7. Mensuration

1 mark Questions

1. The curved surface area of a right circular cone of height 15 cm and base diameter 16 cm is

   (A) $60\pi\ cm^2$ (B) $68\pi\ cm^2$ (C) $120\pi\ cm^2$ **(D) $136\pi\ cm^2$**

2. If two solid hemispheres of same base radius r units are joined together along their bases, then curved surface area of this new solid is MAY-22

   (A) $4\pi r^2$ sq. units (B) $6\pi r^2$ sq. units (C) $3\pi r^2$ sq. units (D) $8\pi r^2$ sq. units

3. The height of a right circular cone whose radius is 5 cm and slant height is 13 cm will be SEP-21

   (A) 12 cm (B) 10 cm (C) 13 cm (D) 5 cm

4. If the radius of the base of a right circular cylinder is halved keeping the same height, then the ratio of the volume of the cylinder thus obtained to the volume of original cylinder is JUL-22

   (A) 1 : 2 **(B) 1 : 4** (C) 1 : 6 (D) 1 : 8

5. The total surface area of a cylinder whose radius is $\frac{1}{3}$ of its height is PTA-1

   (A) $\frac{9\pi h^2}{8}$ sq. units (B) $24\pi h^2$ sq. units **(C) $\frac{8\pi h^2}{9}$ sq. units** (D) $\frac{56\pi h^2}{9}$ sq. units

6. In a hollow cylinder, the sum of the external and internal radii is 14 cm and the width is 4 cm. If its height is 20 cm, the volume of the material in it is PTA-4

   (A) $5600\pi\ cm^3$ **(B) $1120\pi\ cm^3$** (C) $56\pi\ cm^3$ (D) $3600\pi\ cm^3$

7. If the radius of the base of a cone is tripled and the height is doubled then the volume is

   (A) made 6 times **(B) made 18 times** (C) made 12 times (D) unchanged

8. The total surface area of a hemi-sphere is how much times the square of its radius.

   (A) π (B) 4π **(C) 3π** (D) 2π PTA-3, SEP-21, JUL-22

9. A solid sphere of radius x cm is melted and cast into a shape of a solid cone of same radius. The height of the cone is

   (A) $3x\ cm$ (B) $x\ cm$ **(C) $4x\ cm$** (D) $2x\ cm$

10. A frustum of a right circular cone is of height 16 cm with radii of its ends as 8 cm and 20 cm. Then, the volume of the frustum is

    (A) $3328\pi\ cm^3$ (B) $3228\pi\ cm^3$ (C) $3240\pi\ cm^3$ (D) $3340\pi\ cm^3$

11. A shuttle cock used for playing badminton has the shape of the combination of

    (A) a cylinder and a sphere (B) a hemisphere and a cone

    (C) a sphere and a cone **(D) frustum of a cone and a hemisphere**

12. A spherical ball of radius r_1 units is melted to make 8 new identical balls each of radius r_2 units. Then $r_1 : r_2$ is PTA-6, SEP-20

    (A) 2: 1 (B) 1: 2 (C) 4: 1 (D) 1: 4

13. The volume (in cm^3) of the greatest sphere that ca be cut off from a cylindrical log of wood of base radius 1 cm and height 5 cm is

(A) $\frac{4}{3}\pi$ (B) $\frac{10}{3}\pi$ (C) 5π (D) $\frac{20}{3}\pi$

14. The height and radius of the cone of which the frustum is a part are h_1 units and r_1 units respectively. Height of the frustum is h_2 units and radius of the smaller base is r_2 units. If $h_2 : h_1 = 1:2$ then $r_2 : r_1$ is PTA-2

(A) 1:3 **(B) 1:2** (C) 2:1 (D) 3:1

15. The ratio of the volumes of a cylinder, a cone and a sphere, if each has the same diameter and same height is PTA-5

(A) 1:2:3 (B) 2:1:3 (C) 1:3:2 **(D) 3:1:2**

2 mark Questions

1. The radius and height of a cylinder in the ratio 5:7 and its curved surface area is 5500sq. cm Find its radius and height. JUL-22

