Basic Mathematics_22103_UO4.4

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MSBTE LEAD: Learning at your Doorstep

Unit 4: Mensuration

Topic : Volume of Sphere, Cone and Cylinder

Course Outcome:

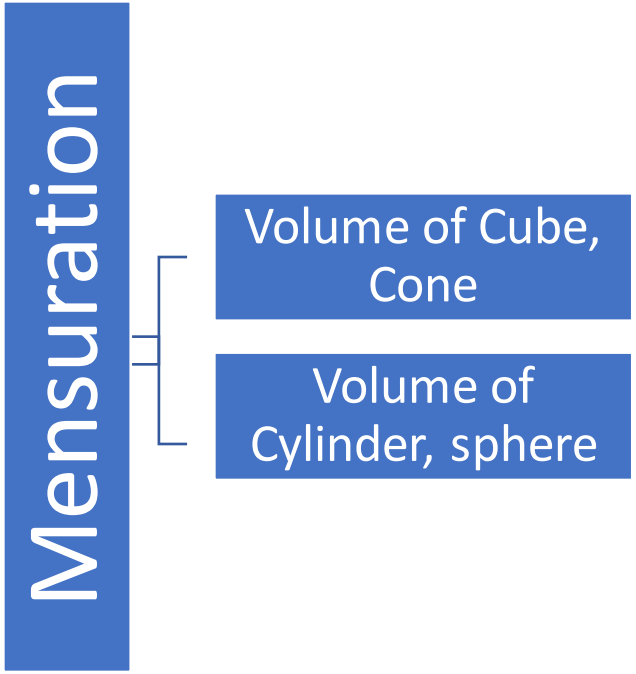
- **Co4 :** Solve the problems based on measurement of regular closed figures and regular solids.

- **Learning Objectives:**

  Determine volume of given cuboids ,sphere ,cone and cylinder.

Contents

Concept Map



Volume of Cube, Cone

Mensuration deals with length, area and volume of different kinds of shape- both plane and solid.

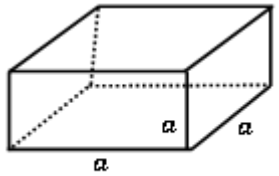
Solid figures are three-dimensional objects. Solid figures have a width, a depth, and a height.

The space occupied by a solid is called the volume.

1) Cube

Volume $= (\text{side})^3 = (\text{a})^3$

Diagonal of cube $= \sqrt{3}\ (\text{side}) = \sqrt{3}\ a$

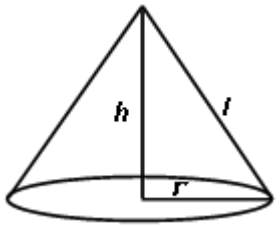


2) Cone

$$\text{Volume} = \frac{1}{3}(\text{base area} \times \text{height})$$

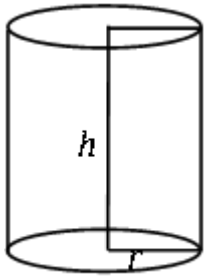
$$= \frac{1}{3}\pi r^2 h$$

Slant height $l = \sqrt{h^2 + r^2}$



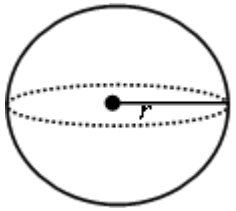
Volume of Cylinder, Sphere

3) Cylinder



$$\text{Volume} = \text{base area} \times \text{height} = \pi r^2 h$$

4) Sphere



$$\text{Volume} = \frac{4}{3}\pi r^3$$

Examples:

1) The radius of cone is 7 cm and slant height is 25 cm. Find volume of the cone

Given: $\mathrm{r} = 7\ \mathrm{cm.}$; $l = 25\ \mathrm{cm.}$

Now slant height l of a cone is calculated as

$$l^2 = \mathrm{h}^2 + \mathrm{r}^2$$

$$\Rightarrow \quad (25)^2 = \mathrm{h}^2 + (7)^2$$

$$\Rightarrow \quad \mathrm{h}^2 = 625 - 49 = 576$$

$$\Rightarrow \quad \mathrm{h} = 24\ \mathrm{cm}$$

Now volume of a cone is

$$\mathrm{v} = \frac{1}{3}\pi\,\mathrm{r}^2\mathrm{h}$$

$$\Rightarrow \quad \mathrm{v} = \frac{1}{3} \times \frac{22}{7} \times (7)^2 \times 24$$

