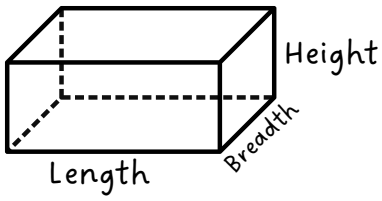
Surface Areas and Volumes

Formulas

1. CUBOID

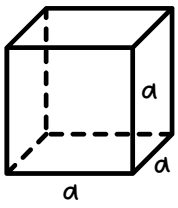


(i) Surface Area of a Cuboid (TSA)
= $2(lb + bh + hl)$

(ii) Lateral surface area of a Cuboid
(Area of four walls)
= $2(l + b)h$

(iii) Volume of a Cuboid
= Length × Breadth × Height

2. CUBE

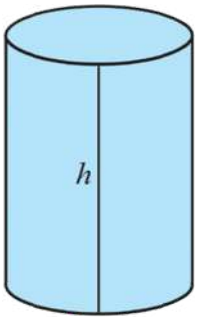


(i) Surface Area of a Cube (TSA)
= $6a^2$

(ii) Lateral surface area of a Cube
(Area of four walls)
= $4a^2$

(iii) Volume of a Cube
= edge × edge × edge = a^3

3. CYLINDER

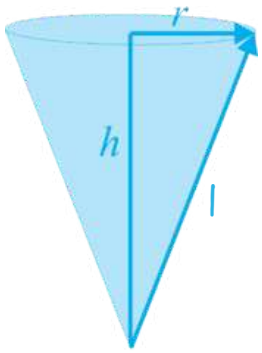


(i) Curved Surface Area (CSA) = $2\pi rh$

(ii) Total Surface Area (TSA) = $2\pi r(r + h)$

(iii) Volume of a Cylinder = $\pi r^2 h$

4. CONE



(i) Curved Surface Area (CSA) = πrl

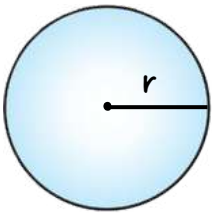
(ii) Total Surface Area (TSA) = $\pi r(l + r)$

(iii) Volume of a Cone = $\frac{1}{3}\pi r^2 h$

where, h = Height and l = Slant height

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

5. SPHERE



(i) Surface Area of a Sphere (CSA = TSA)
$= 4\pi r^2$

(ii) Volume of a Sphere $= \frac{4}{3}\pi r^3$

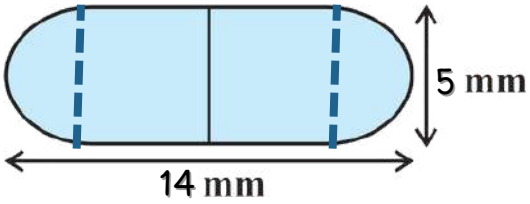
6. HEMISPHERE

(i) Curved Surface Area (CSA) $= 2\pi r^2$

(ii) Total Surface Area (TSA) $= 3\pi r^2$

(iii) Volume of a Hemisphere $= \frac{2}{3}\pi r^3$

Example: A medicine capsule is in the shape of a cylinder with two hemispheres stuck to each of its ends. The length of the entire capsule is 14 mm and the diameter of the capsule is 5 mm. Find its surface area.



SOLUTION: Radius (r) of Cylindrical part = Radius (r) of two Hemispheres

$$= \frac{\text{Diameter}}{2} = \frac{5}{2}$$

Length of Cylindrical part = Total length - 2 × r

$$= 14 - \cancel{2} \times \frac{5}{\cancel{2}}$$

$$= 14 - 5 = 9\text{mm}$$

Surface area of capsule = 2 × CSA of Hemispheres + CSA of Cylinder

$$= 2 \times 2\pi r^2 + 2\pi rh$$

$$= 2\pi r\,(2r + h)$$

$$= \cancel{2}\pi \times \frac{5}{\cancel{2}}\left(\cancel{2} \times \frac{5}{\cancel{2}} + 9\right)$$

$$= 5\pi\,(5 + 9)$$

$$= 5\pi \times 14$$

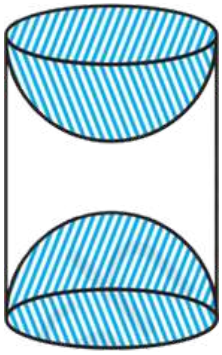
$$= 70\pi$$

$$= \cancel{70} \times \frac{22}{\cancel{7}}$$

$$= 10 \times 22$$

$$= 220\text{mm}^2$$

Example: A wooden article was made by scooping out a hemisphere from each end of a solid cylinder. If the height of the cylinder is 10 cm, and it's base is of radius 3.5 cm, find the total surface area of the article.



