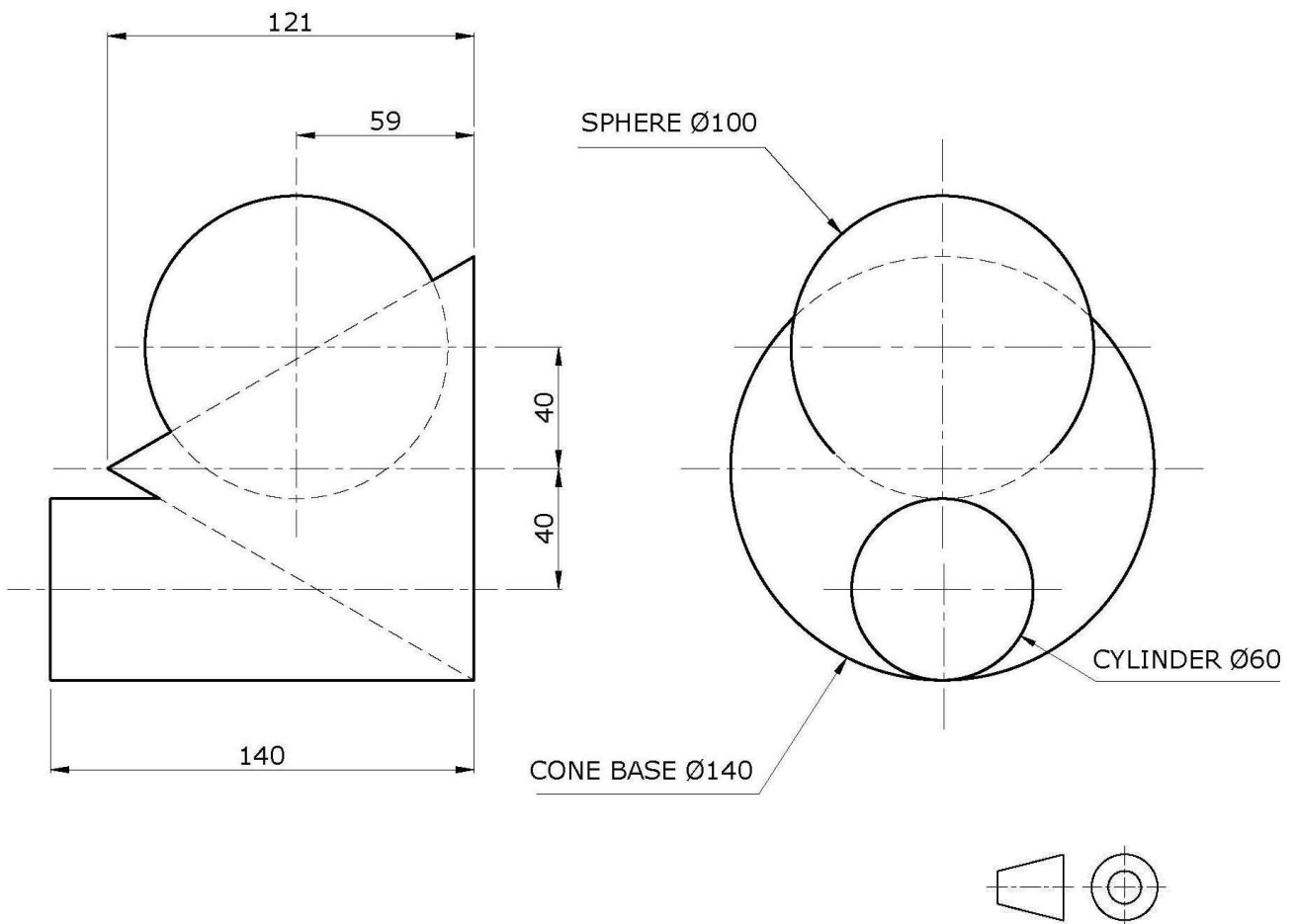


Figure 3b

4. An offset roller-ended follower operating on a plate cam is shown in Figure 4a. The line of action of the roller-ended follower is 25 mm to the right of the vertical centre-line of the cam and the roller follower is 20 mm diameter. The cam is to rotate in an anti-clockwise direction.
- Copy, full size, the profile of the plate cam shown in Figure 4b. (5)
 - Plot round the cam profile the locus of the roller centre. (2)
 - Draw the cam graph displacement curve for the cam which rotates at 30 rpm. Use a scale of 180 mm to represent one revolution of the cam for the cam graph. (13)

