FOUNDATION PROGRAMME

IN LITERACY, NUMERACY AND SKILLS

(FPLNS)

GRADE 9

Design and Realisation 4

Metal Technology

UNIT 1: ORTHOGRAPHIC PROJECTION

NOTES TO EDUCATORS - UNIT 1: ORTHOGRAPHIC PROJECTION

1. To ensure good understanding on the visualization of front, top and side views of objects, use simple objects available in the DT studio/workshop as teaching aids to demonstrate to students.

2. The colour codes used for the illustration of the orthographic views are as follows:

   FRONT VIEW – Red Colour

   TOP VIEW – Green Colour

   SIDE VIEW -Blue Colour

3. Do not skip activities. Make sure that ALL students tackle ALL the given activities in the correct order on after the other, starting from Activity 1 to 18. This will ensure the implementation of differentiated instructions in the classroom, from low to high order performance.

4. Always make sure that students leave 2 units in between the orthographic views on the square grids.

5. Carry out demonstration sessions to show students how to place their ruler on the given grid lines, how to hold their pencil to draw faint lines at first and how to finally outline in dark so as to ensure precise and neat drawings.

6. When drawing orthographic views of given square grids, make sure that students position the views correctly on the square grids in order to ensure optimum space usage.

Learning Objectives

At the end of this unit, you will be able to:

- Identify the principles of drawing in orthographic projection.
- Draw the front, top and side view of cubes, cuboids and shaped blocks.

Introduction

Orthographic projection is a type of drawing commonly used in the **design industry**. Designers use this drawing to communicate details to manufacturers on products to be made.

An orthographic drawing is very common in the **building and construction industry** (Fig. 1). The drawing communicates various details such as:

- Form of building when viewed from front, top and side.
- Dimensions.
- Placement of features such as doors, windows, stairs etc…

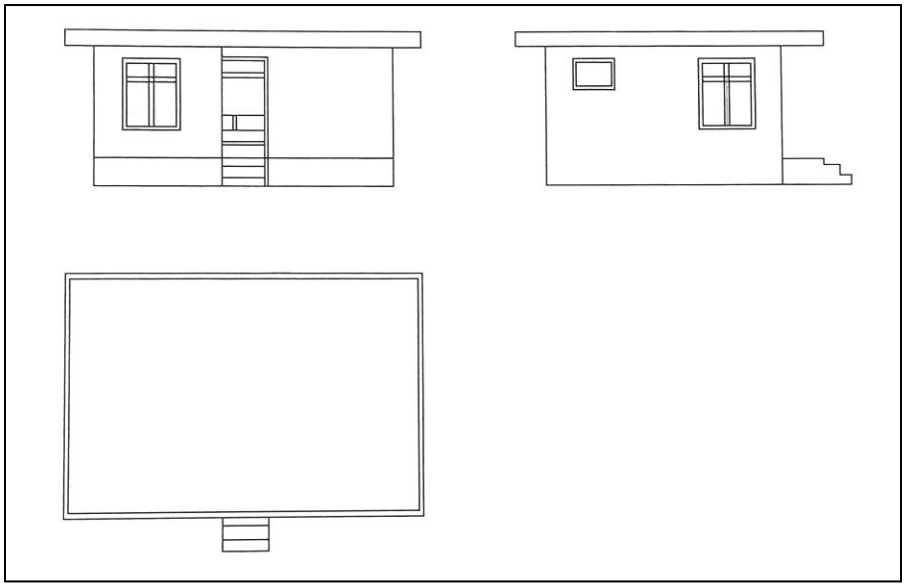


Figure 1: Orthographic Projection of a house.

Note:

Before building a house, you need to have a building permit. For this, you need to submit details of the house through drawings in orthographic projection.

What you need to draw in an orthographic drawing

In an orthographic drawing, you have to draw a given 3D object's front, top and side view. To draw these views, the 3D object should be looked from three different directions, indicated by the arrows F, T and S. An example of a television has been given below along with arrows F, T and S.

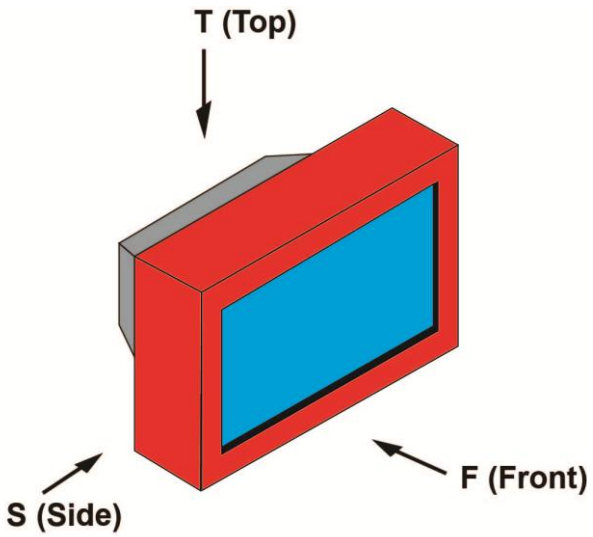


Figure 2: 3D illustration of a television with arrows F, T and S

By looking in the direction of the arrows F, T and S, the three views can be visualized and drawn as shown below. These three views all together represent the orthographic projection of the television.

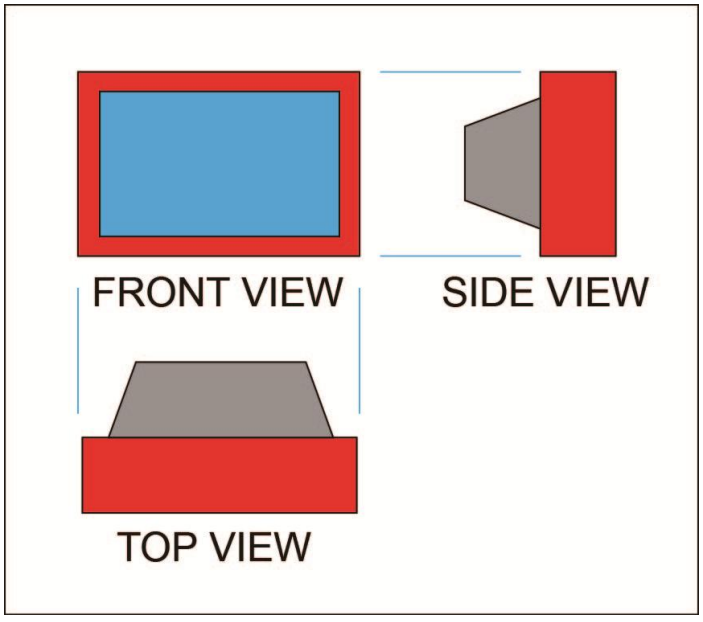


Figure 3: Orthographic Projection of the television

Note:

To draw the front view, the object is viewed in the direction of arrow F.

The top view is drawn exactly below the front view, when viewed from arrow T.

The side view is drawn exactly to the right of the front view, when viewed from arrow S.

Drawing cuboids in orthographic projection

Now, let us learn how to draw cuboids in orthographic projection. Let us consider the cuboid shown below in Fig. 4.

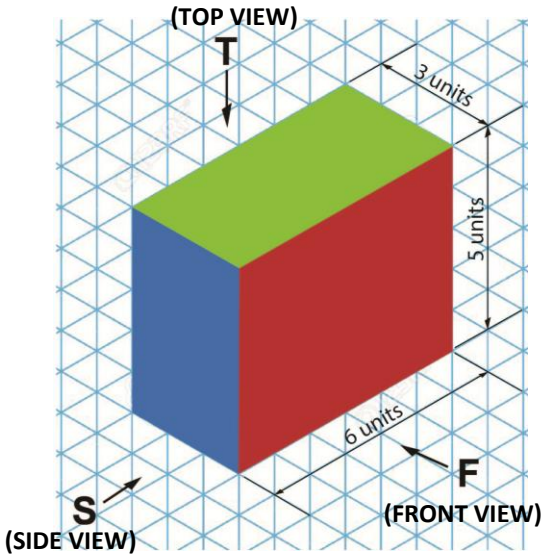


Figure 4: 3D drawing of a cuboid given on isometric grid

The cuboid has the following dimensions:

Height – 5 units, Width – 6 units, Depth – 3 units

Let us learn how to view the cuboid to obtain the different views.

First of all, make as if you are holding the cuboid in your hands, as shown in Fig. 5.

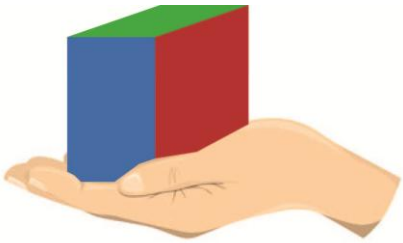


Figure 5: Hand holding cuboid

The Front View

To visualize the front, make as if you are holding the cuboid exactly at the level of your eyes, and you are looking in the direction of arrow F.

Which shape will you see?

……

Of which colour will it be?

……

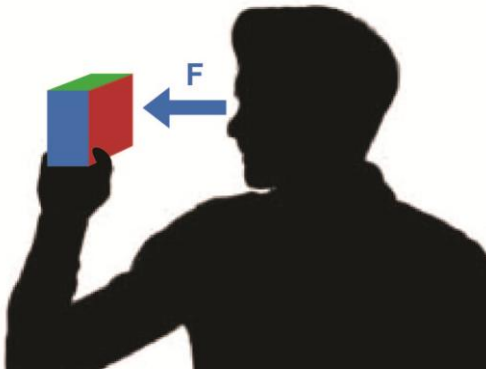


Figure 6: Holding cuboid at eye level to view front

Activity 1

Draw the front view in the square grid according to the size given in question.

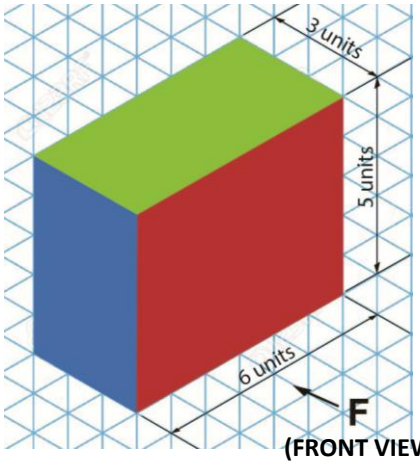
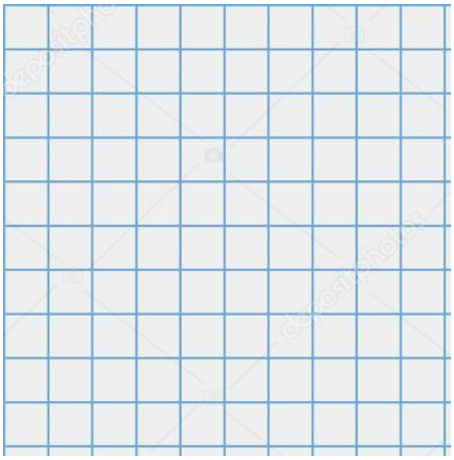


Figure 7: Cuboid with arrow F



The Top View

To visualize the top, make as if you are holding the cuboid exactly below your eyes, and you are looking in the direction of arrow T.

