# CHAPTER - 14 UNDERSTANDING 3D AND 2D SHAPES

## 14.1 INTRODUCTION

Pictures of some objects are given below.

Carefully study the shape of these objects. Classify them according to their shape in this table:

**Table - 14.1**

| **Shape** | **Object** |
|---|---|
| Like a match box | |
| Like a ball | |
| Like a wooden log | |
| Like a dice | |
| Like a cone | |

## 14.2 3D-SHAPES

We have learnt about triangles, squares, rectangles etc. in the previous classes. All these shapes spread in two directions only and thus called two-dimensional or 2D shapes.

All solid objects like above, have a length, breadth and height or depth. They are thus called three dimensional or 3D-shapes. Now, we will learn about various 3 dimensional or 3D shapes.

### 14.2.1 Cuboid

The shapes like a closed match box are examples of a cuboid. Touch your hand on the top of the match box. This plane surface is the face of match box. How many faces does a match box have?

The sides of the faces are the edges. How many edges does a match box have?

The corners of the edges are the vertices of the match box. How many vertices does a match box have?

Now take an eraser, whose shape is similar to that of a match box. Touch your hand along its faces, edges and vertices.

Does the eraser have the same number of faces, edges and vertices as that of match box? You will find this to be true.

Objects like match boxes, erasers etc. are in the shape of a cuboid and have 6 faces, 12 edges and 8 vertices.

### 14.2.2 Cube

A dice is an example of a cube. Take a dice. Locate its faces, edges and vertices. Count them. How many faces, edges and vertices does a dice have?

You will find that a die has 6 faces, 12 edges and 8 vertices, same as that of a cuboid. Then what is the difference between a cube and a cuboid? You will find that the length, breadth and height of a cube are all same, but in a cuboid they are different. Verify this by measuring the length, breadth and height of an eraser and a die.

### TRY THESE

1. (i) What is the shape of the face of a cube?

(ii) What is the shape of the face of a cuboid?

2. Ramesh has collected some boxes in his room. Pictures of these are given here. How many are cubes and how many are cuboids.

3. Ajith has made a cuboid by arranging cubes of 2 centimeter each. What is the length, breadth and height of the cuboid so formed?

### 14.2.3 Cylinder

Objects like a wooden log, a piece of pipe, a candle, tube light are in the shape of a cylinder. Take a candle. Slice it on the top as shown in the *fig*.1. Lay it down horizontally (*fig*.2). Can you roll it?

Now erect candle up vertically (*fig*.3). Does it roll?

The surface on which the candle rolls is called its curved surface. The surface on which the candle does not roll, but stands on vertically is the base, which is circular in shape.

Now what is the height and width of the candle? Look at the height and width of the cylinder shown in the figure.

### 14.2.4 Cone

Raju wants to buy a special cap for his birthday. He asked Leela to come along with him. Leela said that there is no need to go to the market as they can make the cap on their own.

Would you like to make a cap? Let us try.

Draw a circle on a thick paper using a compass. Draw two lines from the centre to the circumference as shown in the *fig.*(ii)

(i) (ii) (iii) (iv) (v)

Cut this part with scissors it will look like. (*fig.*iii)

Now join $\overline{OA}$ and $\overline{OB}$ with adhesive tape. Your cap is ready now. Decorate it as you wish.

Raju inverted the cap and said "oh! it looks like an ice-cream cone."

Here is a figure of a cone. $\overline{OA}$ is the radius of the circular part and OC is the height of the cone.

## Think, Discuss and Write

What is the difference between a cylinder and a cone with respect to the number of faces, vertices and edges? Discuss with your friends.

### 14.2.5 Sphere

Balls, laddoos, marbles etc. are all in the shape of a sphere. They roll freely on all sides.

Can you call a coin a sphere? Does it roll on all its sides? Is the case with a bangle?

You may have seen lemon in your daily life.

When we cut it horizontally it looks like the shape shown in the figure. The shape of such an object is called semisphere.

## Do This

Fill the table accordingly:

**S. No. Object Shape Slides only Roll only Slides and rolls**

1. Cell Cylindrical × × ✓
2. Ball
3. Oil can
4. Biscuit packet
5. Coin
6. Marble
7. Orange

The cylinder, the cone and the sphere have no straight edges. What is the base of a cone? Is it a circle? The cylinder has two bases. What shape is the base? Of course, a sphere has no face! Think about it.

### 14.2.6 Prism

Here is a diagram of a **prism.**

Have you seen it in the laboratory? Two of its faces is in the shape of triangle. Other faces are either in the shape of rectangle or parallelogram. It is a triangular prism. If the prism has a rectangular base, it is a rectangular prism. Can you recall another name for a rectangular prism?

### 14.2.7 Pyramid

A **pyramid** is a solid shape with a base and a point vertex, the other faces are triangles. All the triangular faces meet at vertex of the prism.

Here is a square pyramid. Its base is a square. Can you imagine a triangular pyramid? Attempt a rough sketch of it.

## Activity

Take a sheet of chart. Draw a triangle with equal sides on the chart, cut it. Then using this triangle cut out three more triangles of exactly same size from the chart. Join the edges of the four triangles, thus formed in order to make a closed object. This object is in the shape of a tetrahedron or triangular pyramid.

