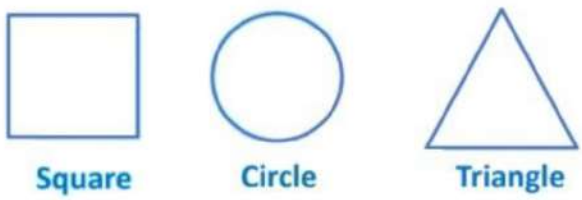
Chapter 10

Visualising Solid Shapes

Introduction to Solid Shapes

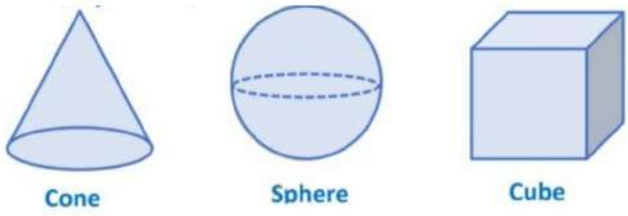
Plane Figures

They have two dimensions like length and breadth. They are also called a Two-dimensional figure(2-D). Examples: Square, Triangle, Rectangle, Circle, etc.



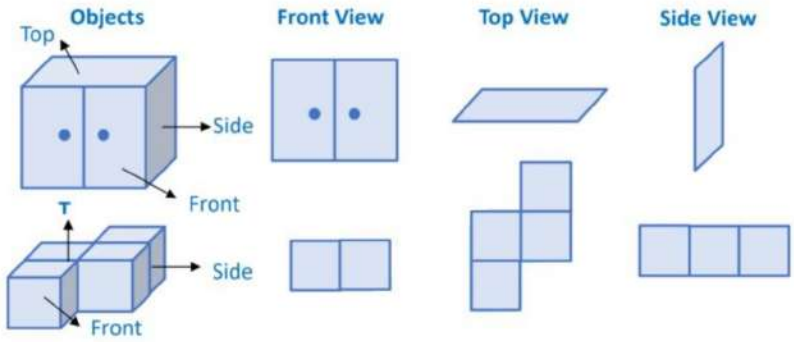
Solid Figures

They have three dimensions like length, breadth and height or depth. They are also called Three dimensional Figures(3-D). Examples: Cone, Spheres, Cubes, Cylinders, etc.

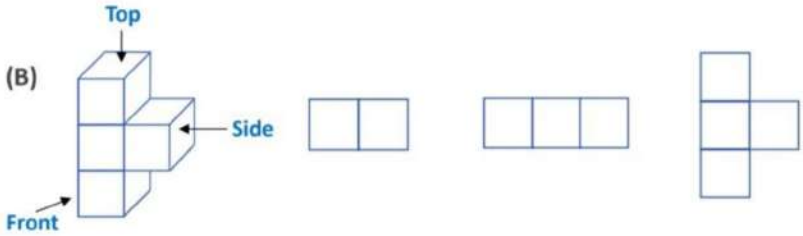


Views of 3 – D Shapes

A 3-dimensional object can look different from different positions and can be viewed from a different perspective.



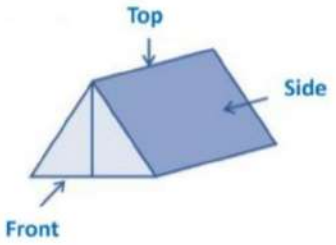
For each of the given solid, the three views are given. Identify for each solid the corresponding top, front and side views. (REFERENCE: NCERT)



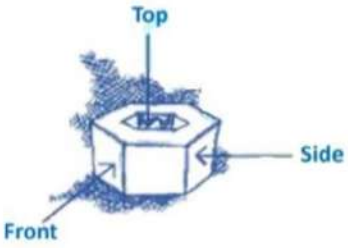
Draw the front view, side view and top view of the given objects. (REFERENCE: NCERT)

a) A military tent b) A weighing stone c) A die

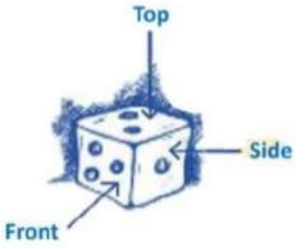
(a)