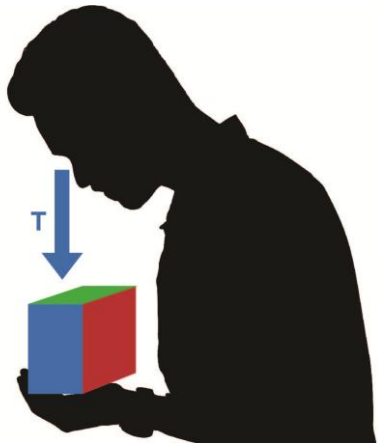


Figure 8: Holding cuboid below eyes to view top

Which shape will you see?

……

Of which colour will it be?

……

Activity 2

Draw the top view in the square grid according to the size given in question.

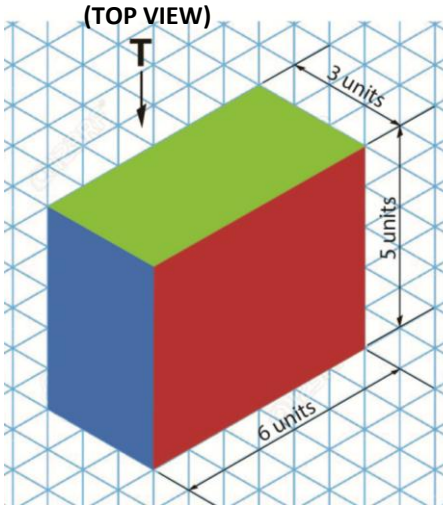
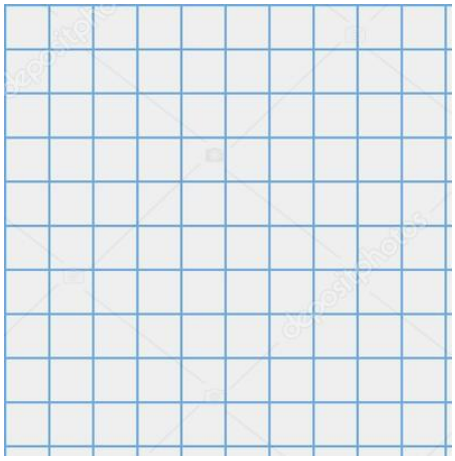


Figure 9: Cuboid with arrow T



The Side View

To visualize the side view, make as if you are holding the cube once again at the level of your eyes, and you are now looking at the side face in the direction of arrow S.

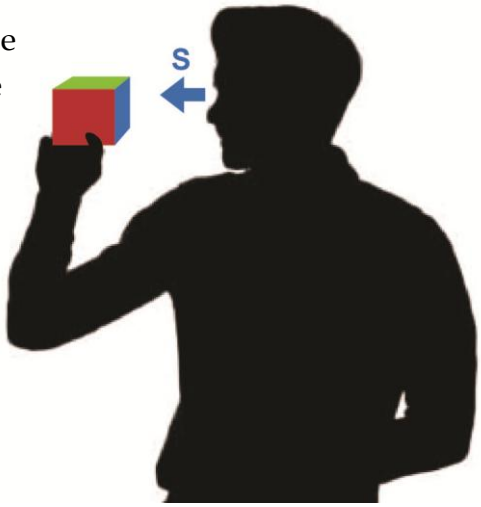


Figure 10: Holding cuboid at eye level to view side

Which shape will you see?

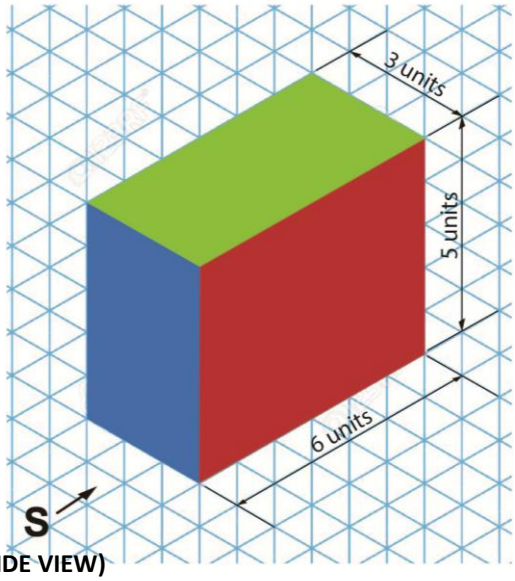
……

Of which colour will it be?

……

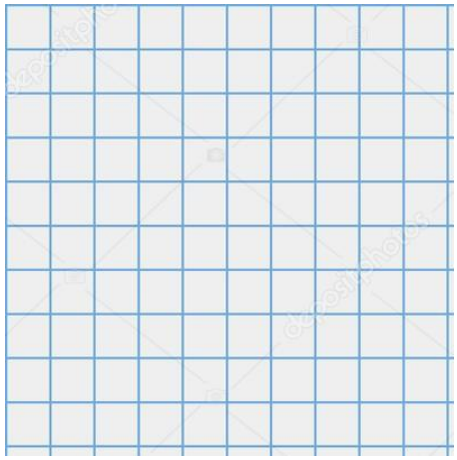
Activity 3

Draw the side view on the square grid below according to the size given in question.



(SIDE VIEW)

Figure 11: Cuboid with arrow S



Now, let us draw all the three views of the cuboid together in order to get a complete orthographic drawing.

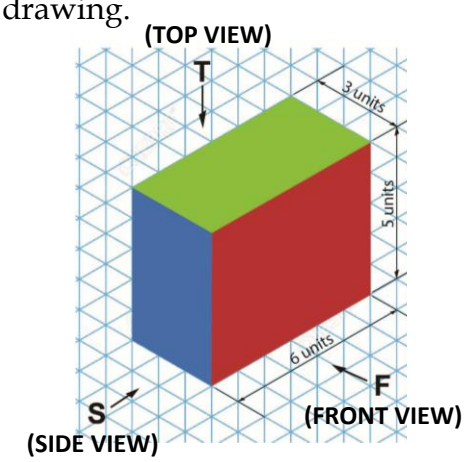
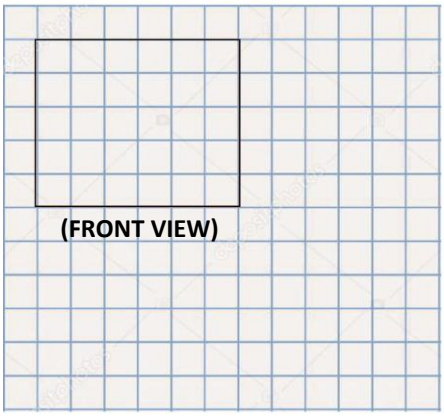


Figure 12: Isometric projection of cuboid

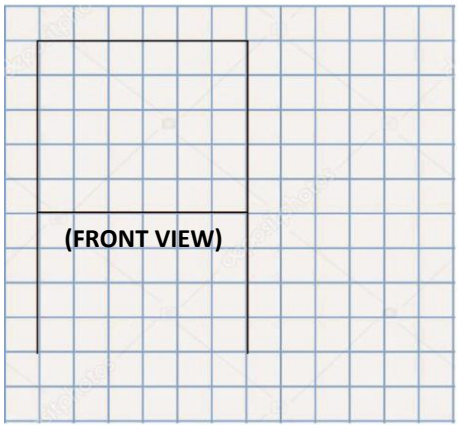
You have to draw:

i. the FRONT view, looking in the direction of arrow F,
ii. the TOP view, looking in the direction of arrow T,
iii. the SIDE view, looking in the direction of arrow S.

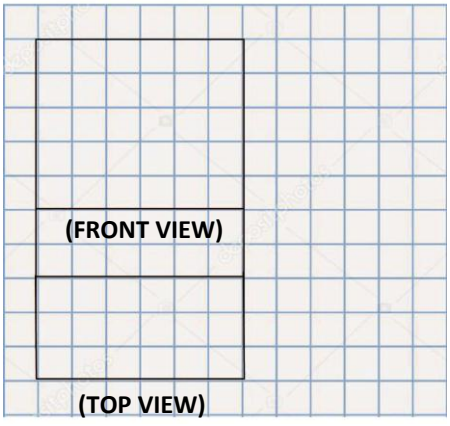
Step 1: Draw the front view on square grid paper.



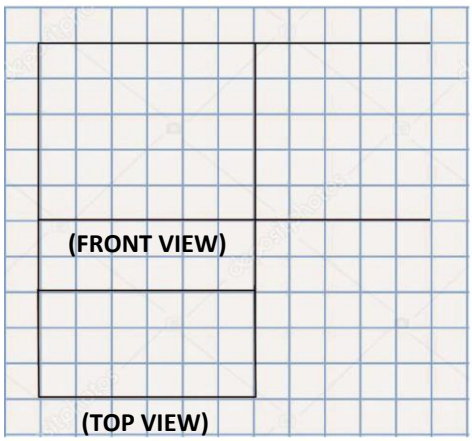
Step 2: Project two lines below the front view using thin lines.



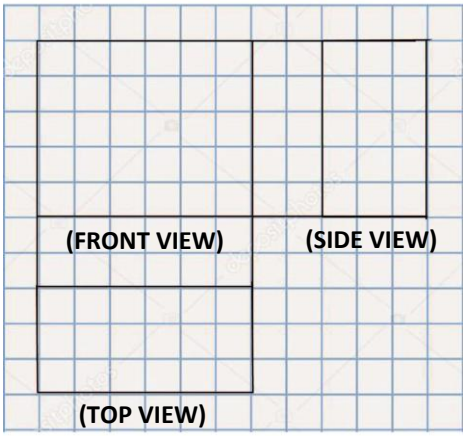
Step 3: Draw the top view exactly below the front, between the lines. Leave 2 units between the views.



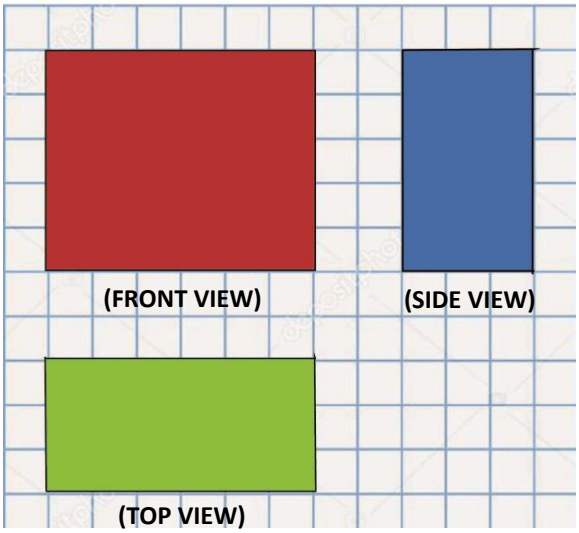
Step 4: Project two thin lines to the right of the front view.



Step 5: Draw the side view exactly between the two projection lines, 2 squares to the right of the front view.



The orthographic views would appear like this on your square grid with colours.