(Total: 20 marks)

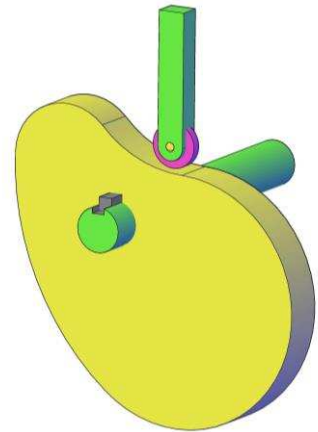


Figure 4a

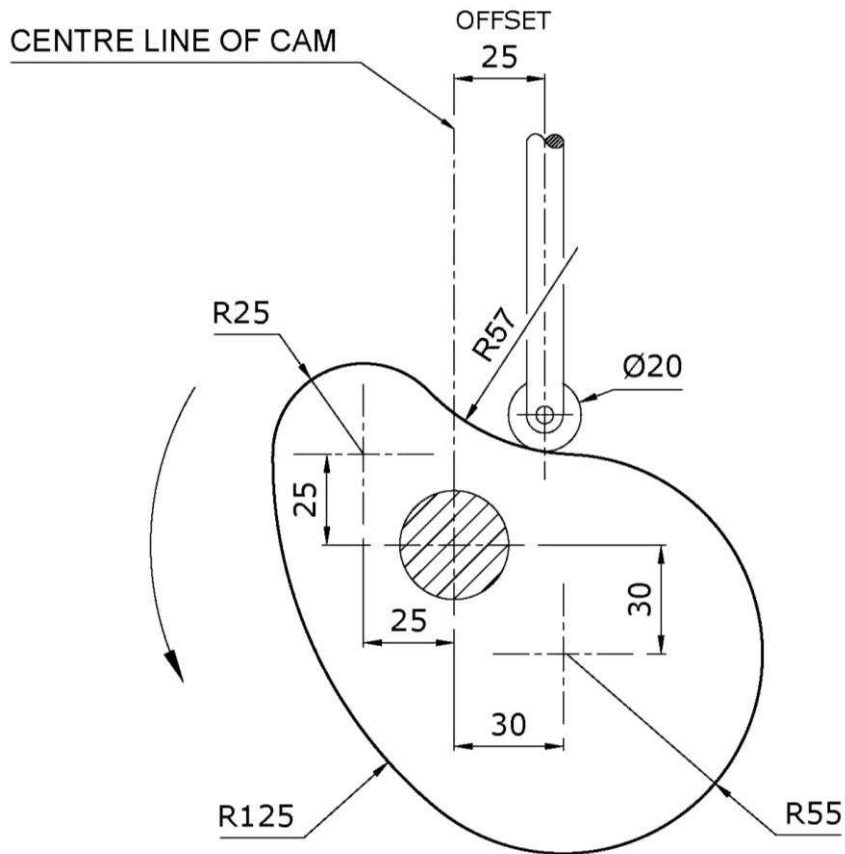


Figure 4b

5. Figure 5 shows a framework consisting of nine jointed light rods hinged to a fixed point at the top left-hand corner of the frame. The framework is kept in position by a horizontal reaction at the left-hand bottom corner. The framework is loaded with 100 kg each at the point indicated in Figure 5.
- Copy the space diagram and use the scale indicated. (4)
 - Determine graphically:
 - the stresses in the rods, stating whether they are in tension or in compression; (8)
 - the magnitude, direction and angle with the H.P. of the reaction at the hinge; (4)
 - the magnitude of the reaction at the left-hand bottom corner. (4)
- (Total: 20 marks)**