(b)



(c)

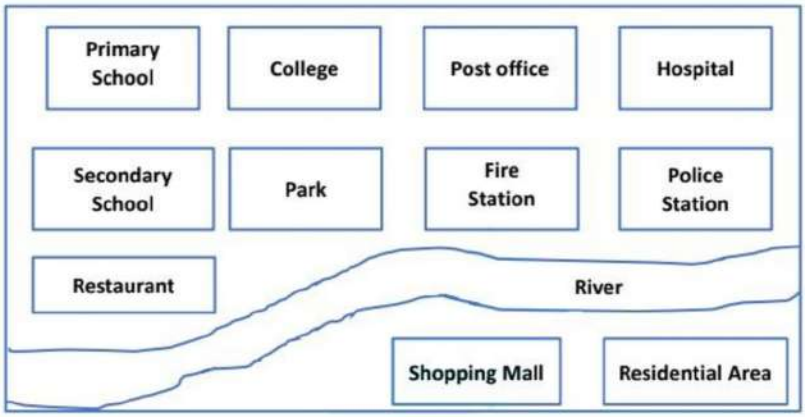


Mapping Space Around Us

Map

A map shows the relation between a particular object/place with other objects/places. Symbols are used to show different objects or places. In a map, an object which is closer to the observer is of the same size as that which is far away. Maps use a scale. For example, we can take 1cm = 1000km. his is done to reduce the real distance. The map of the house remains the same irrespective of the position of the observer. In other words, perspective is very important for drawing a picture but it is not relevant for a map.

How do we read maps? What can we conclude and understand while reading a map? What information does a map have and what it does not have? Is it any different from a picture? In this section, we will try to find answers to some of these questions. Look at the map given below and try to answer the question given along with it.
(REFERENCE: NCERT)



Answer the following question:

i) Which is farther east, hospital or post office from primary school?
Sol.
It can easily be identified that if we see from the primary school post office is comparatively nearer to the primary school than the hospital in the east direction.

So our answer will be the hospital.

ii) Which is farther south, Police Station or Residential area from the hospital?

Sol.
It can easily be identified that if we see from the hospital, the police station is comparatively nearer to the hospital than the residential area in the south direction.

So our answer will be the residential area.

Faces, Edges and Vertices

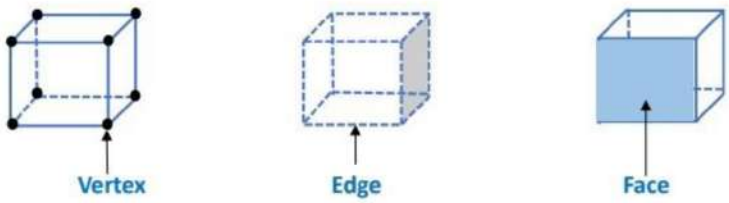
Polyhedra

Faces

The flat surfaces of any solid called faces.

Edges
Line segments common to intersecting faces of a polyhedron are known as its edges. Line segments that form the solid are called edges.

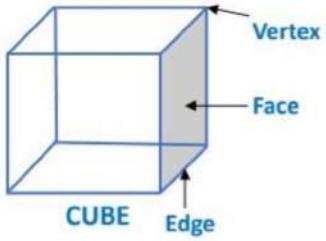
Vertices



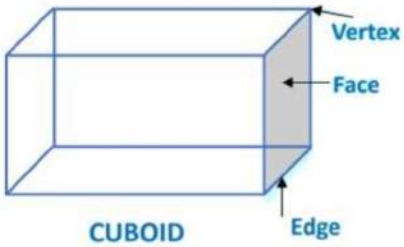
Points of intersection of edges of a polyhedron are known as its vertices. Corners of the solid are its vertices.