SOLUTION: Radius (r) of Cylinder = Radius (r) of Hemisphere = 3.5cm

Height of Cylinder (h) = 10cm

Surface area of Article = CSA of the Cylinder + 2 × CSA of the hemispherical part

$= 2\pi rh + 2 \times 2\pi r^2$

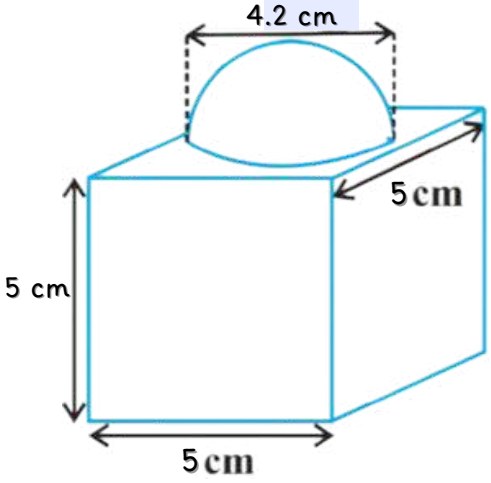
$= 2\pi r\,(h + 2r)$

$= 2\pi \times 3.5\,(10 + 2 \times 3.5)$

$= 7\pi \times (10 + 7) = 7\pi \times 17$

$= \cancel{7} \times \frac{22}{\cancel{7}} \times 17 = 22 \times 17 = 374\,cm^2$

Example: The decorative block shown in given figure is made of two solids – a cube and a hemisphere. The base of the block is a cube with edge 5 cm, and the hemisphere fixed on the top has a diameter of 4.2cm. Find the total surface area of the block.



SOLUTION: The total Surface area of the cube

$= 6 \times (edge)^2 = 6 \times 5 \times 5\ cm^2$

$= 150\ cm^2$

Now, the surface area of the block

= TSA of cube - base area of hemi. + CSA of hemisphere

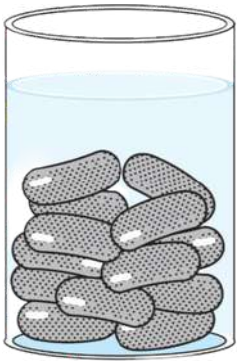
$= 150 - \pi r^2 + 2\pi r^2$

$= (150 + \pi r^2)\ cm^2$

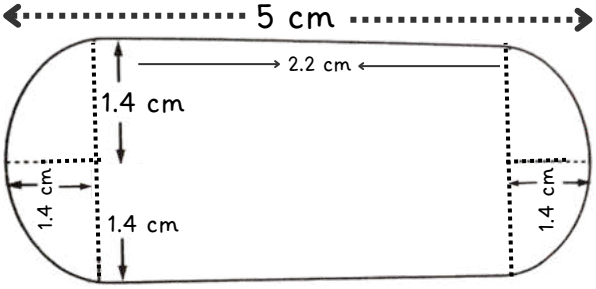
$= 150\ cm^2 + \left(\frac{22}{7} \times \frac{42}{2} \times \frac{42}{2}\right) cm^2$

$= (150 + 13.86)\ cm^2 = 163.86\ cm^2$

Example: A gulab jamun, contains sugar syrup up to about 30% of its volume. Find approximately how much syrup would be found in 45 gulab jamuns, each shaped like a cylinder with two hemispherical ends with length 5cm and diameter 2.8 cm (given fig.).



SOLUTION:



Radius (r) of cylinder = Radius (r) of hemispheres = 2.8/2 = 1.4 cm

Length of Cylindrical part = (5 - 2 × 1.4) cm = (5 - 2.8) cm = 2.2 cm

Volume of one gulab jamun

= Volume of Cylindrical part + 2 × Volume of hemispherical part

$= \pi r^2 h + 2 \times 2/3\ \pi r^3$

$= \pi r^2 h + 4/3\ \pi r^3$

$= \pi r^2 (h + 4/3r) = 22/7 \times 1.4 \times 1.4 \times (4/3 \times 1.4 + 2.2)\ cm^3$

$= 22 \times 0.2 \times 1.4 \times 12.2/3\ cm^3 = 75.152/3\ cm^3$

Volume of 45 gulab jamuns $= 75.152/3 \times 45\ cm^3$

$= 1127.28\ cm^3$

Volume of syrup = 30% of $1127.28\ cm^3$

$= \frac{30}{100} \times 1127.28\ cm^3$

$= 338.184\ cm^3$