## Exercise-14.1

1. A triangular pyramid has a triangle at its base. It is also known as a tetrahedron. Find the number of

Faces : _____

Edges : _____

Vertices : _____

2. A square pyramid has a square at its base. Find the number of

Faces : _____

Edges : _____

Vertices : _____

3. Fill the table

**Shape No. of curved surfaces No. of plane surfaces No. of Vertices**

4. A triangular prism is often in the shape of a kaleidoscope. It has triangular faces.

No. of triangular Faces : _____

No. of rectangular Faces : _____

No. of Edges : _____

No. of Vertices : _____

## 14.3 Polygons

We have learnt about open and closed figures in the chapter 'Basic Geometrical Ideas'. See the figures given below. Which of the following figures are open and which are closed?


A figure is a polygon if it is a closed figure,

formed with a definite number of straight lines.

Some examples are shown here.

### Do This

1. Draw ten polygons with different shapes in your notebook.

2. Use match-sticks or broom-sticks and form closed figures using:

(i) Six sticks (ii) Five sticks

(iii) Four sticks (iv) Three sticks (v) Two sticks

In which case was it not possible to form a polygon? Why?

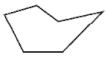
You will find that you could not form a polygon using two sticks. A polygon must have at least three sides. A polygon with three sides is called a triangle. Study the table given below and learn the names of the various types of polygons.

**Figure No. of sides Name**

 3 Triangle

 4 Quadrilateral

 - Pentagon

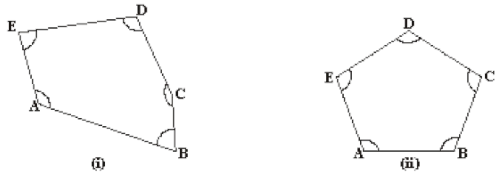
 - Hexagon

 7 Septagon

 - Octagon

### Try This

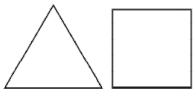
Find out the differences:




Measure the lengths of the sides and angles of (i) and (ii). What did you find?

#### 14.3.1 Regular Polygon

A polygon with all equal sides, and all equal angles is called a regular polygon. Equilateral traingles and squares are examples of regular polygons.



**Equilateral triangle** : A triangle with all sides and all angles equal

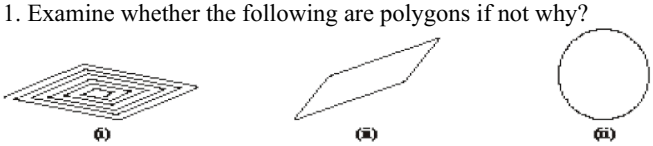
**Square** : A quadrilateral with all sides and all angles equal.

Similarly, if all the sides and all the angles of a pentagon, hexagon, septagon and octagon are equal they are called regular pentagon,

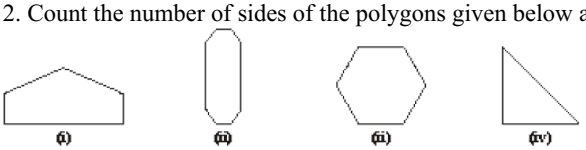
regular hexagon, regular septagon and regular octagon respectively.

## Exercise - 14.2

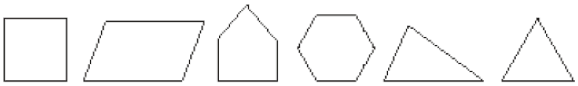
1. Examine whether the following are polygons if not why?




2. Count the number of sides of the polygons given below and name them:




3. Identify the regular polygons among the figures given below:



## What have we discussed?

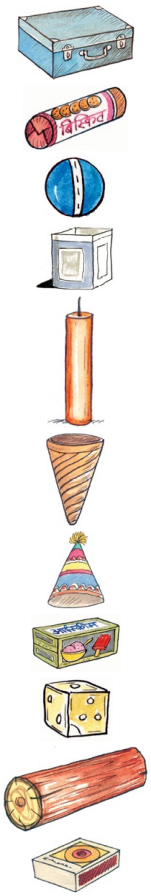
1. Various boxes are normally in the shapes of cubes and cuboids:

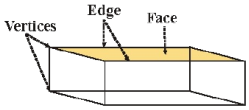
**Shapes Faces Edges Vertices**

 6 12 8

 6 12 8

2. Ice-cream cones, joker's caps etc. are in the shape of cone.
3. Tins, oil drums, wooden logs are in the shape of a cylinder.
4. Balls, laddoos etc. are in the shape of a sphere.
5. A polygon is a closed figure made up of line segments.
6. If all the sides and angles of a polygon are equal, it is called a regular polygon.



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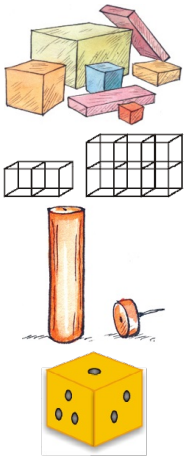
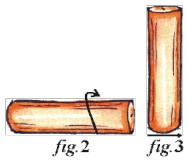


***fig.*1**

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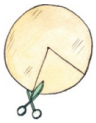

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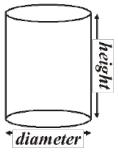
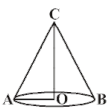
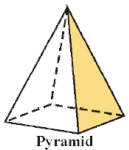
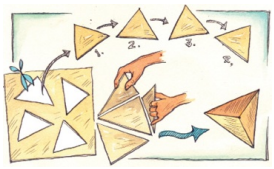
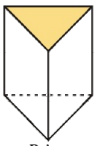


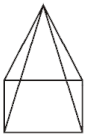


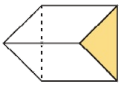
Pyramid

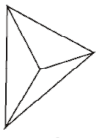


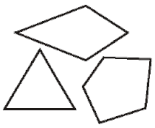


Prism









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**(iii)**