



Basic Mathematics_22103_UO4.3

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Unit 4: Mensuration

Topic : Surface area of Solids



Course Outcome:

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

- ▶ **Learning Objectives:**

Compute surface area of given cuboids, sphere, cone and cylinder.



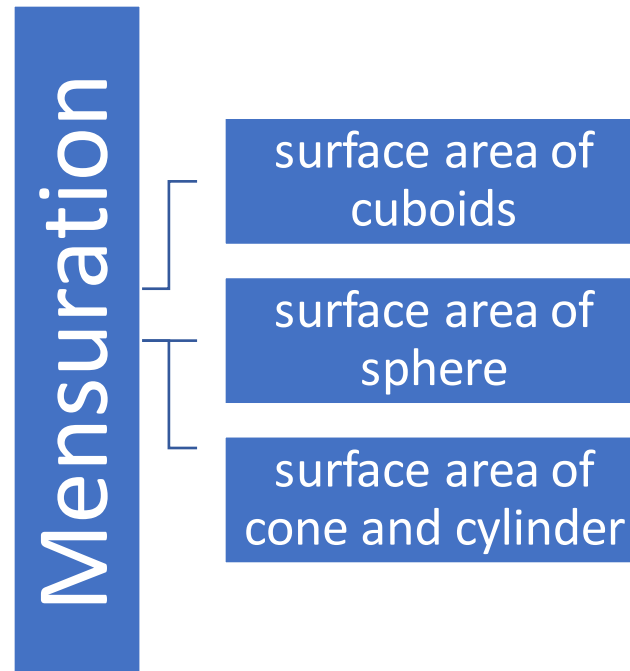
Contents



1. Different formulae for surface area of cube and cuboid.
2. Surface area of Sphere, Cone and Cylinder.
3. Examples to compute Surface area of given solid.



Concept Map



Surface Area of Rectangle and square

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

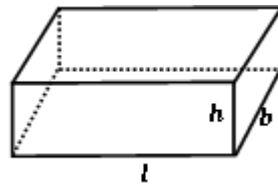
Any figure which occupies space is called a solid. A solid figure has three dimensions namely length , breadth and height (thickness)

1) Cuboids :

$$\text{Surface Area} = 2(lb + bh + hl)$$

$$\text{Vertical Surface Area} = 2(l + b)h$$

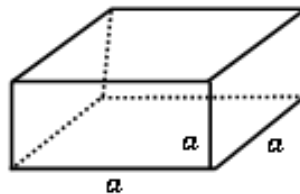
$$\text{Diagonal of cuboid} = \sqrt{l^2 + b^2 + h^2}$$



2) Cube

$$\text{Surface Area} = 6a^2$$

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

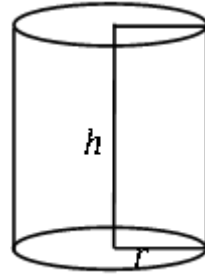


Surface Area of Cylinder, Cone and Sphere

3) Cylinder

Lateral /Curved Surface Area = $2\pi rh$

Total Surface Area = $2\pi rh + 2\pi r^2$
 $= 2\pi r(h + r)$

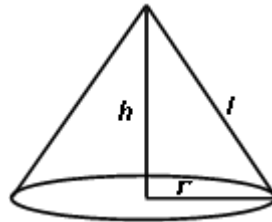


4) Cone

Curved Surface Area = πrl ; l – slant height

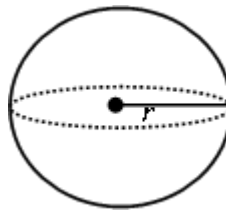
Total Surface Area = $\pi rl + \pi r^2 = \pi r(l + r)$

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



5) Sphere

Surface Area = $4\pi r^2$



Examples:

1) The length, breadth and height of a cuboid are 8 cm, 11 cm and 15 cm respectively. Find the total surface area.

Ans: We know S.A. of cuboid = $2(lb + bh + hl)$
 \Rightarrow S.A. = $2(8 \times 11 + 11 \times 15 + 15 \times 8)$
 \Rightarrow S.A. = 746 cm^2

2) A cone has a circular base of radius 10 cm and a slant height of 30 cm. Calculate the surface area.