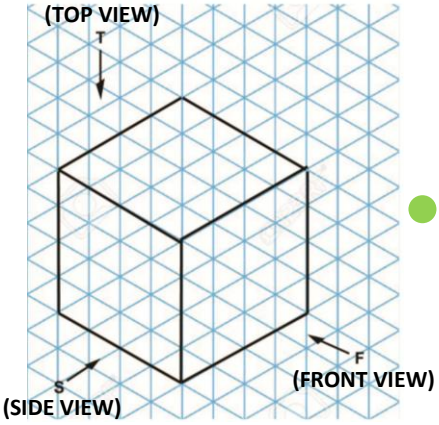
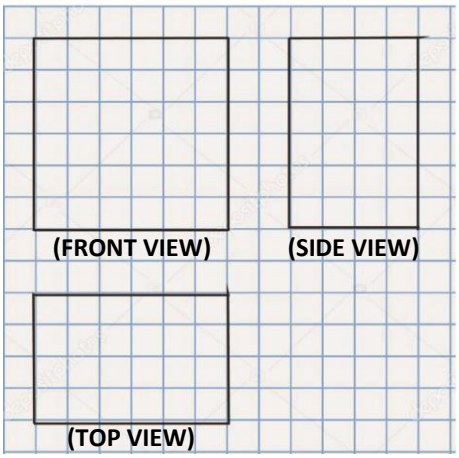
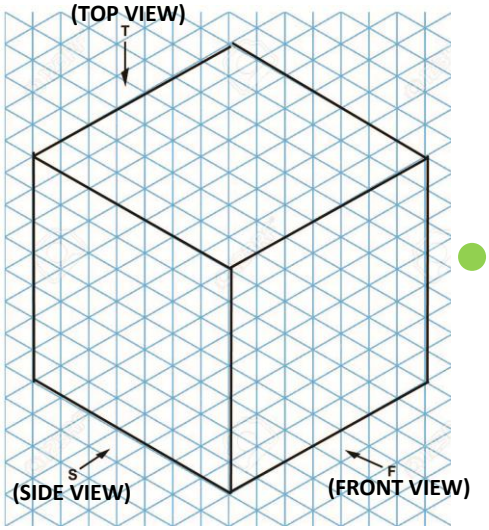
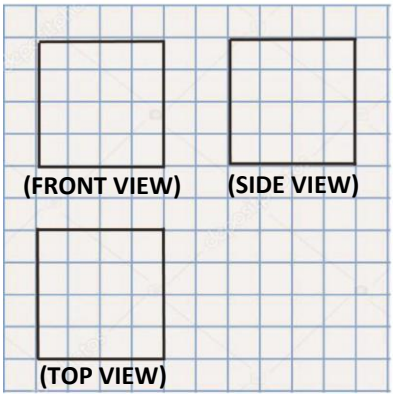
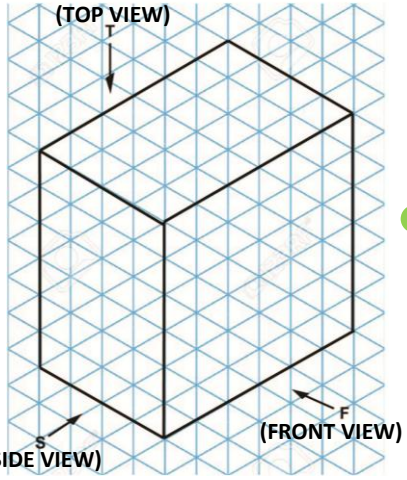
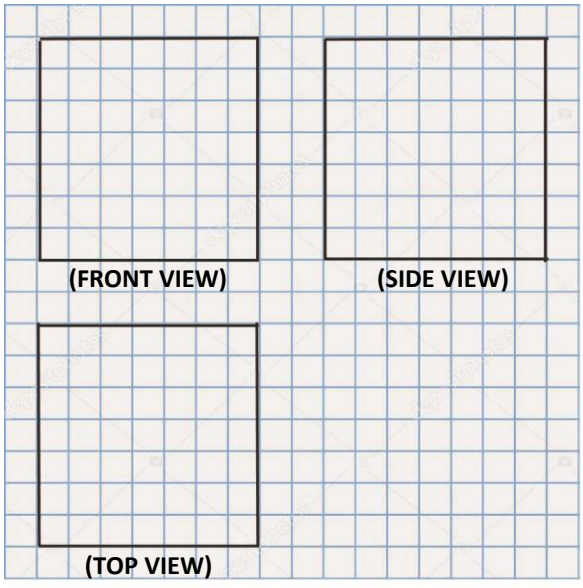


Activity 4

In the space given, draw the front, top and side view. Make sure that the views are to the correct size.

Activity 5

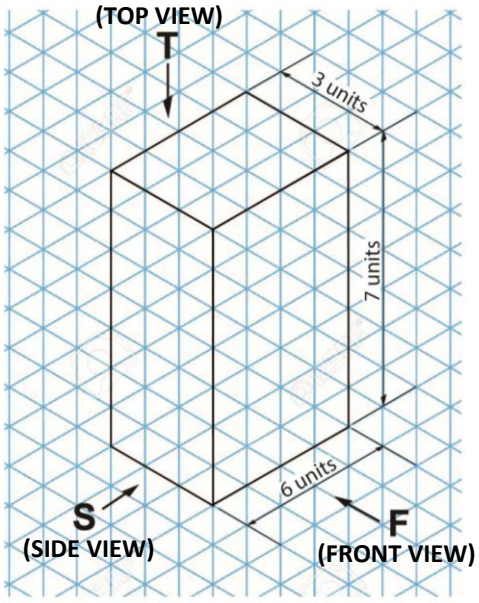
Match the cubes/cuboids with their corresponding orthographic views.

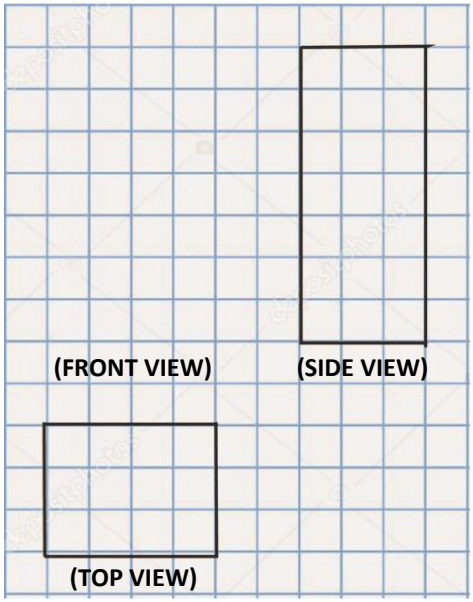
CUBES/CUBOIDS	ORTHOGRAPHIC VIEWS
1. 	
2. 	
3. 	

Activity 6

Some cuboids are given to you. Complete the missing orthographic views.

1.





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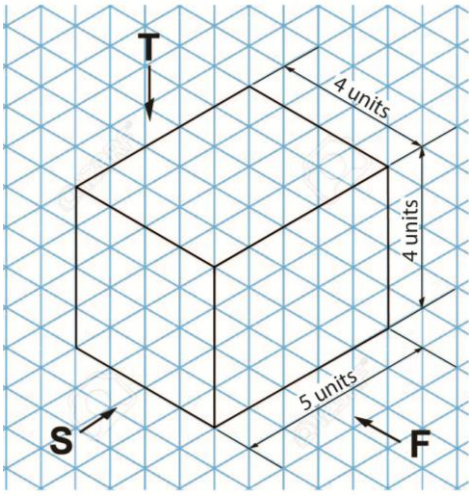

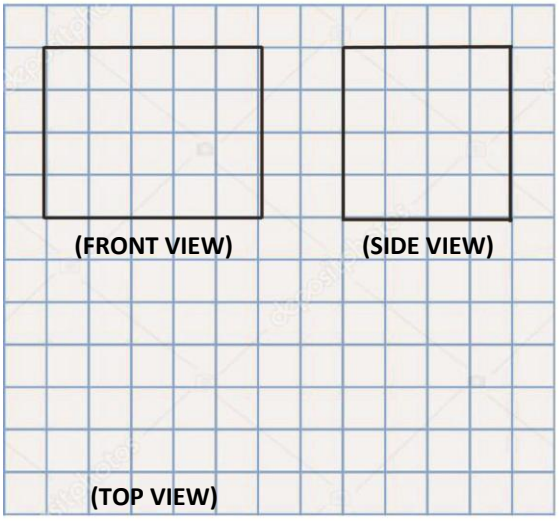

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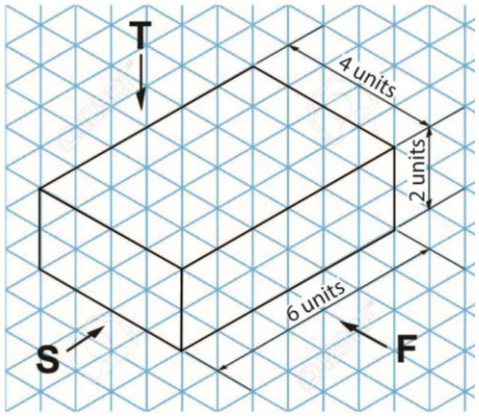

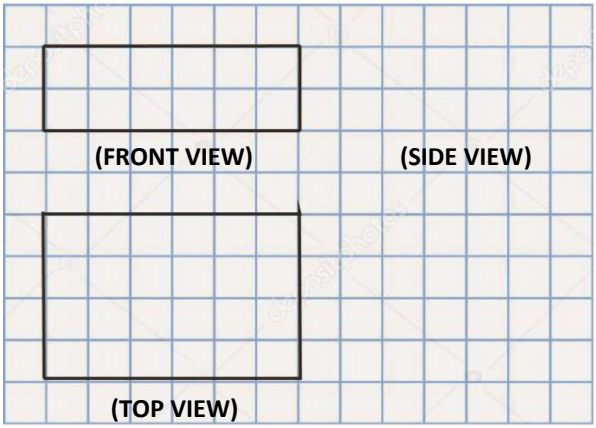

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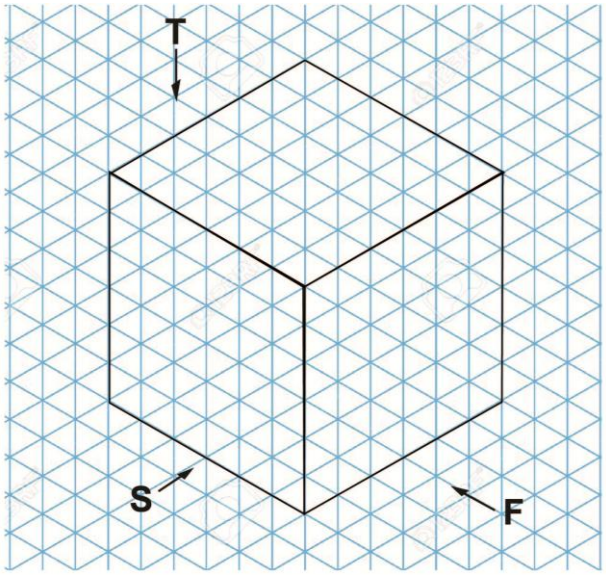

