12

CHAPTER

Surface Areas and Volumes

Level - 1

CORE SUBJECTIVE QUESTIONS

MULTIPLE CHOICE QUESTIONS (MCQs) (1 Mark)

1. Option (B) is correct

Explanation: The radius of the base of the right circular cone and the radius of the sphere are both given as 5 cm.

The volume of a sphere is given by:

$$V_{sphere} = \frac{4}{3}\pi r^3$$

Substituting $r = 5$:

$$V_{sphere} = \frac{4}{3}\pi(5)^3 = \frac{4}{3}\pi \times 125$$

$$= \frac{500}{3}\neq$$

The volume of a cone is

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

Substituting $r = 5$

$$V_{cone} = \frac{1}{3}\pi(5)^3 h = \frac{25}{3}\pi h$$

Since, the volume of a sphere and cone are equal, we set the volumes equal to each other:

$$\frac{25}{3}\neq h = \frac{500}{3}\neq$$

$$25h = 500 \Rightarrow h = 20 \text{ cm}$$

Therefore, the height of the cone is 20 cm.

2. Option (D) is correct

Explanation: r is the radius of the base of the cone and h is the height of the cone

Given,

$h = 2$ cm (the height of the cube)

The diameter of the base of the cone is 2 cm, so the radius $r = \frac{2}{2} = 1$ cm.

$$V = \frac{1}{3}\pi(1)^2(2) = \frac{2}{3}\pi \text{ cm}^3$$

$$V = \frac{2}{3}\neq \text{ cm}^3$$

3. Option (C) is correct

Explanation: Ratio of SA of sphere to SA of 2 hemisphere.

$$\Rightarrow \frac{4\pi r^2}{3\pi r^2 + 3\pi r^2} = \frac{4\pi r^2}{6\pi r^2} = 2:3$$

4. Option (B) is correct

Explanation: The length of the cuboid is the combined length of the two cubes

Length (L) = 6 cm + 6 cm = 12 cm

The width (W) and height (H) remain the same as the edge of the cube, which is 6 cm.

Length (L) = 12 cm

Width (W) = 6 cm

Height (H) = 6 cm

The surface area A of a cuboid is given by the formula:

$$A = 2(LW + LH + WH)$$

$$A = 2(12 \times 6 + 12 \times 6 + 6 \times 6)$$

$$A = 2(72 + 72 + 36) = 2 \times 180$$

$$= 360 \text{ cm}^2$$

5. Option (D) is correct

Explanation:

$$r = 7 \text{ cm}$$

$$\text{Volume of the hemisphere} = \frac{2}{3}\neq r^3$$

$$\text{Volume of biggest sphere} = \frac{4}{3}\pi\left(\frac{r}{2}\right)^3$$

$$= \frac{1}{6}\pi r^3$$

$$\therefore \quad \text{Required ratio} = \frac{\frac{2}{3}\pi r^3}{\frac{1}{6}\pi r^3}$$

$$= \frac{2}{3} \times \frac{6}{1}$$

$$= \frac{4}{1} = 4:1$$

6. Option (D) is correct

Explanation: Radius of Cone = r = 3.5 cm

Total height of toy = 15.5 cm

Radius of Hemisphere = radius of cone = r = 3.5 cm

Height of cone = 15.5 – 3.5 = 12 cm

Now, Pythagoras Theorem to find slant height of the cone.

Slant height of cone

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

$= \sqrt{(3.5)^2+(12)^2} = \sqrt{12.25+144}$

$= \sqrt{156.25} = 12.5$ cm

Total surface area of toy

= Surface area of Cone + Surface area of Hemisphere

$= \pi rl + 2\pi r^2$

$= \left(\frac{22}{7}\times 3.5\times 12.5\right)+2\times\frac{22}{7}\times 3.5\times 3.5$

$= 137.5 + 77 = 214.5\text{ cm}^2$

7. Option (B) is correct

Explanation: The inner radius $r_{inner} = 5$ cm

The thickness of the steel is 1 cm, so the outer radius $r_{outer} = r_{inner} + 1 = 6$ cm

$V_{hemisphere} = \frac{2}{3}\neq r^3$

For the outer hemisphere with $r_{outer} = 6$ cm

$V_{outer} = \frac{2}{3}\pi(6)^3 = \frac{2}{3}\pi\times 216$

$= \frac{432}{3}\pi\text{ cm}^3$

Volume of the inner hemisphere:

For the inner hemisphere with $r_{inner} = 5$ cm

$V_{inner} = \frac{2}{3}\neq(5)^3 = \frac{2}{3}\pi\times 125$

$= \frac{250}{3}\neq$

$V_{steel} = V_{outer} - V_{inner} = \frac{432}{3}\pi - \frac{250}{3}\neq$

$V_{steel} = \left(\frac{432}{3}-\frac{250}{3}\right)\pi = \frac{182}{3}\neq\text{ cm}^3$

8. Option (C) is correct

Explanation: Flow speed : 2 km/h = 2000 m/h.

Time : 2 minutes $= \frac{2}{60}$ hours $= \frac{1}{30} = \frac{1}{30}$ hours

This distance d travelled by water in 2 minutes is:

d = speed × time

$= 2000\text{ m/h}\times\frac{1}{30}$ hours

$= \frac{2000}{30}$ m

The volume V of water that flows in this time is given by

V = cross-sectional area × distance

The cross-sectional area A of the river is:

A = width × depth = 40 m × 3m

$= 120\text{ m}^2$

The volume of water is:

$V = 120\text{ m}^2 \times 66.67 = 8000\text{ m}^3$

9. Option (B) is correct

Explanation: Cuved Surface of a cylinder is 94.2 cm^2

Height of the cylinder (h) = 5 cm

Let the radius of the cylinder be r

CSA of cylinder is $2\pi rh$

$\Rightarrow \quad 2\pi rh = 94.2\text{ cm}^2$

$\Rightarrow \quad 2\times 3.14\times r\times 5 = 94.2$

$\Rightarrow \quad 31.4\,r = 94.2$

$\Rightarrow \quad r = \frac{94.2}{31.4}$

$\Rightarrow \quad r = 3$ cm

10. Option (C) is correct

Explanation: Radius of cone, $r = 7$ cm

Height of cone, $h = 24$ cm

$\because \quad l^2 = r^2 + h^2$

$\therefore \quad l^2 = 7^2 + 24^2$

$l^2 = 49 + 576$

$l^2 = 625$

$l = 25$

Curved surface area of Cone

$= \pi rl$

$= \frac{22}{7}\times 7\times 25$

$= 22 \times 25$

$= 550\text{ cm}^2$

11. Option (D) is correct

Explanation: $r = \frac{d}{2}$

The curved surface area (CSA) is:

$\text{CSA} = 2\pi r^2 = 2\pi\left(\frac{d}{2}\right)^2 = \frac{\pi d^2}{2}$

$\text{Base Area} = \pi r^2 = \pi\left(\frac{d}{2}\right)^2 = \frac{\pi d^2}{4}$

The total surface area of the solid hemisphere is the sum of the curved surface area and the base area:

$\text{Total Surface Area} = \frac{\pi d^2}{2}+\frac{\pi d^2}{4} = \frac{3\pi d^2}{4}$

12. Option (B) is correct

Explanation: For Cone P:

Radius $r = 3$ cm

Slant height $l = 5$ cm

$\text{CSA}_P = \pi\times 3\times 5 = 15\pi\text{ cm}^2$

For cone Q:

Radius $r = 5$ cm

Slant height $l = 7$ cm

$\text{CSA}_Q = \pi\times 5\times 7 = 35\pi\text{ cm}^2$

For Cone R:

Radius $r = 3.5$ cm

Slant height $l = 10$ cm

$\text{CSA}_R = \pi\times 3.5\times 10 = 35\pi\text{ cm}^2$

Conclusion:

- Curved surface area of Cone P = $15\pi\text{ cm}^2$
- Curved surface area of Cone Q = $35\pi\text{ cm}^2$
- Curved surface area of Cone R = $35\pi\text{ cm}^2$

Thus, Cone Q and Cone R have the same curved surface area.

13. Option (B) is correct

Explanation: Base area = P

$lb = P$

Volume of sphere R cu unit

let the increase height = h_1

volume of increase area = volume of sphere

$$lbh_1 = R$$
$$Ph_1 = R$$
$$h_1 = R/P$$

So increase height is $\frac{R}{P}$ units.