Ans: Given: $r = 10 \text{ cm}$ $l = 30 \text{ cm}$
We know, total surface area of cone = $\pi r l + \pi r^2 = \pi r(l + r)$
 \Rightarrow T.S.A. = $\frac{22}{7} \times 10 \times (30 + 10)$
 \Rightarrow T.S.A. = 1257.14 cm^2



3) A metal plate 27 cm long, 8cm broad and 1 cm thick is melted and recast into a cube. Find the difference in the total surface areas of the plate and the cube.

Ans: We know, volume of metal plate = $l \times b \times h$

$$\Rightarrow \text{Volume of metal plate} = 27 \times 8 \times 1 = 216 \text{ cm}^3$$

$$\text{Also, Volume of cube} = a^3 = 216$$

$$\Rightarrow a^3 = 216$$

$$\Rightarrow a = 6 \text{ cm}$$

$$\text{Now S.A. of plate} = 2(l \times b + b \times h + h \times l)$$

$$\Rightarrow \text{S.A. of plate} = 2(27 \times 8 + 8 \times 1 + 1 \times 27)$$

$$\Rightarrow \text{S.A. of plate} = 502 \text{ cm}^2$$

$$\Rightarrow \text{S.A. of cube} = 6(6)^2 = 216 \text{ cm}^2$$

$$\therefore \text{Difference in surface areas} = 502 - 216$$

$$\Rightarrow \text{Difference in surface areas} = 286 \text{ cm}^2$$



4) A lead bar 10cm X 5cm X 4cm is melted and made into 5 equal spherical bullets. Find the diameter and surface area of bullet.

Ans:

A lead bar is 10cm X 5cm X 4cm

$$\begin{aligned}\text{Volume of lead bar} &= l \times b \times h \\ &= 10 \times 5 \times 4 \\ &= 200 \text{ cm}^3\end{aligned}$$

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

Since the bar is melted and used to make 5 bullets

Volume of bar = 5 (Volume of bullet)

$$200 = 5 \left(\frac{4}{3} \pi r^3 \right)$$

$$\begin{aligned}r^3 &= \frac{200 \times 3}{20\pi} \\ &= 9.55 \\ r &= 2.122 \text{ cm}\end{aligned}$$

$$\text{Diameter of bullet} = 2r = 2(2.122) = 4.244 \text{ cm}$$

$$\begin{aligned}\text{Surface Area of bullet} &= 4\pi r^2 \\ &= 4\pi(2.122)^2 \\ &= 56.58 \text{ cm}^2\end{aligned}$$



5) An aquarium is in the form of a cuboid whose external measures are $80 \times 30 \times 40$ cm. The base, side faces and back face are to be covered with a coloured paper. Find the area of the paper needed?

Ans:

Given: $l = 80$ cm; $b = 30$ cm and $h = 40$ cm

Area of the base = $l \times b = 80 \times 30 = 2400 \text{ cm}^2$

Area of the side face = $b \times h = 30 \times 40$
 $= 1200 \text{ cm}^2$

Area of the back face = $l \times h = 80 \times 40$
 $= 3200 \text{ cm}^2$

Required area = Area of base + area of back face + $(2 \times \text{area of a side face})$
 $= l \times b + l \times h + 2(b \times h)$
 $= 2400 + 3200 + (2 \times 1200)$
 $= 8000 \text{ cm}^2$

Hence the area of the coloured paper required is 8000 cm^2 .



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 surface areas is an important skill used by many people in their daily work.
- ▶ Builders and tradespeople often need to work out the surface areas and dimensions of the structures they are building, and so do architects, designers and engineers.



Summary:

So today we learned....

- ▶ Formulae for surface area of different solids.
- ▶ To solve different problems related to surface area of regular closed figures.



Now take this quiz.....

1) Find the surface area of cuboid if the length, breadth and height are 4 cm, 3 cm and 12 cm respectively.

- a) 192 cm^2
- b) 182 cm^2
- c) 172 cm^2
- d) 162 cm^2

2) Find the curved surface area of a right circular cone whose slant height is 10 cm and base radius is 7 cm.

- a) 220 m^2
- b) 220 cm^2
- c) 240 cm^2
- d) 240 m^2

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

- a) 3200 cm^2
- b) 3190 cm^2
- c) 3150 cm^2
- d) 3168 cm^2

Ans: 1) a 2) c 3) d



Thank you