Each of these solids is made up of polygonal regions which are called its faces. These faces meet at edges which are line segments and the edges meet at vertices which

are points. Such solids are called as polyhedrons.



F = Number of Faces = 6
E = Number of Edges = 12
V = Number of Vertices = 8
Clearly, F + V = E + 2



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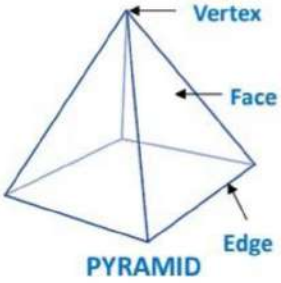
E = Number of Edges = 12
V = Number of Vertices = 8
Clearly, F + V = E + 2



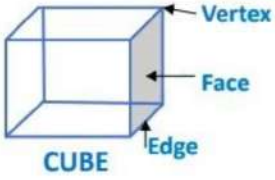
F = Number of Faces = 5
E = Number of Edges = 8
V = Number of Vertices = 5
Clearly, F + V = E + 2

Shapes			
Faces(F)	6	5	10
Edges(E)	12	8	16
Vertices(V)	8	5	9

Polyhedron

Polyhedrons

A polyhedron is a solid shape that is bounded by polygons which are called its faces, these faces meet ar edges which are line segments and the three edges meet at vertices which are points.



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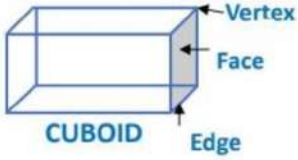
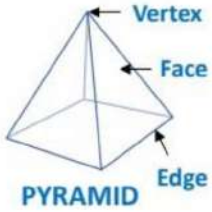
E = Number of Edges = 12
V = Number of Vertices = 8
Clearly, F + V = E + 2



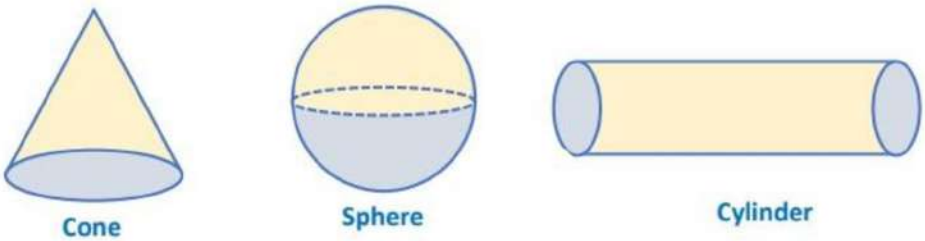
F = Number of Faces = 6
E = Number of Edges = 12
V = Number of Vertices = 8
Clearly, F + V = E + 2



F = Number of Faces = 5
E = Number of Edges = 8
V = Number of Vertices = 5
Clearly, F + V = E + 2

Spheres, Cones, and Cylinders are a few examples of non-polyhedrons.

These are non-polyhedrons as they do not have polygon-shaped faces.



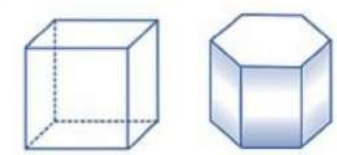
Types of Polyhedron

a) Convex Polyhedron

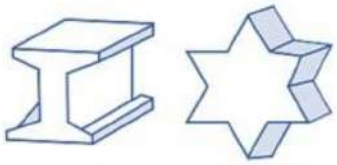
b) Regular Polyhedron

c) Irregular Polyhedron

Convex Polyhedron
The segment connecting any two points lie in the interior of the polyhedron. Or A polyhedron is a convex polyhedron, is itself in the interior or lies inside the polyhedron.