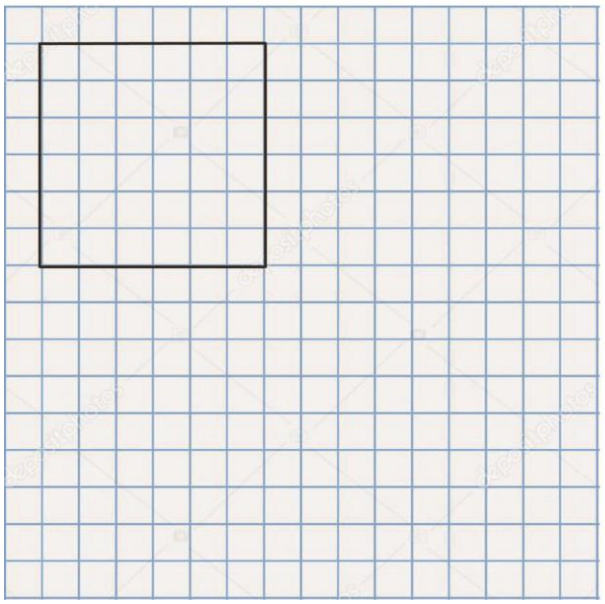

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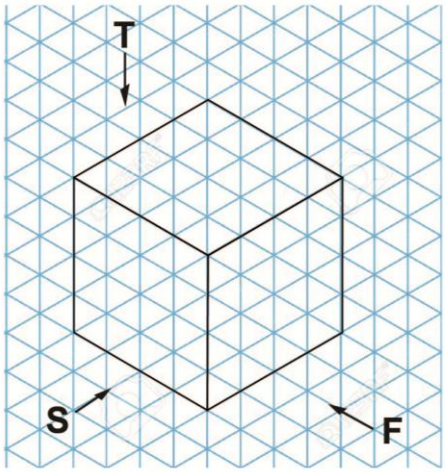

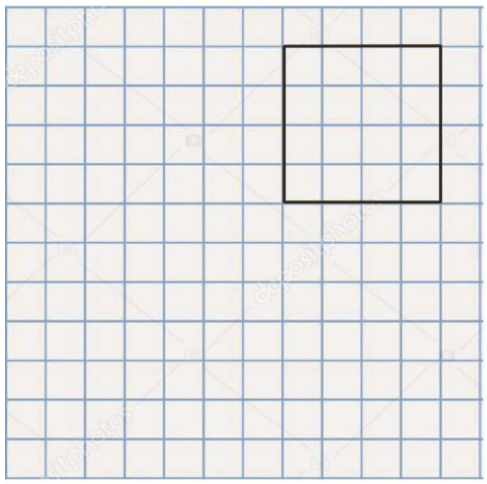

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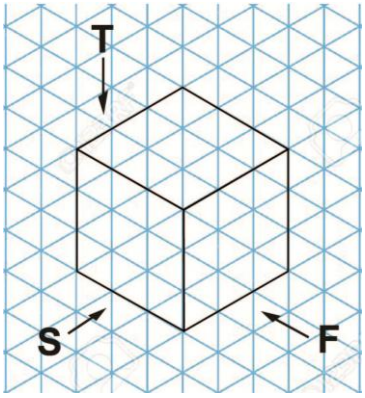
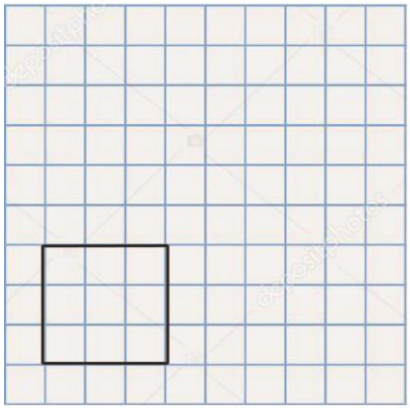
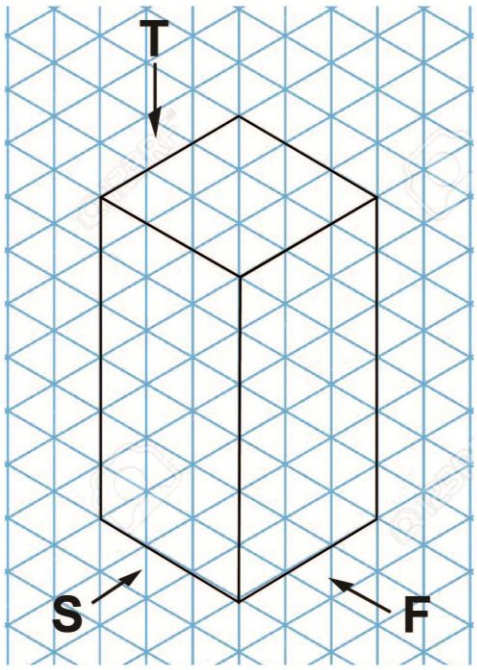


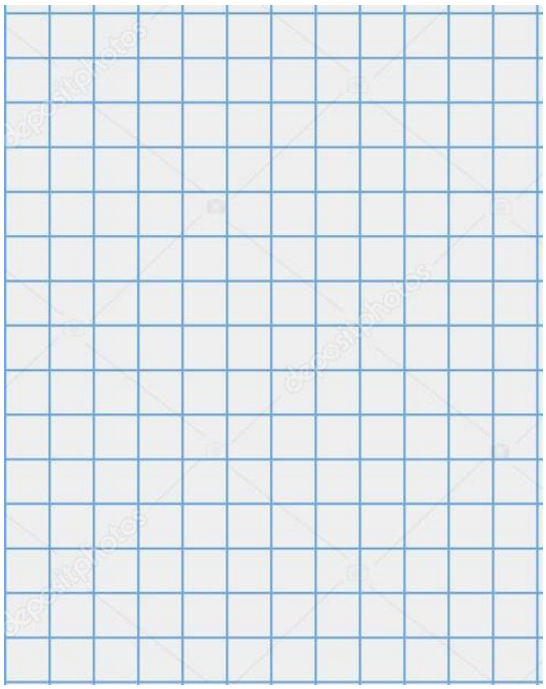


Activity 7

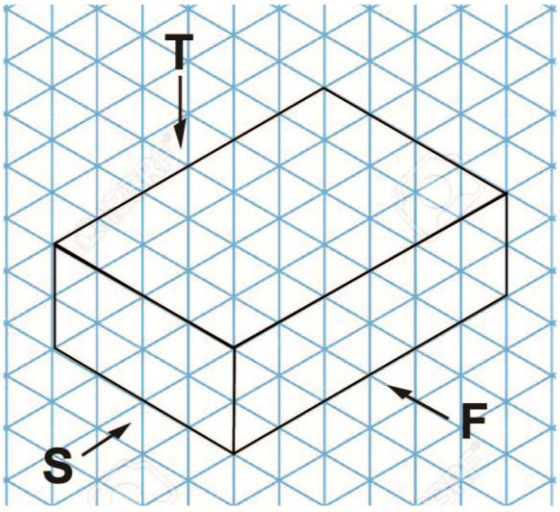
Now, try to draw all the three orthographic views by yourself.

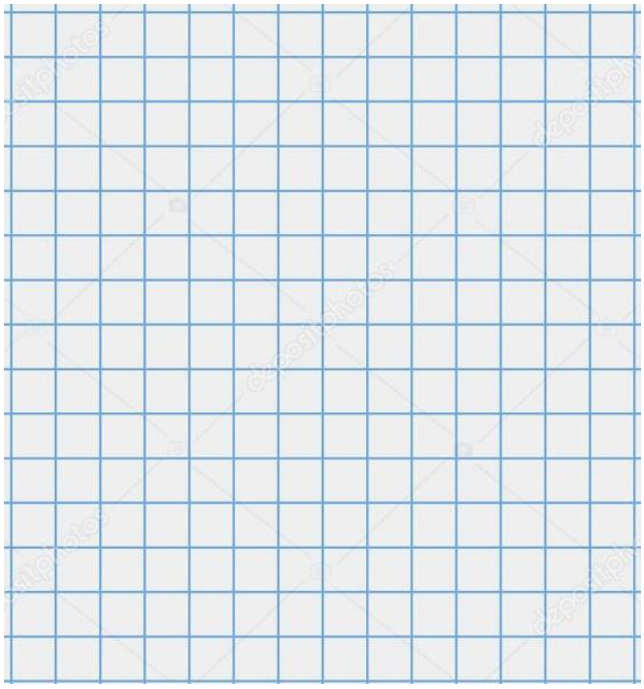
1.





2.





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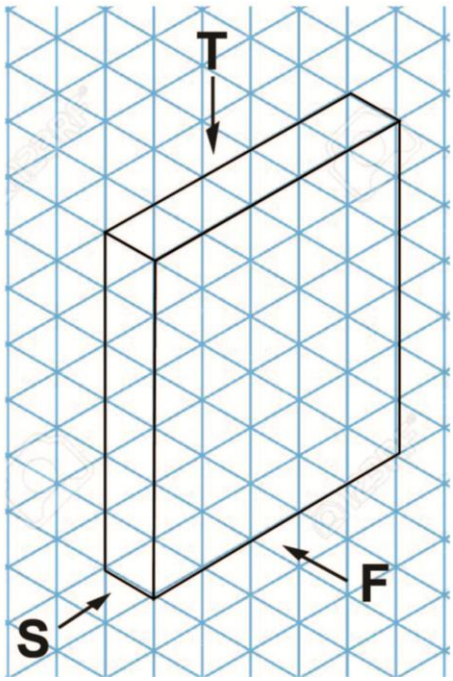

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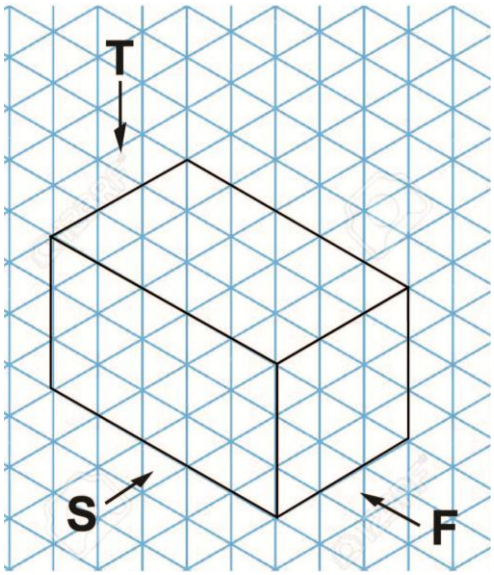

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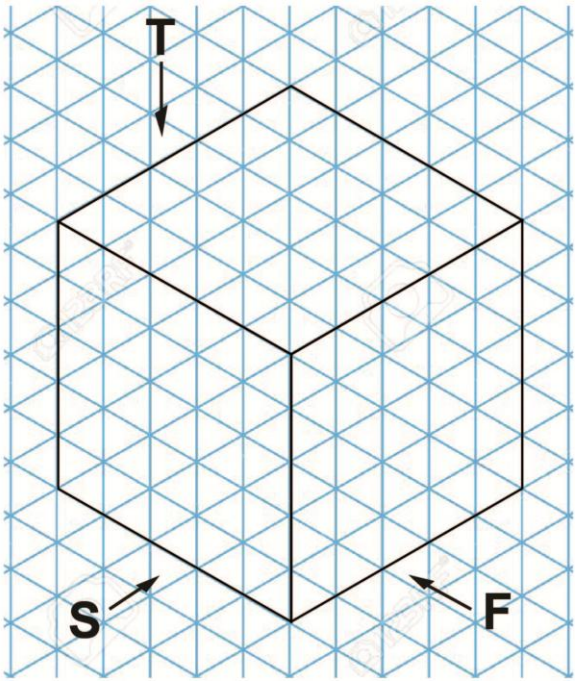

