

SURFACE AREA AND VOLUMES

KEY CONCEPTS

1. CUBOID :

- (I) TOTAL SURFACE AREA OF A CUBOID : $2(LB + BH + HL)$
- (II) Volume of a cuboid = $L \times B \times H$ sq units
- (III) Diagonal of a cuboid = $\sqrt{L^2 + B^2 + H^2}$ units

2. CUBE :

- (I) Total Surface Area of a Cube = $6a^2$ sq units
- (II) Volume of the Cube = a^3 cubic units
- (III) Diagonal of a Cube = $\sqrt{3}a$

3. Right Circular Cylinder :

- (I) Curved Surface Area = $2\pi rh$
- (II) Total Surface Area = $2\pi r(h + r)$
- (III) Volume = $\pi r^2 h$

4. Right Circular Hollow Cylinder :

- (I) Area of each end = $\pi(R^2 - r^2)$ [R and r be the external radius and internal radius]
- (II) Curved Surface Area of Hollow Cylinder = $2\pi h(R + r)$
- (III) Total Surface Area = $\pi(R + r)[2h + R - r]$
- (IV) Volume of material = $\pi h(R^2 - r^2)$

5. Sphere :

- (I) Surface Area = $4\pi r^2$
- (II) Volume = $\frac{4}{3}\pi r^3$

6. Hemisphere :

- (I) Curved Surface Area = $2\pi r^2$
- (II) Total Surface Area = $3\pi r^2$
- (III) Volume = $\frac{2}{3}\pi r^3$

7. Right Circular Cone :

- (I) Curved Surface Area = πrl [l = Slant Height]
- (II) Total Surface Area = $\pi r(L + r)$ sq units
- (III) Volume = $\frac{1}{3}\pi r^2 h$

8. Frustum of a Cone :

- (I) Volume of a Frustum of a Cone = $\frac{\pi h (R^2 + r^2 + Rr)}{3}$
[R – radius of base, r – radius of frustum]
- (II) Lateral Surface Area of the Frustum of a cone = $\pi L (R + r)$ [where $L^2 = h^2 + (R - r)^2$]
- (III) Total Surface Area of the Frustum of the cone = $\pi [R^2 + r^2 + L (R + r)]$ sq units

LEVEL WISE QUESTIONS

LEVEL-I

1. The Surface Area of a Sphere is 616 cm^2 . Find its radius.
2. The slant height of the frustum of a cone is 5 cm. if the difference between the radii of its two circular ends is 4cm, write height of the frustum.
3. A cylinder and a cone area of the same base radius and of the same height. Find the ratio of the cylinder to that of the cone.
4. Two cones have their heights in the ratio 1:3 and radii 3:1. What is the ratio of their volumes?
5. The radii of two cones are in the ratio 2:1 and their volumes are equal. What is the ratio their heights?
6. The diameter of a sphere is 6 cm. it is melted and drawn into a wire of diameter 2mm. Find the length of the wire.
7. Find the curved surface area of a right circular cone of height 15cm and base diameter is 16 cm.
8. Find the maximum volume of a cone that can be out of a solid hemisphere of radius r.
9. The diameter of the ends of a frustum of a cone are 32cm and 20 cm. If its slant height is 10 cm. Find the lateral surface area.

LEVEL-II

1. Metallic sphere of radii 6cm, 8cm and 10cm respectively, are melted to form a single solid sphere. Find the radius of the resulting sphere.
2. A 20m deep well with diameter 7m is dug and the earth from digging is evenly spread out to form a platform 22m by 14m. Find the height of the platform.
3. Two cubes of volume 64cm^3 are joined end to end. Find the volume of the sphere.
4. The largest sphere is curved out of a cube of a side 7cm. Find the volume of the sphere.
5. A circus tent is cylindrical up to a height of 3m and conical above it. If the diameter of the base is 105m and the slant height of the conical part is 53m. Find the total canvas used in making the tent.
6. A vessel is in the form of a hemispherical bowl mounted by a hollow cylinder. The diameter of the sphere is 14cm and the total height of the vessel is 13 cm. Find it's capacity?
7. A solid toy is in the form of a right circular cylinder with a hemispherical shape at one end and a cone at the other end. Their common diameter is 4.2cm and the height of the cylindrical and conical position are 12cm and 7cm respectively. Find the volume of the solid toy.

8. A solid is in the shape of a cone standing on a hemisphere with both their radii being equal to 1cm and the height of the cone is equal to its radius. Find the volume of the solid in terms of π .

Level-III

1. A hemispherical depression is cut from one face of the cubical wooden block such that the diameter l of the hemisphere is equal to the edge of the cube. Determine the surface area of the remaining solid.
2. A juice seller was serving his customers using glasses. The inner diameter of the cylindrical glass was 5cm, but the bottom of the glass had a hemispherical raised portion which reduced the capacity of the glass was 10cm, find what the apparent capacity of the glass was and what the actual capacity was.
3. The height of a cone is 30cm. A small cone is cut off at the top by a plane parallel to the base of its volume be $\frac{1}{27}$ of the volume of the given cone, at what height above the base is the section made ?
4. An oil funnel of tin sheet consists of a cylindrical portion 10cm long attached to a frustum of a cone. If the total height be 22cm, diameter of the cylindrical portion be 8cm and the diameter of the top of the funnel be 18cm. Find the area of the tin required to make the funnel.
5. A solid wooden toy is in the shape of a right circular cone mounted on a hemisphere. If the radius of the hemisphere is 4.2cm and the total height of the toy is 10.2cm. Find the volume of the wooden toy.

SELF-EVALUATION

1. A tent is of the shape of a right circular cylinder up to a height of 3m and then becomes a right circular cone with a maximum height of 13.5m, above the ground.
Calculate the cost of painting the inner side of the tent at the rate of Rs. 2 per sq. metre, if the radius of the edge is 14 metres.
[Total Area = 1034m^2 , Cost of painting = Rs. 2068]
2. A bucket is in the form of a cone and holds 28.490 litres of water. The radii of the top and bottom are 28cm and 21cm respectively. Find the height of the bucket.
[Height of the bucket = 15cm]
3. The perimeter of the ends of a frustum are 48cm and 36cm. If the height of the frustum be 11cm, find its volume.
[1553 cm^3]
4. If the radii of the circular ends of a conical bucket which is 45cm high, are 28cm and 7cm. Find the capacity of the bucket.
[Capacity of the bucket = 48510cm^3]
5. A pen stand made of wood is in the shape of a cuboid with four conical depression's to hold pens. The dimensions of the cuboid are 15cm by 10 cm by 3.5cm. The diameter of each of the depression is 1cm and the depth is 1.4 cm. Find the volume of the word in the entire stand.
[ans. 523.53 cm^3]
6. Three cubes each of side 5 cm are joined end to end. Find the surface area of the resulting cuboid.
[ans. 350 cm^2]
7. The diameter of a metallic sphere is 6cm. The sphere is melted and drawn into a wire of uniform cross-section. If the length of the wire is 36m. Find its radius.

[ans 10 mm]

8. If the diameter of cross-section of a wire is decreased by 5%. How much percent will the length be increased so that the volume remains the same?

[ans. 10.8%]