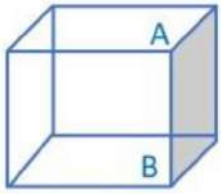
These are convex polyhedrons



These are not convex polyhedrons

Regular Polyhedron
A polyhedron is said to be regular if its faces are made up of regular polygons and the same number of faces meet at each vertex. Or A regular polyhedron is a convex polyhedron, whose faces are congruent

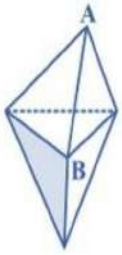
regular polygonal regions, such that the same number of faces meet at each vertex.



3 faces meet at A. Similarly, 3 faces meet at B. Therefore, it is a Regular Polyhedron

Irregular Polyhedron

These are those polyhedrons whose vertices are not formed by the same number of faces.



This polyhedron is irregular. All the sides are congruent; but the vertices are not formed by the same number of faces. 3 faces meet at A but 4 faces meet at B.

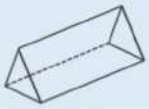
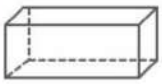
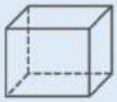
Polyhedrons are divided into two categories Prisms and Pyramids.

Prisms

A prism is a polyhedron whose base and top are congruent polygons and whose other faces, i.e., lateral faces are parallelograms in shape.

A solid whose base and top are identical polygons and the faces (lateral faces) are parallelograms or rectangles, is known as a prism.

Some examples of prisms with their respective figures, faces, edges, and vertices are given.

Shapes	Figure	Faces	Edges	Vertices
Triangular Prism		5	9	6
Cuboid (Rectangular Prism)		6	12	8
Square Prism (Cube)		6	12	8
Pentagonal Prism		7	15	10
Cylinder		3	2	-

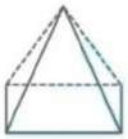
Pyramid

A pyramid is a polyhedron whose base is a polygon (of any number of sides) and whose lateral faces are triangles with a common vertex. (If you join all the corners of

a polygon to a point, not in its plane, you get a model for pyramid).

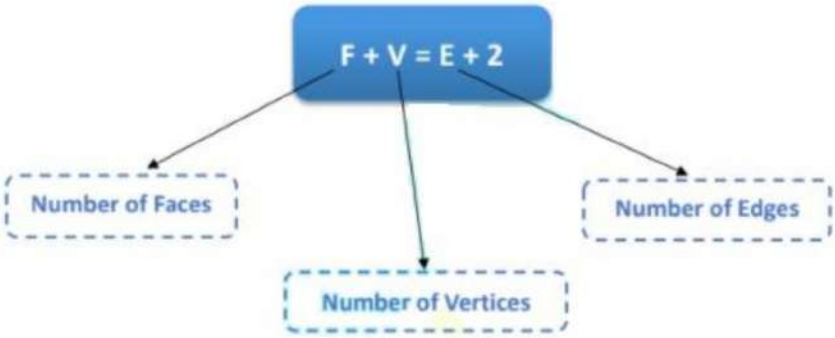
A pyramid is a polyhedron whose base is a polygon (of any number of sides) and whose other faces are triangles with a common vertex. The name of the pyramid is based on the base polygon.

Some examples of pyramids with their respective figures, faces, edges, and vertices are given in the following table:

Shapes	Figure	Faces	Edges	Vertices
Triangular Pyramid (Triangular base)		4	6	4
Rectangular Pyramid		5	8	5
Pentagonal Pyramid (Pentagonal base)		6	10	6
Square Pyramid (Square base)		5	8	5
Cone (Circular base)		2	1	1

Euler's Formula

It is a simple relationship between the number of Faces, the number of Edges and the number of Vertices of a polyhedron. This relationship is true for any polyhedron.



Name of polyhedron	F	E	V	F – E + V
Cuboid	6	12	8	2
Triangular Prism	5	9	6	2
Pentagonal Prism	7	15	10	2
Pyramid on a Quadrilateral base	5	8	5	2
Hexagonal Pyramid	7	12	7	2