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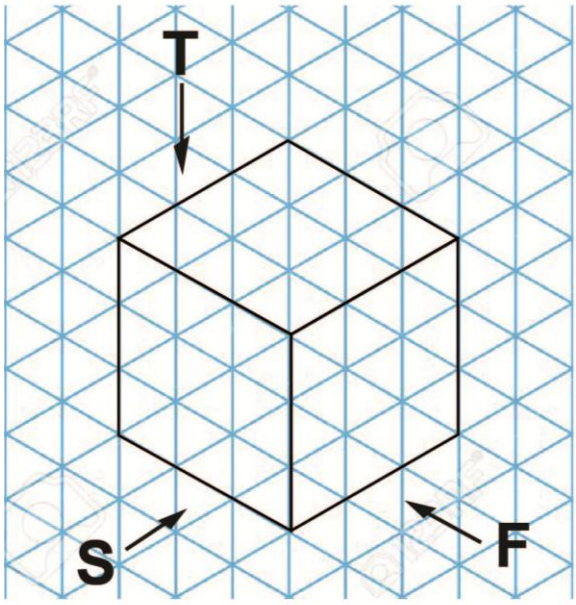


Drawing shaped blocks in orthographic projection

Now, let us try to draw the orthographic projection of shaped blocks. We are going to consider the shaped block shown in Fig. 13 and draw its front, top and side view.

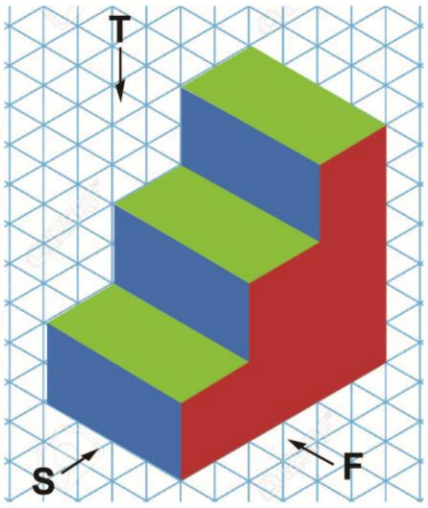
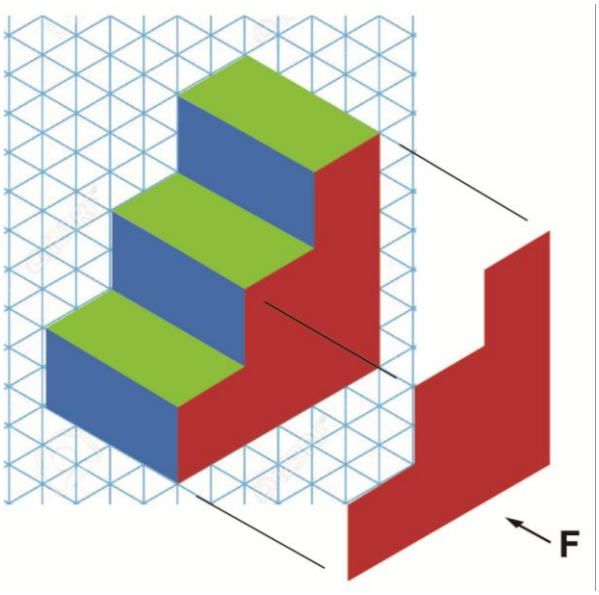


Figure 13: Isometric projection of shaped block

Step 1: Using the same visualizing principles explained earlier, you will look at the object in the direction of arrow F to identify the front view. You will see the red coloured surface only.

Activity 8

Draw the front view on the square grid.



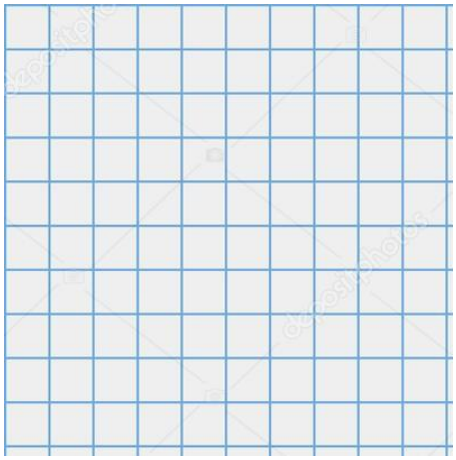
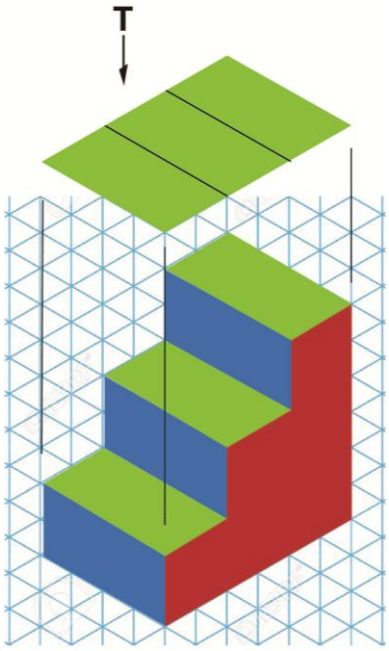


Figure 14: Front face projected out of shaped block

Step 2: After drawing the front view, you will look at the object in the direction of arrow T to visualise the top view. You will see the green coloured surfaces only.

Activity 9

Draw the top view on the square grid.



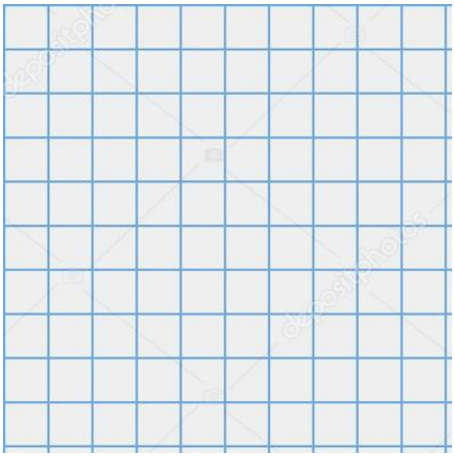
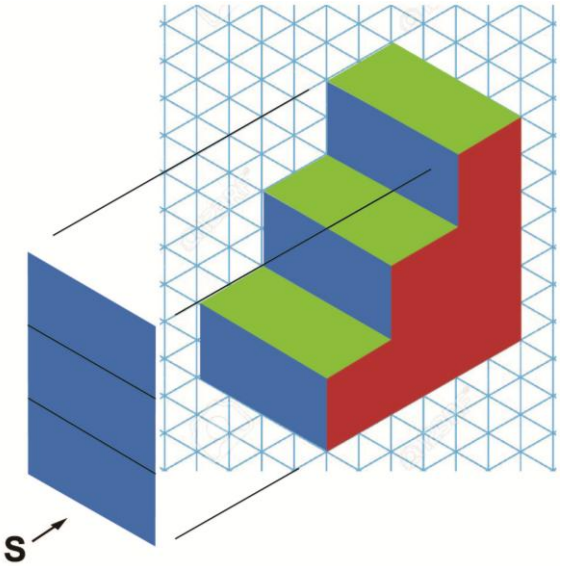


Figure 15: Top face projected out of shaped block

Step 3: Now, you will look in the direction of arrow S to visualise the side view. You will see the blue coloured surfaces only.

Activity 10

Draw the side view on the square grid.



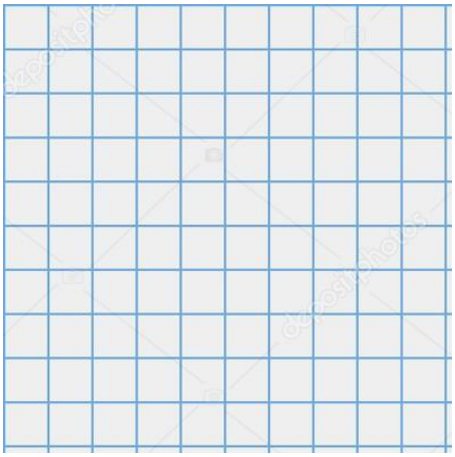
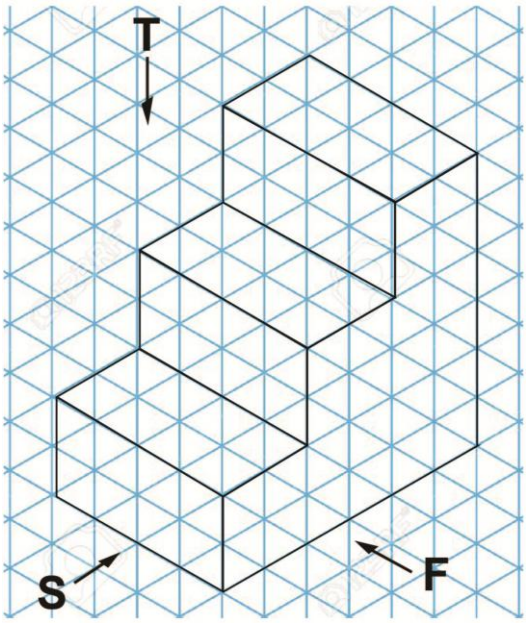
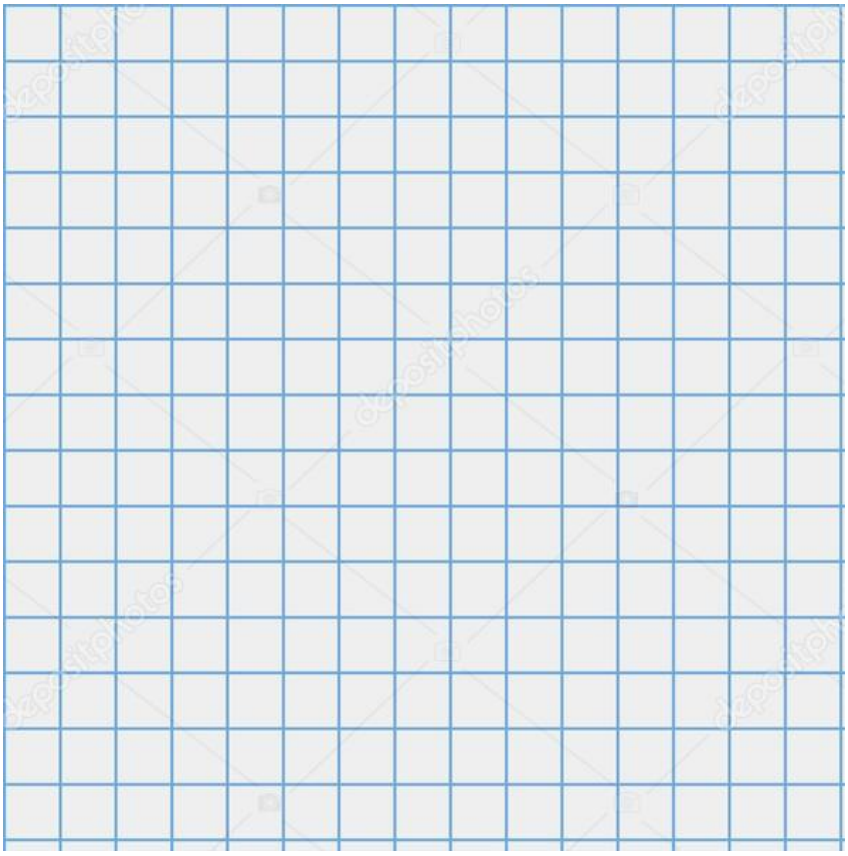


Figure 16: Side face projected out of shaped block

Step 4: Now, draw all the three orthographic views together on the square grid given.