$\frac{\text{Radius}}{\text{Height}} = \frac{r}{h} = \frac{5}{7} \Rightarrow r = \frac{5h}{7}$ .....(1)

CSA of the cylinder $= 2\pi rh = 5500$

$$2 \times \frac{22}{7} \times \frac{5h}{7} \times h = 5500$$

$$h^2 = \frac{5500 \times 7 \times 7}{2 \times 22 \times 5}$$

$$= 5 \times 5 \times 7 \times 7$$

$$h = 35\text{cm}$$

Substitute h=35 in (1), $r = \frac{5(35)}{7} \Rightarrow r = 25\text{cm}$.

$r = 25$ cm, $h = 35$cm

2. The ratio of the radii of two right circular cones of same height is 1:3. Find the ratio of their curved surface area when the height of each cone is 3 times the radius of the smaller cone. PTA-2

Smaller cone:	**Large cone:**
$r_1 \to r$	$r_2 \to 3r$
$h_1 \to 3r$	$h_2 \to 3r$
$l_1 = \sqrt{(3r)^2 + r^2} = \sqrt{10r^2} = r\sqrt{10}$	$l_2 = \sqrt{(3r)^2 + (3r)^2} = \sqrt{18r^2} = \sqrt{9 \times 2}(r) = 3r\sqrt{2}$

CSA of small cone : CSA of large cone

$$\pi r_1 l_1 : \pi r_2 l_2$$

$$r \times r\sqrt{10} : 3r \times 3r\sqrt{2}$$

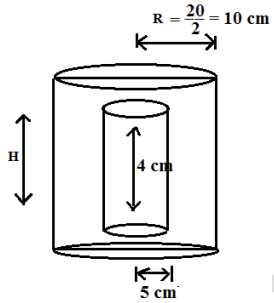
$$\sqrt{5}\,\sqrt{2} : 9\sqrt{2}$$

$$\sqrt{5} : 9$$

Ratio of the CSA is $\sqrt{5} : 9$

3. A cylindrical glass with diameter 20 cm has water to a height of 9 cm. A small cylindrical metal of radius 5 cm and height 4 cm is immersed it completely. Calculate the raise of the water in the glass?

SEP-20



Volume of water raised in cylindrical glass

= Volume of cylindrical metal immersed

$$\pi R^2 H = \pi r^2 h$$

$$\pi \times 10 \times 10 \times h = \pi \times 5 \times 5 \times 4$$

$$h = \frac{5\times5\times4}{10\times10}$$

$$= 1$$

The raise of the water in the glass **= 1 cm**

4. The volumes of two cones of same base radius are 3600 cm^3 and 5040 cm^3. Find the ratio of heights.

PTA-4, MAY-22

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

Volume of cone 1 : Volume of cone 2 $= 3600 : 5040$

$$\frac{1}{3}\pi r^2 \times h_1 : \frac{1}{3}\pi r^2 \times h_2 = 180 : 252$$

$$h_1 : h_2 = 45 : 63$$

$$h_1 : h_2 = 5 : 7$$

5. A solid sphere and a solid hemisphere have equal total surface area. Prove that the ratio of their volume is $3\sqrt{3} : 4$.

PTA-6

TSA of sphere = TSA of hemisphere

$$\cancel{4}\pi r_1^2 = \cancel{3}\pi r_2^2 \Rightarrow \frac{r_1^2}{r_2^2} = \frac{3}{4} \Rightarrow \frac{r_1}{r_2} = \frac{\sqrt{3}}{2}$$

$$\frac{\text{volume of sphere}}{\text{volume of hemisphere}} = \frac{\frac{4}{3}\pi r_1^3}{\frac{2}{3}\pi r_2^3}$$

$$= 2\left(\frac{r_1}{r_2}\right)^3$$

$$= 2\left(\frac{\sqrt{3}}{2}\right)^3$$

$$= \frac{2\times3\sqrt{3}}{8}$$

$$= \frac{3\sqrt{3}}{4}$$

∴ Ratio of the volume $3\sqrt{3} : 4$

6. Find the number of coins, $1.5\ cm$ in diameter and $2\ mm$ thick, to be melted to form a right circular cylinder of height $10\ cm$ and diameter $4.5\ cm$. PTA-1