SPACE DIAGRAM SCALE: 50 mm REP 1 m

FORCE DIAGRAM SCALE: 50 mm REP 100 kg

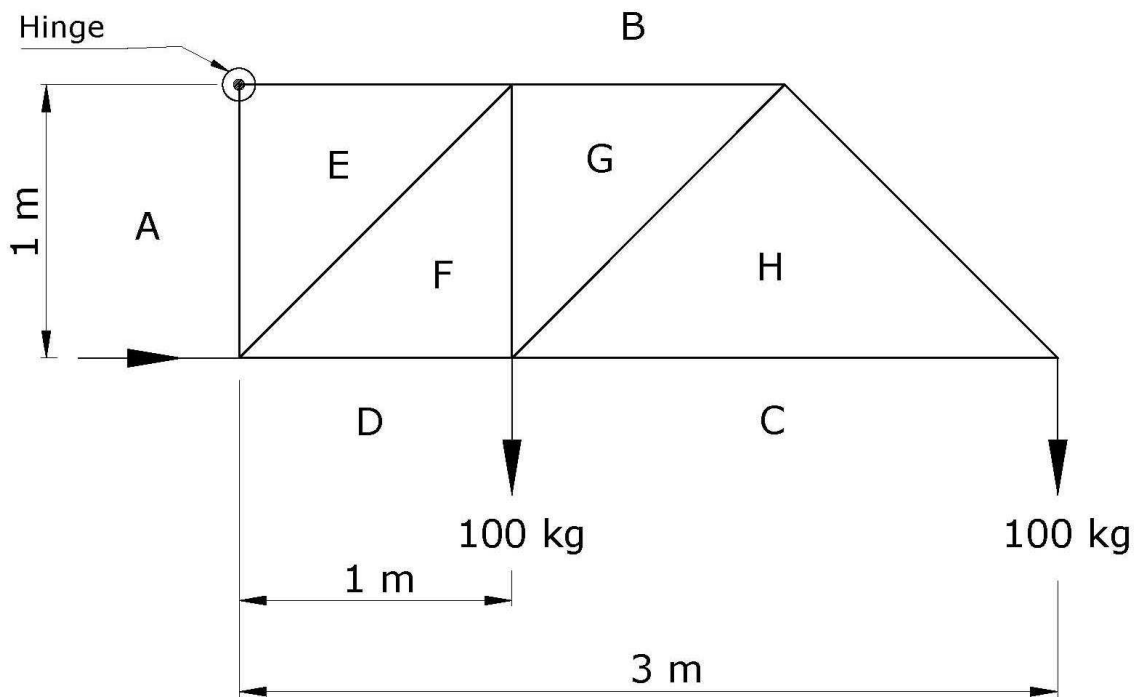


Figure 5

6. A cylindrical solid was machined and its shape partly changed from a cylinder to a cone with a spherical nose end as illustrated in Figure 6a. Two vertical parallel sections were cut off leaving two flat surfaces. Finally, a square hole was machined through the upper conical solid.

- a) Draw, full size, the front elevation and the incomplete plan shown in Figure 6b. (4)
- b) Project a view looking on the flat surface from the direction of the arrow X showing:
 - i) the resulting curves of intersection between the solid and the vertical section; (3)
 - ii) the outline of the cone as affected by the square through hole. (4)
- c) Complete the plan by showing the curve of intersection between the cone and the through square hole. (9)

Note: Show hidden details.

(Total: 20 marks)