Activity 11



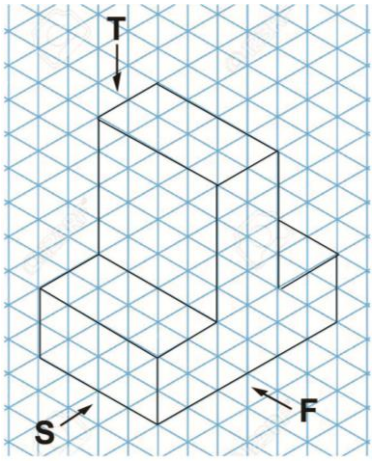
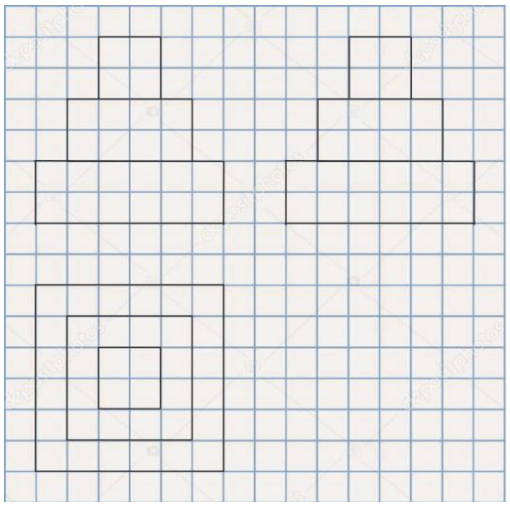
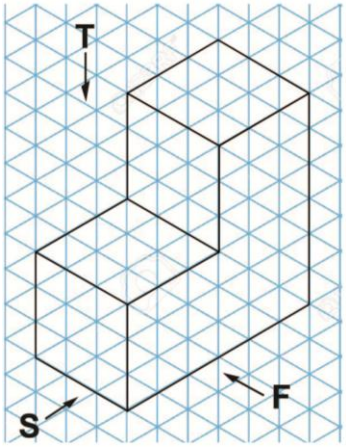
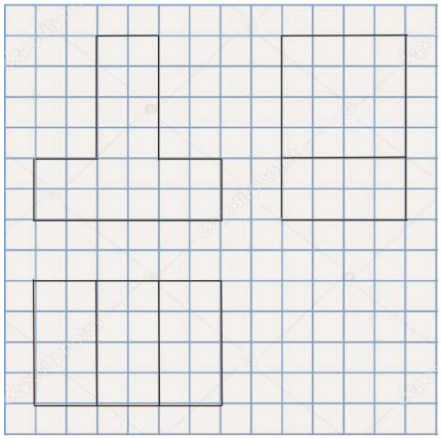
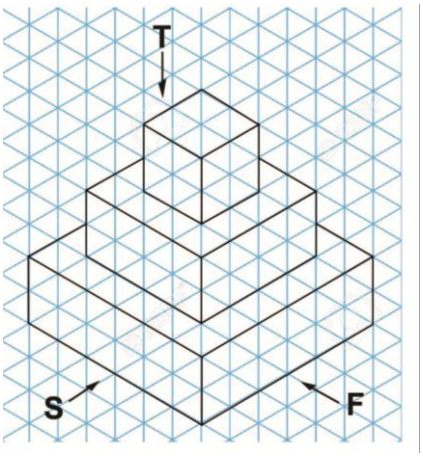
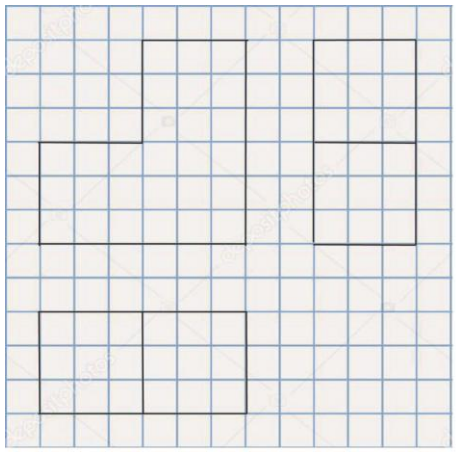


NOTE:

The front view should be drawn first, then the top view exactly below it, and the side view exactly to its right.

Activity 12

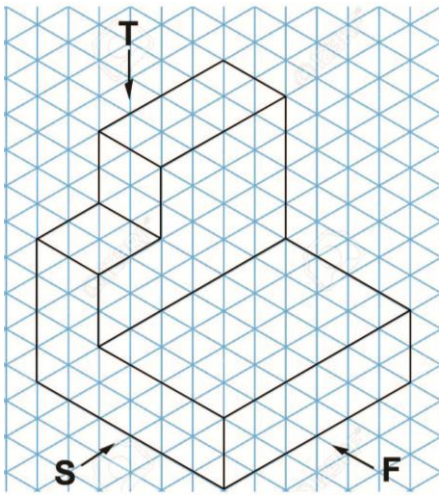
Match the shaped blocks with their corresponding orthographic views.

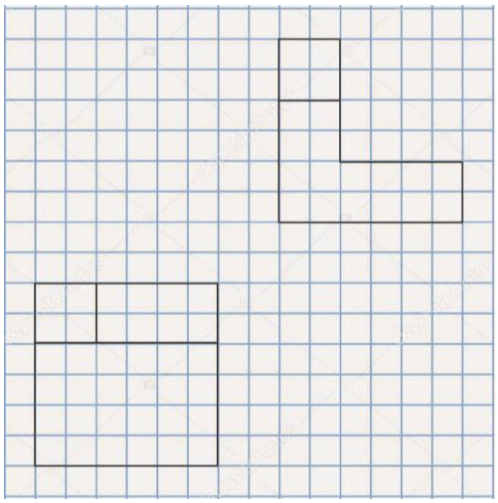
SHAPED BLOCKS	ORTHOGRAPHIC VIEWS
1. 	
2. 	
3. 	

Activity 13

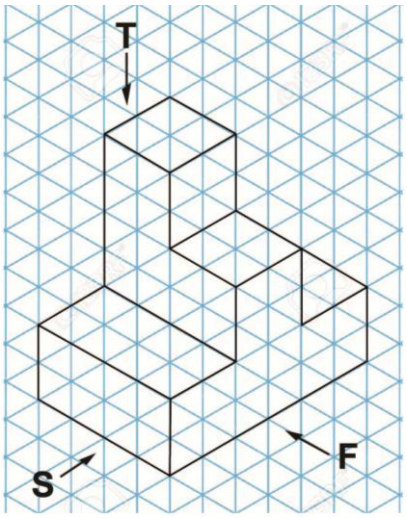
Some shaped blocks are given to you. Complete the missing orthographic views.

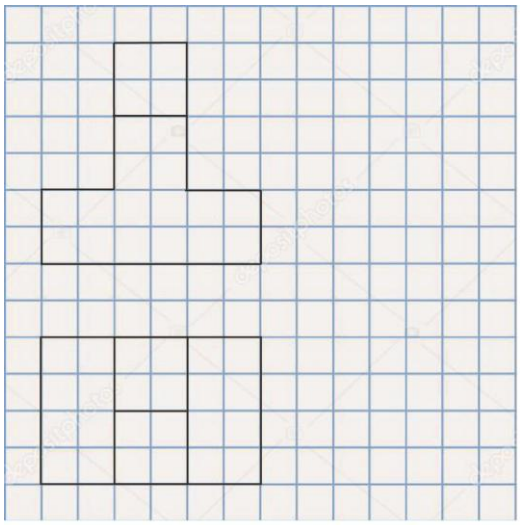
1.



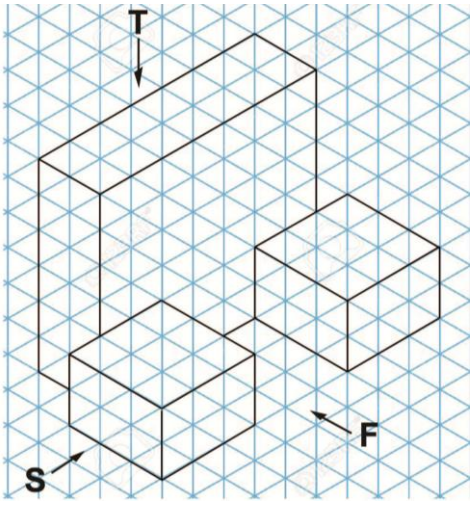


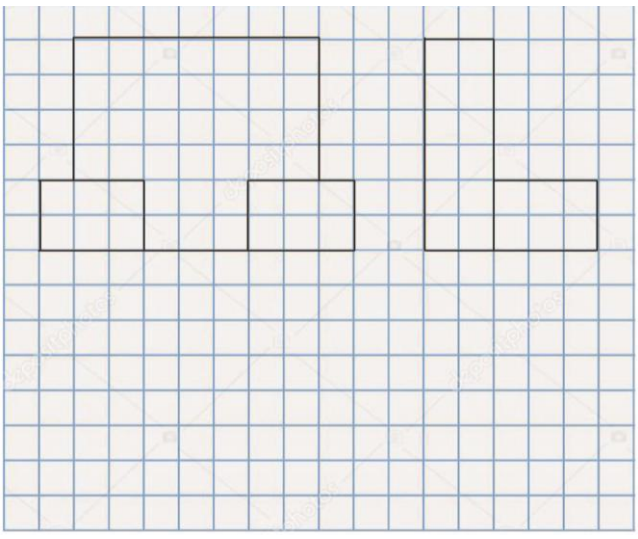
2.