Number of coins $= \frac{\text{volume of cylinder } (\pi r^2 h)}{\text{volume of a coin } (\pi r^2 h)}$

$= \frac{\pi\times45\times45\times10\times10\times2\times10\times2\times10}{2\times10\times2\times10\times\pi\times15\times15\times2}$

Number of coins to be melted **= 450 coins**

5 mark Questions

1. A container open at the top is in the form of a frustum of a cone of height $16\ cm$ with radii of its lower and upper ends are $8\ cm$ and $20\ cm$ respectively. Find the cost of milk which can completely fill a container at the rate of ₹ 40 per litre. MAY-22

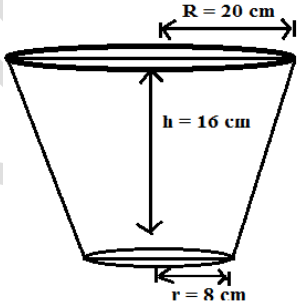
Volume of frustum $= \frac{1}{3}\pi h(R^2 + r^2 + Rr)$

$= \frac{1}{3}\times\frac{22}{7}\times16\left(20^2 + 8^2 + (20\times8)\right)$

$= \frac{1}{3}\times\frac{22}{7}\times16\times624$

$= \frac{73216}{7}$

$= 10459.4\ cm^3$



$\therefore 1000\ cm^3 = 1 litre$

Volume of frustum $= 10.4594$ litres

Required cost $= 10.4594\times40$

$= ₹\ 418.376$

Cost of the milk which can completely fill the container $\cong$ **₹ 418.38**

2. Nathan, an engineering student was asked to make a model shaped like a cylinder with two cones attached at its two ends. The diameter of the model is $3\ cm$ and its length is $12\ cm$. If each cone has a height of $2\ cm$, find the volume of the model that Nathan made. MAY-22

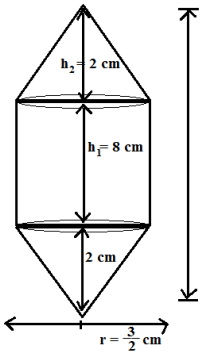
Volume of the model = Volume of cylinder + Volume of cone $\times$ 2

$= \pi r^2 h_1 + \frac{1}{3}\pi r^2 h_2 \times 2$

$= \pi r^2\left[h_1 + \frac{2}{3}h_2\right]$

$= \frac{22}{7}\times\frac{3}{2}\times\frac{3}{2}\times\left[8 + \frac{2}{3}(2)\right]$

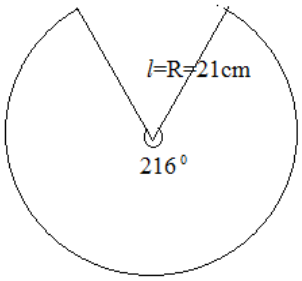
$= \frac{22}{7}\times\frac{3}{2}\times\frac{3}{2}\times\frac{28}{3}$



Volume of the model **= 66 cm^3**

3. A metallic sheet in the form of a sector of a circle of radius $21\ cm$ has central angle of 216°. The sector is made into a cone by bringing the bounding radii together. Find the volume of the cone formed.

PTA-2



Arc length $L = \frac{2\pi R}{360} \times 216$

$$L = \frac{2\pi \times 21 \times 3}{5}$$

Circum of base of the cone = Arc length

i.e, $2\pi r = \frac{2\pi \times 21 \times 3}{5}$

$$= \frac{63}{5}$$

$$r = 12.6\ cm$$

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

$$= \sqrt{21^2 - 12.6^2}$$

$$= \sqrt{441 - 158.76}$$

$$= \sqrt{282.24}$$

$$h = 16.8\ cm$$

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

$$= \frac{1}{3} \times \frac{22}{7} \times 12.6 \times 12.6 \times 16.8$$

$$= 2794.176\ cm^3$$

Volume of the cone formed $\mathbf{= 2794.176\ cm^3}$