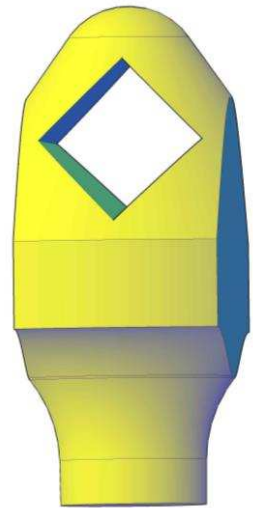


Figure 6a

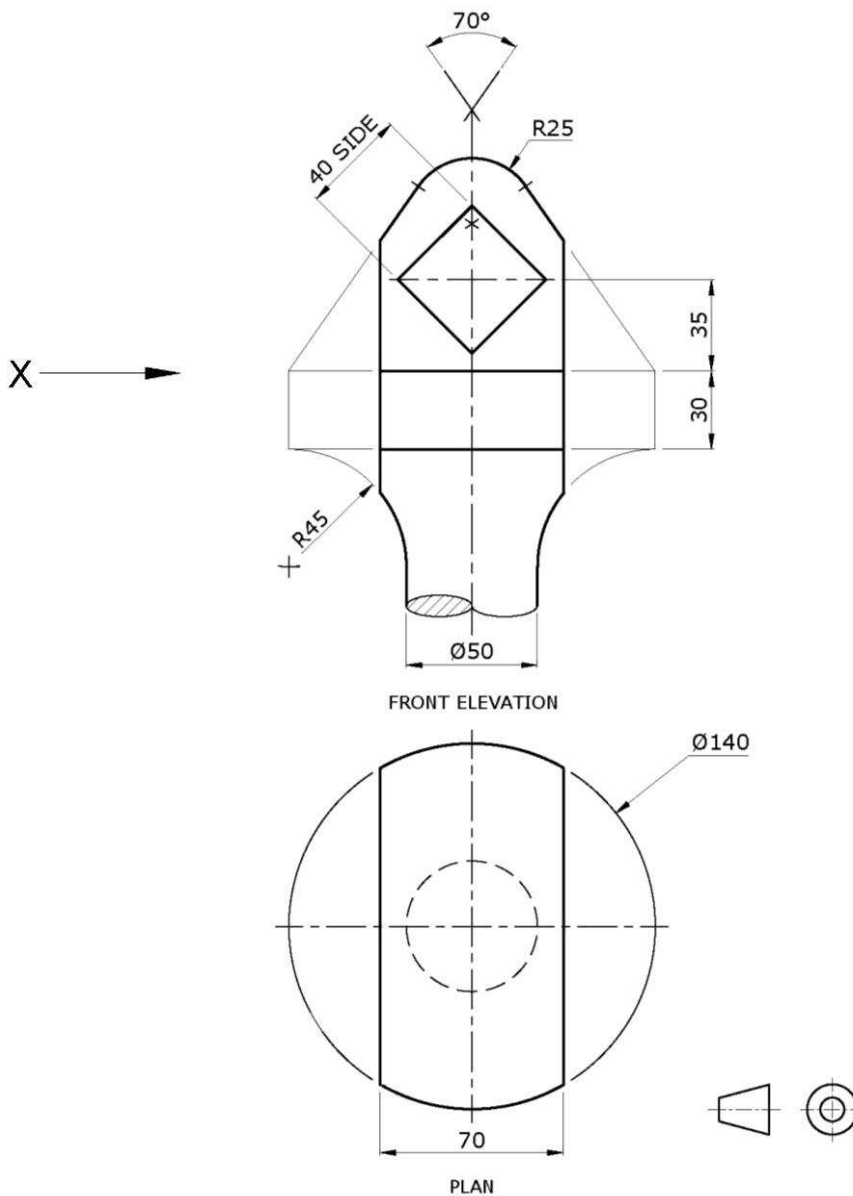


Figure 6b



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|---------------|--------------------------------|
| SUBJECT: | Graphical Communication |
| PAPER NUMBER: | II |
| DATE: | 30 th May 2019 |
| 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 **all** 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 and 4 carry 22 marks each.

1. Three orthographic views of a proposed conversion of a warehouse corner are given in Figure 1b. The area is to be transformed into an office and reception area. The floor of the office zone is to be raised by half a course above the surrounding area. A drop-down ceiling is to be constructed directly above the office area. The office furniture consists of a front desk, a computer desk, a combined filing cabinet and bookcase and a wall mounted framed painting. The reception area is furnished with three cushioned chairs, two rectangular flower pots and two carpets. Pictorial drawings of the furniture are given in Figure 1a. The given orthographic views constitute an integral part of the design process but fail to convey a feeling of the 3D proportions of the office and reception area. You are to meet this requirement by drawing a two-point estimated perspective drawing. The viewing direction required is indicated by the arrows in the plan view.
 - 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 reception area and the office layout. (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:

1. Ceramic floor tiles pave the reception area.
2. Rubber floor tiles pave the office area.

(Total: 34 marks)