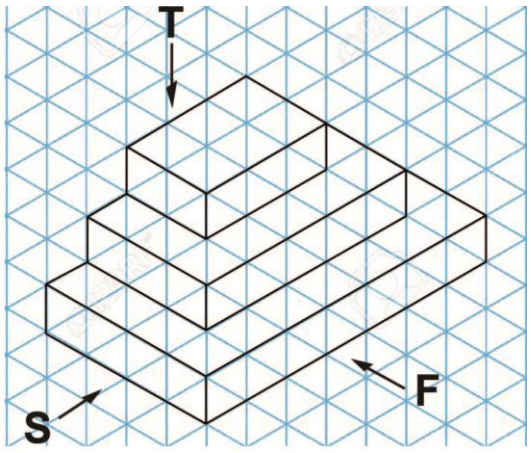


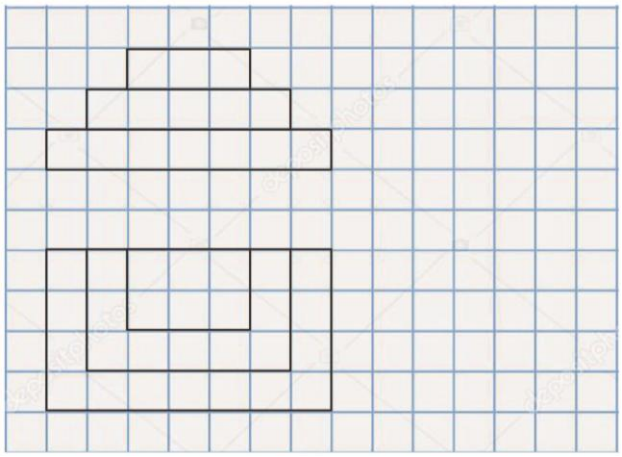
3.



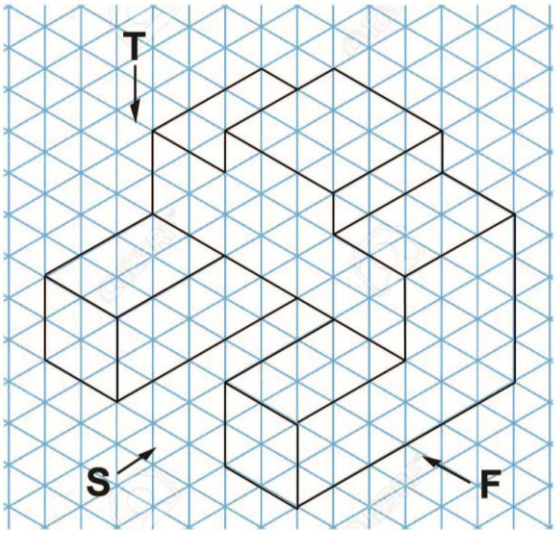


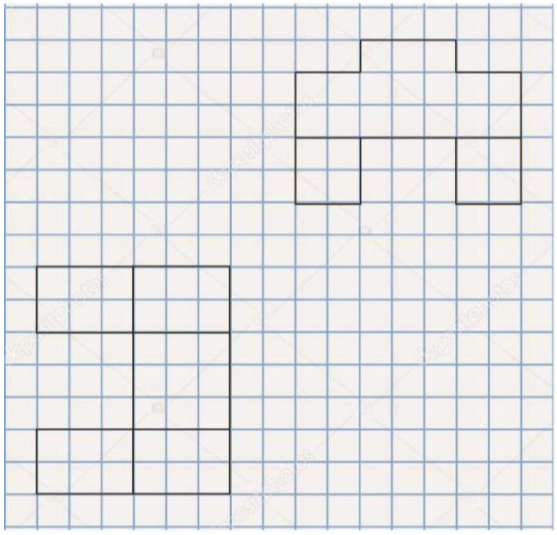
4.



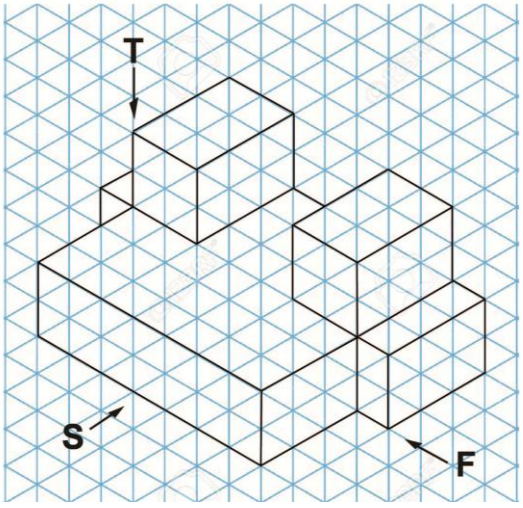


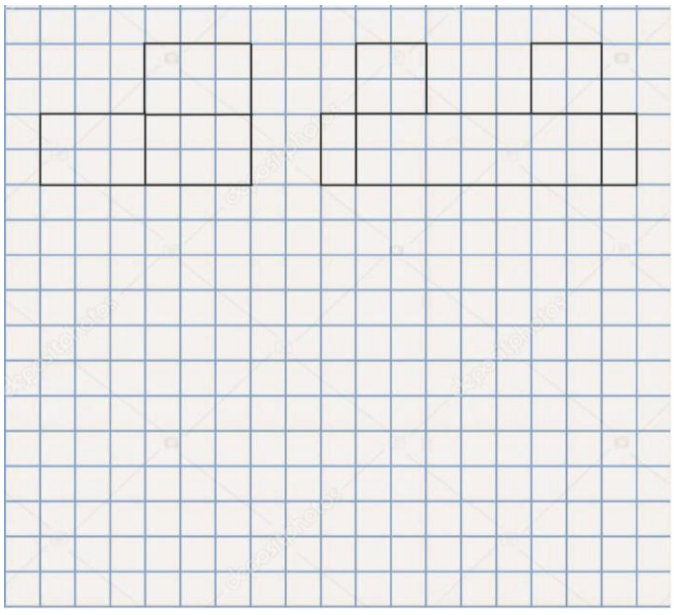
5.





6.

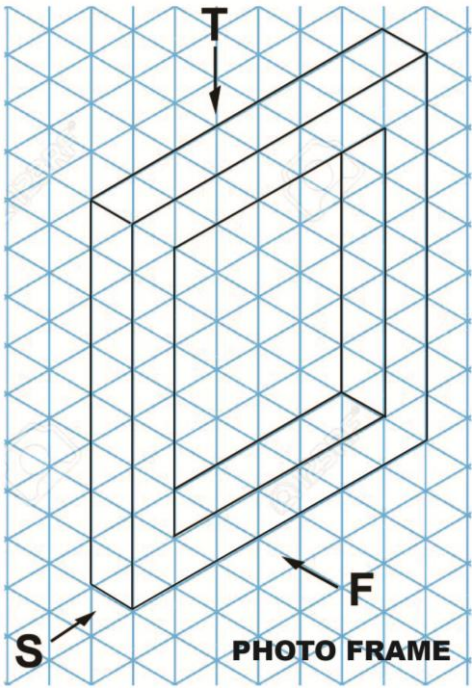




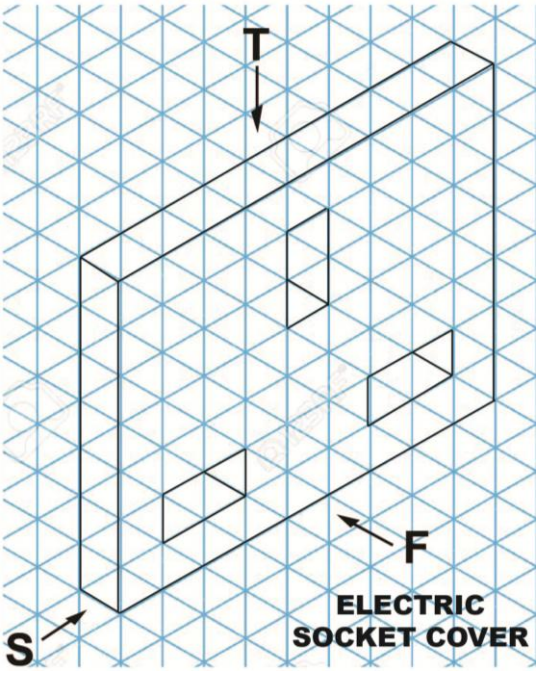
Activity 14

Draw all the three orthographic views of each of the blocks.

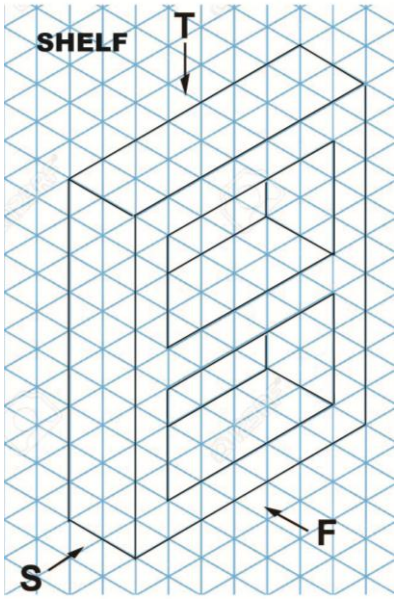
1.



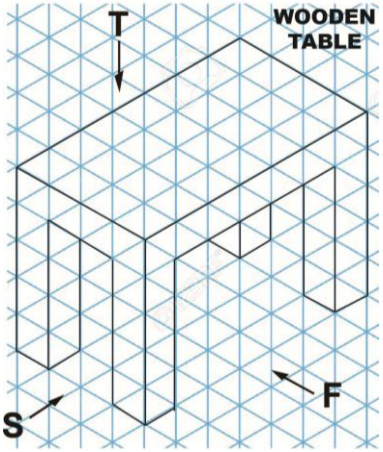
2.



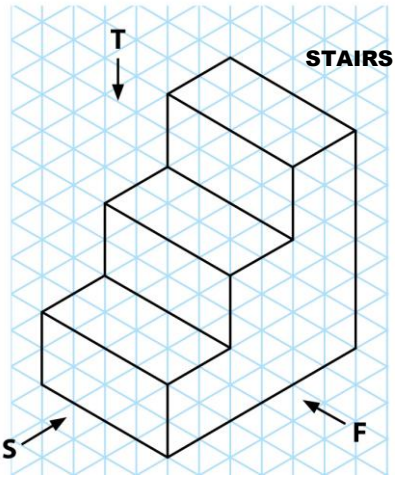
3.



4.



5.



How to tackle an orthographic projection question on A3 plain paper

Now, you will learn how to draw the front, top and side view of objects by **applying the same drawing principles learnt earlier**. However, **you will draw them on plain A3 paper**. An example of such type of drawing is shown to you.