$$\Rightarrow \quad \mathrm{v} = 1232\ \mathrm{cm}^3$$

2) **Find the volume of a sphere whose surface area is 616 sq.cm.**

Ans: Given: surface area of sphere $= 616\ \text{cm}^2$

$\Rightarrow \quad 4\pi r^2 = 616$

$\Rightarrow \quad 4 \times \frac{22}{7} \times r^2 = 616$

$\Rightarrow \quad r^2 = \frac{616 \times 7}{4 \times 22}$

$\Rightarrow \quad r^2 = 49 \quad \Rightarrow \quad r = 7\ \text{cm}$

Now volume of sphere $= \frac{4}{3}\pi r^3$

$= \frac{4}{3} \times \frac{22}{7} \times (7)^3$

$= 1437.33\ \text{cm}^3$

3) **A solid metallic sphere of radius 30 cm is melted to make solid cylinders of radius 10 cm and height 6 cm each. How many such cylinders can be made?**

Ans: Given: radius of sphere $r = 30$ cm.

$\therefore$ Volume of the sphere $= \frac{4}{3}\pi r^3 = \frac{4}{3} \times \frac{22}{7} \times (30)^3$

Also Given: radius cylinder $r = 10$ cm and height =6cm

Now, volume of a cylinder = $\pi r^2 h$

$$= \frac{22}{7} \times (10)^2 \times 6$$

$$\text{No. of cylinders} = \frac{\text{Volume of the sphere}}{\text{Volume of a cylinder}}$$

$$= \frac{\frac{4}{3} \times \frac{22}{7} \times (30)^3}{\frac{22}{7} \times (10)^2 \times 6} = \frac{\frac{4}{3} \times 27000}{100 \times 6}$$

$$= 60$$

Therefore we can say 60 small cylinders will be formed from the sphere.

4) A metal strip $11 \times 7 \times 5$ cm is melted down and minted into coins each of diameter 1.4 cm and thickness 0.08cm. Assuming no wastage, how many coins can be minted?

Ans: We know, volume of metal strip $= l \times \mathrm{b} \times \mathrm{h}$

$\Rightarrow$ Volume of metal strip $= 11 \times 7 \times 5$

$\Rightarrow$ Volume of metal strip $= 385\ \mathrm{cm}^3$

Also, Volume of coin $= \pi \mathrm{r}^2 \mathrm{h}$

$\Rightarrow \text{Volume of coin } = \frac{22}{7} \times (0.7)^2 \times 0.08$

$\because$ diameter $= 1.4$

$\therefore \ \mathrm{r} = 0.7$

$\Rightarrow \text{Volume of coin } = 0.1232\ \mathrm{cm}^3$

$\therefore$Number of coins $= \frac{\text{Volume of metal strip}}{\text{Volume of one coin}}$

$\therefore$Number of coins $= \frac{385}{0.1232}$

$\Rightarrow$Number of coins $= 3125$

Application of Concept/ Examples in real life:

- In engineering applications and in daily life ,often one needs to estimate the cost of various aspects ,the amount of production which indirectly deals with mensuration.
- Calculating volume is an important skill used by many people in their daily work.
- Builders and tradespeople often need to work out the volume and dimensions of the structures they are building, and so do architects, designers and engineers.

Summary:

So today we learned….

- Formulae for Volume of Cube,cone,cylinder,sphere.
- Solving different problems related to volume of regular closed solids.
- Utilize concept of volume to solve problems in daily life.

Now take this quiz.....

1) The volume of a cylinder is 38016 cm^3 and height is 21 cm. Find the curved surface area.

a) $3168\ \mathrm{cm}^2$ b)$3160\ \mathrm{cm}^2$

c)$3170\ \mathrm{cm}^2$ d)$3100\ \mathrm{cm}^2$

2) There is a cubical room whose length measures 6 metres. How many students can accommodate if each student requires 2.7 $\mathrm{m}^3$of space?

a)90 b)80

c) 95 d) 75

Ans: 1) a 2) b

Thank you