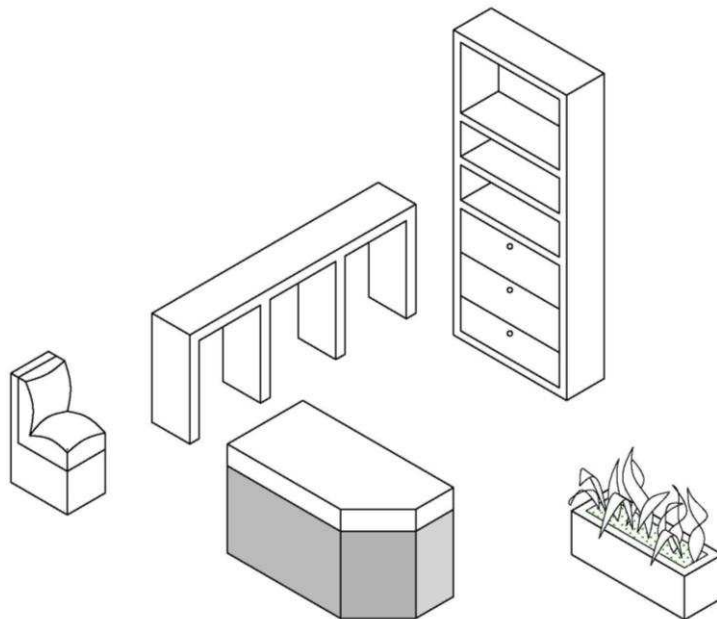
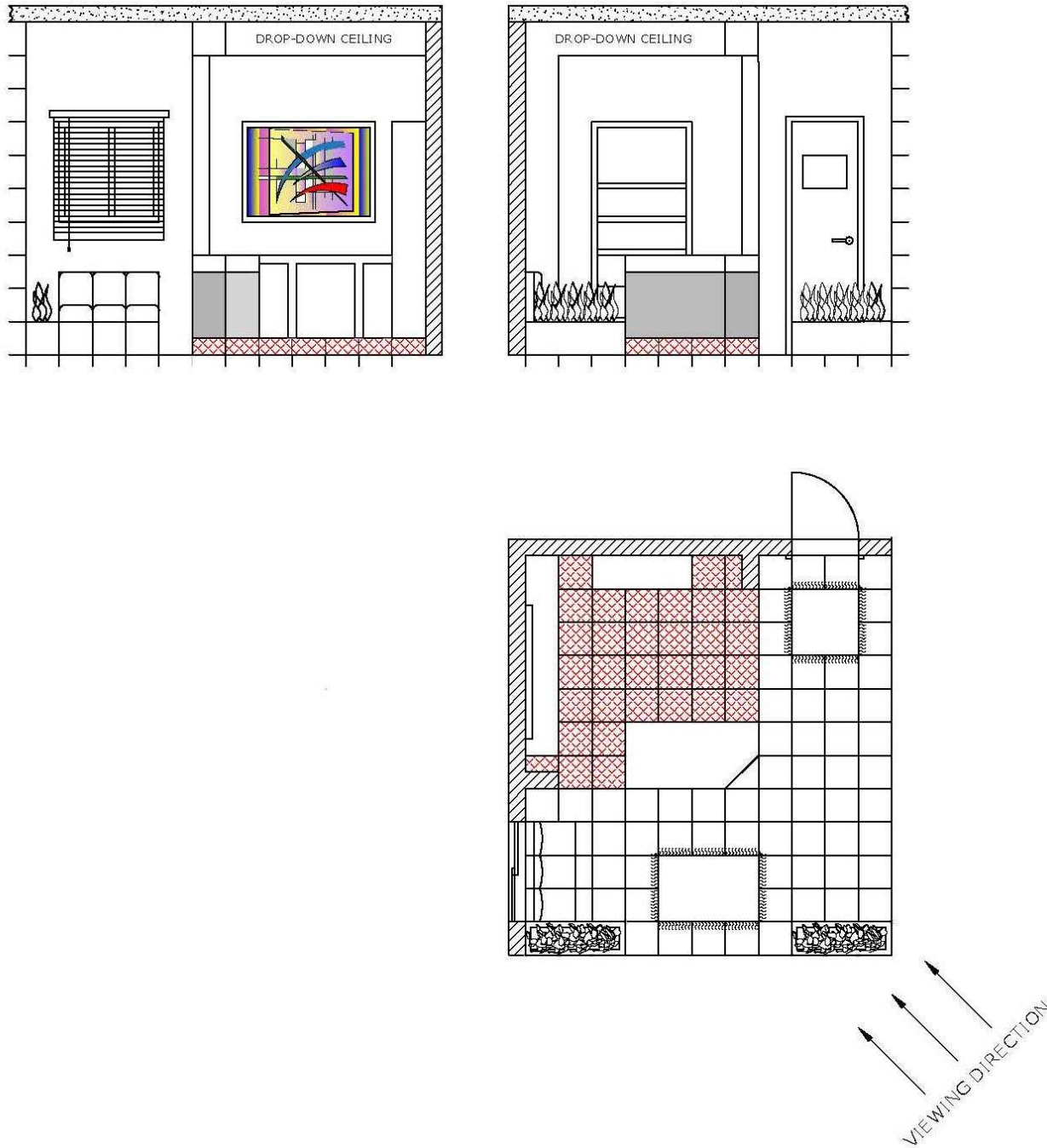