Worked example

The outline of a toy staircase is shown to you. You are required **to draw the font, top and side view of the object on a plain A3 paper.**

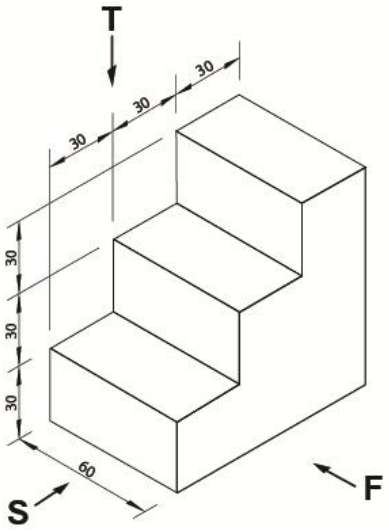
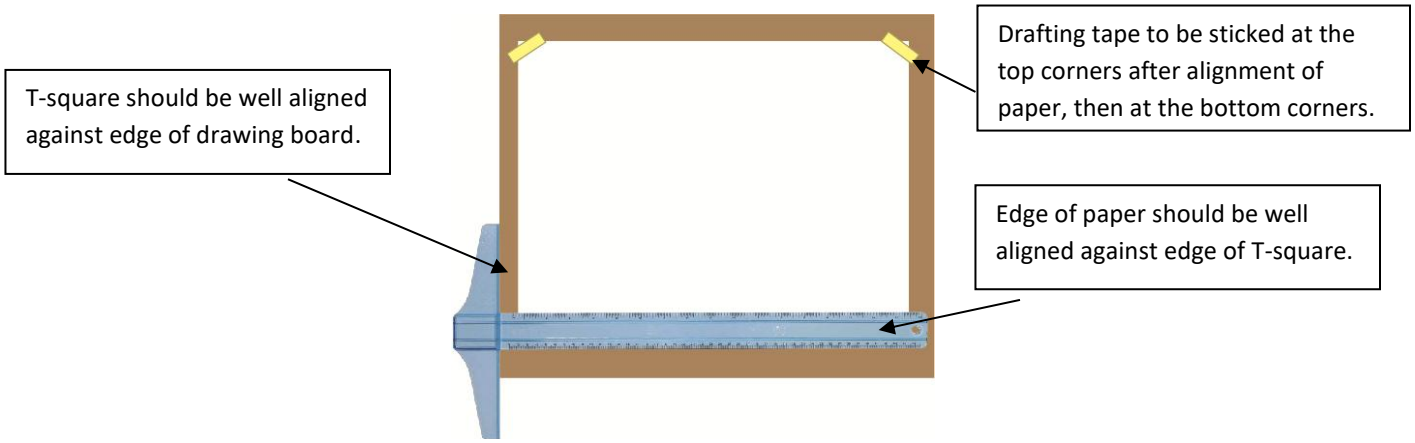


Figure 17: Outline of toy staircase

NOTE: You will notice that the same shaped block practiced earlier on square grid has been used here. This will enable you to better identify the differences in drawing methodologies for this year.

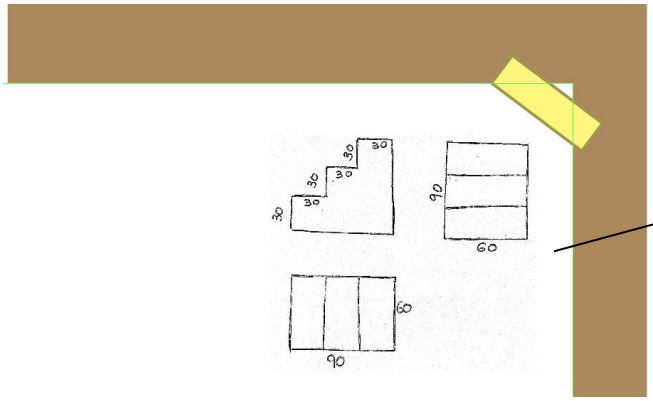
Step 1

Fix your A3 plain paper on the drawing board.

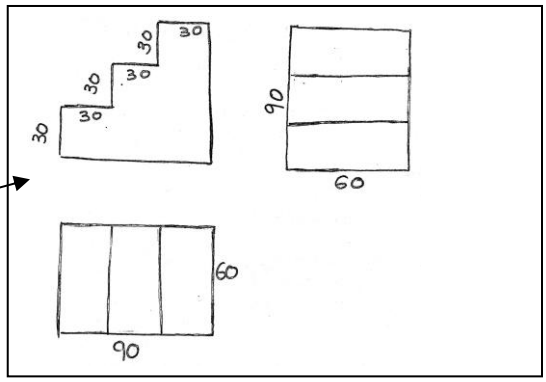


Step 2

On the right corner of the A3 paper, make a sketch of the orthographic views that you will draw. Include overall dimensions also. This will greatly help in planning the layout of your drawing better.



Sketch drawn on the top right corner of fixed page

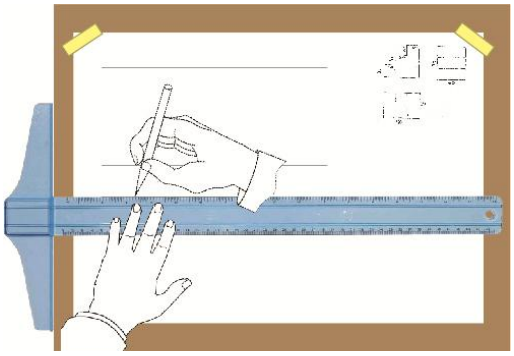


Bigger picture of sketch

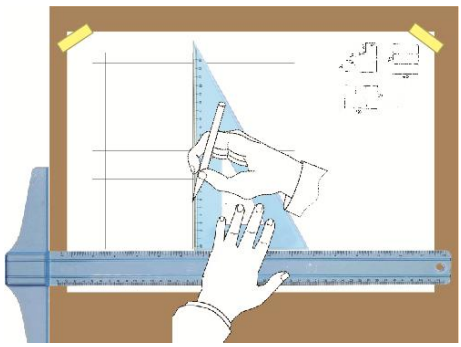
Step 3

Then, draw the crate for the front, the top and the side view. Use the mitre line method to project lines from top view to side view.

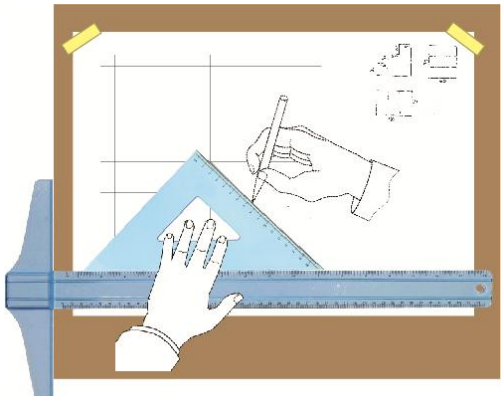
NOTE: Leave 20 mm space between crates. All lines should be construction lines at this stage.



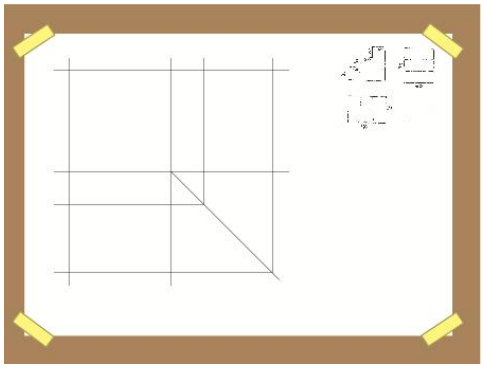
Use your T-square as shown to draw horizontal lines.



Use your 90° set square to draw vertical lines.



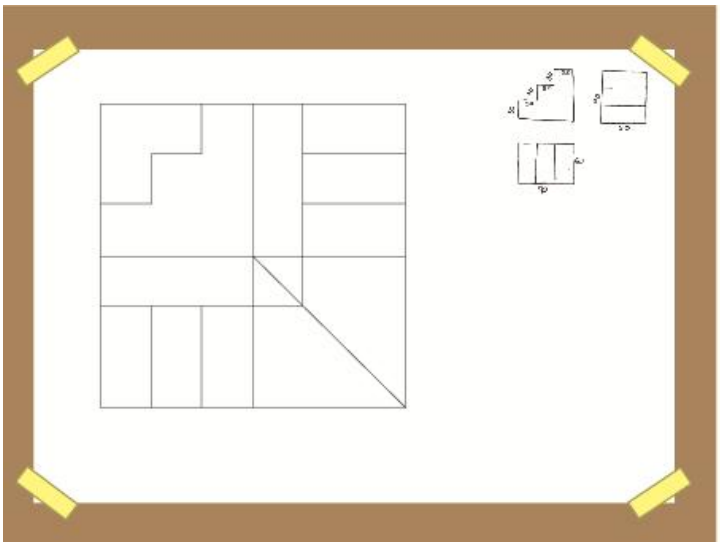
Use your 45° set-square to draw mitre line to the bottom right of the front view.



Crate for the front, top and side view drawn along with mitre line.

Step 4

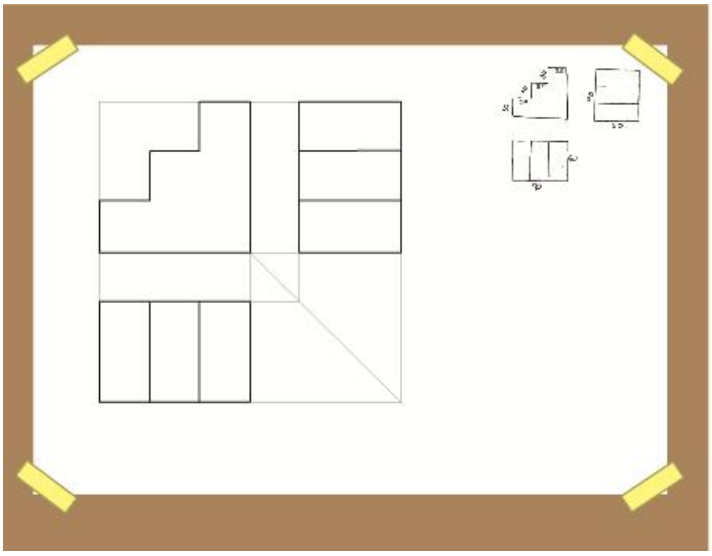
Add remaining lines in each crate by applying the same drawing techniques and equipment as in the previous step.



Remaining lines added to the respective crates.

Step 5

Apply dark outlines on relevant lines to complete the orthographic projection.

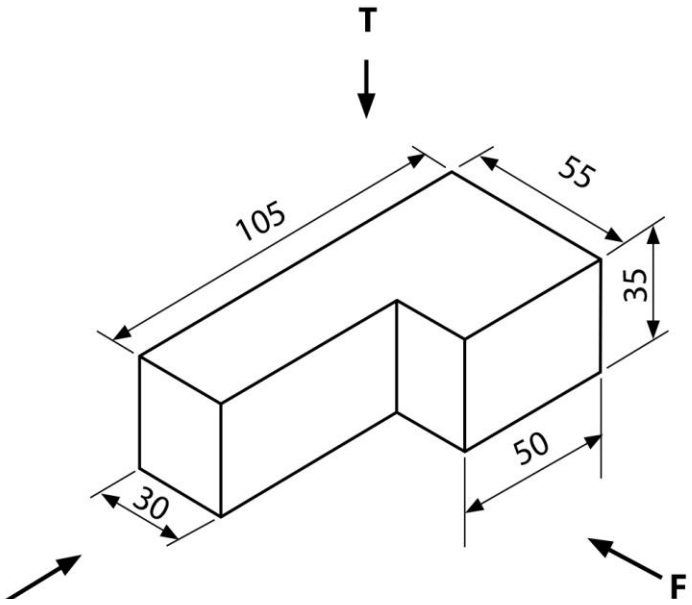


Dark outlines applied on relevant lines to complete drawing.

Activity 15

Draw the orthographic projection of the following objects.

i.



L shaped block