Figure 1a

Figure 1b



2. Orthographic views of two clothes peg models A and B are given below in Figure 2a and Figure 2b.

Model (A) consists of an assembly of two identically machined wooden clips and a specially formed galvanised coiled spring that serves as a pivot and a retainer to hold the clips together.

Model (B) consists of a single stainless-steel sheet metal strip that has been firstly pressed at the ends to form the finger grip indentations and the stiffening ribs, and secondly bent to shape.

You are requested to:

1. draw a freehand isometric sketch of both models; (12)
2. colour and shade both sketches paying attention to the representation of the different materials and textures; (6)
3. neatly annotate your drawings to indicate the following features:
 - coiled spring;
 - wooden clips;
 - finger grip indentations;
 - stiffening rib. (2)
4. draw arrows to illustrate the pinching action necessary to open the pegs. (2)

(Total: 22 marks)

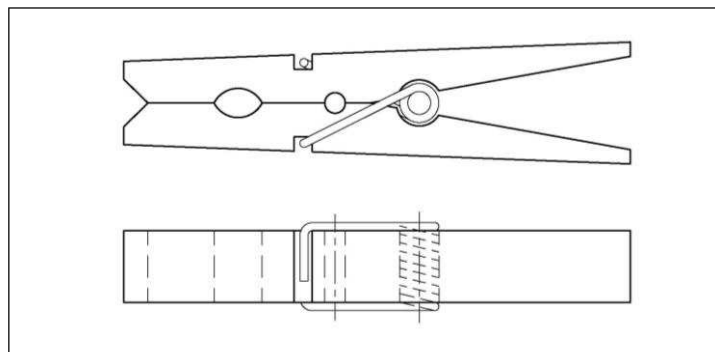


Figure 2a- Model A

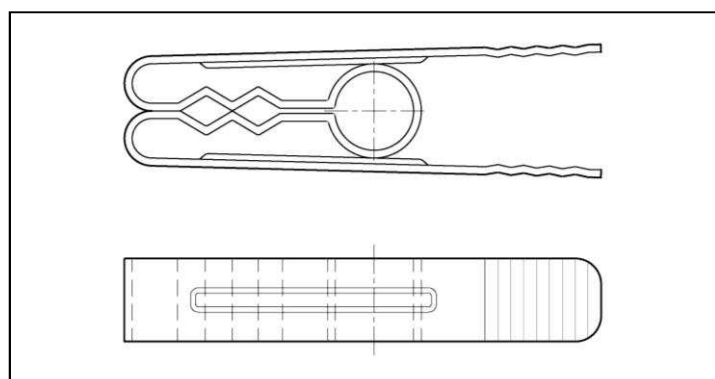


Figure 2b- Model B

3. Hearing loss is a partial or total inability to hear. Hearing loss may result from the following causes:

- birth defects;
- ear infections;
- medicines;
- ageing;
- excessive noise.

Noise is measured in decibels (dB), and medical professionals have set safe levels for both daily life and work environments. The World Health Organization (WHO) recommends that the noise level in the workplace does not exceed 85 dB.

Examples of noise levels:

- 60 dB normal conversation
- 90 dB hair drier
- 120 dB ambulance siren

As part of a hearing loss awareness campaign, the organising committee decided to commission an infographic chart to educate the general public about the causes and the prevention of hearing loss. The campaign logo is shown in Figure 3.

You are requested to design the infographic chart, consisting of both text and graphic symbols, to illustrate the above information. Choose a suitable title and plan an appropriate layout.

Notes:

- a. It is suggested that the infographic is divided into two sections, one for the causes of the hearing loss and the other for the examples of noise levels, what is safe and what is not.
- b. Draw a simple graphic symbol for each bullet in the above lists.
- c. Add colour to the infographic to emphasise the harm that noises exceeding 85 dB cause to the ears.



Figure 3

(Total: 22 marks)

4. Spic-and-Span is a newly setup mobile car wash business. As part of the marketing campaign, the management decided to commission a design for a van wrap advertisement. They want the signage to be colourful and with a clear message to make sure that people can easily see it from the road. Their strong selling points are their punctuality, efficiency and professionalism. The profile of the company van is shown in Figure 4a.

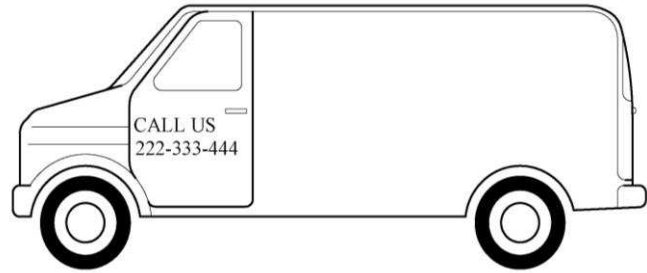


Figure 4a

You have been requested to design the van signage which has to include both graphics and text. You are to submit your work and break it down in the steps given below.

- a) **Written analysis**
Identify, using keywords/short phrases, the main parameters of the brief. (2)
- b) **Graphical analysis**
Based on your response to part (a), produce a series of preparatory sketches that illustrate your developing ideas. (4)
- c) **Graphical synthesis**
Clearly identify those elements produced in your sketches that you intend to use in the final image. (2)
- d) **Final realisation**
Produce your final solution in the shape shown in Figure 4b. (14)

Notes:

- Use suitable typefaces for your design.
 - Details of the page layout and the van and the advertising space are given in Figure 4b.
- (Total: 22 marks)**

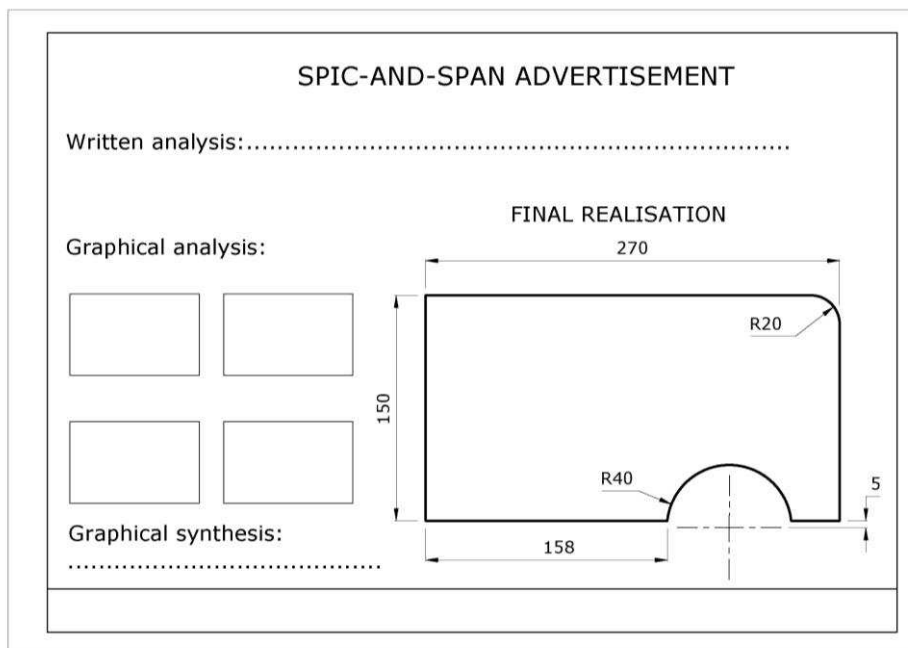


Figure 4b