ASSERTION-REASON QUESTIONS (1 Mark)

1. Option (D) is correct

Explanation: When two cubes are joined together, the dimensions of the resulting cuboid are:

Length (l) = 10 + 10 = 20 cm

Weight (w) = 10 cm

Height (h) = 10 cm

The surface are of a cuboid is

$$S_{cuboid} = 2(l \times w + w \times h + h \times l)$$
$$= 2(20 \times 10 + 10 \times 10 + 10 \times 20)$$
$$= 2(200 + 100 + 200)$$
$$= 1000 \text{ cm}^2$$

Hence, assertion is false.

The area of each surface of a cube with side 10 cm is:

$$\text{Area} = 10 \times 10 = 100 \text{ cm}^2$$

Hence, reason is true.

2. Option (B) is correct

Explanation: In case of Assertion. The total surface area of the top will not include the plane surfaces where the hemisphere and the cone are joined. Thus, the total surface area would be the curved surface area of the hemisphere plus the curved surface area of the cone, without including the circular base of the cone and hemisphere where they are attached.

$\therefore$ Assertion is true

In case of Reason: The reason discusses the plane surfaces, which are not part of the total surface area. Therefore, the correct answer is Both assertion (A) and reason (R) are true, but reason (R) is not the correct explanation of assertion (A).

3. Option (D) is correct

Explanation: In case of assertion,

- Each cube has a side length of 1 cm .
- Two cubes are joined end to end, the dimensions of the resulting cuboid will be:
- Length (L) : 1 + 1 = 2 cm
- Width (W): 1 cm
- Height (H):1cm

surface area of a cuboid is given by formula:

$$A = 2(LW + LH + WH)$$

L = 2 cm, W = 1 cm, H = 1 cm :

$$A = 2(2 \times 1 + 2 \times 1 + 1 \times 1)$$
$$= 2(2 + 2 + 1) = 2 \times 5$$
$$= 10 \text{ cm}^2$$

The surface area of the cuboid is 10 cm^2, not 160 cm^2.

$\therefore$ Assertion is false.

Reason (R) : "Surface area of a cuboid of dimensions $l \times b \times h$ is $2(lb + bh + hl)$."

This is the correct formula for the surface area of a cuboid, the reason is true.

Thus, Assertion is false but Reason is true.

VERY SHORT ANSWER TYPE QUESTIONS (1 Mark)

1. TSA of toy = CSA of cylinder + CSA of two hemisphere.

CSA of cylinder = $2\pi rh$

r = 7 cm (radius of the cylinder)

h = 20 cm (height of the cylinder)

CSA of cylinder = $2\pi \times 7 \times 20 = 280\pi$ cm^2 ...(i)

Surface area of one hemisphere = $2\pi r^2$

Surface area of two hemispheres = $2 \times 2\pi r^2 = 4\pi r^2$

r = 7 cm

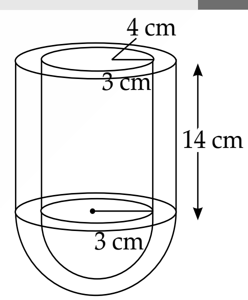
Surface area of two hemispheres = $4\pi \times 7^2 = 196\pi$ cm^2 ...(ii)

From (i) and (ii)

Total surface area = $280\pi + 196\pi = 476\pi$ cm^2

Total surface area = $476 \times \frac{22}{7} = 1496$ cm^2

2. Total surface Area = CSA of cylinder (outer + inner) + CSA of hemisphere (outer + inner) + Area of ring.



Given : Height of cylinder (H) = 14 cm

Outer Radius of cylinder (R_2) = 4 cm

Inner Radius of cylinder (R_1) = 3 cm

Outer Radius of hemisphere (r_2) = 4 cm

Inner Radius of hemisphere (r_1) = 3 cm

Now, CSA of cylinder = $2\pi R_2 H + 2\pi R_1 H$

$$= 2\pi H (R_1 + R_2)$$
$$= 2 \times \frac{22}{7} \times 14 \times (4 + 3)$$
$$= 88 \times 7 = 616 \text{ cm}^2 \quad ...(i)$$

CSA of Hemisphere = $2\pi(r_1)^2 + 2\pi(r_2)^2$

$$= 2\pi(r_1^2 + r_2^2)$$

$$= 2\times\frac{22}{7}\times(3^2+4^2)$$

$$= 2\times\frac{22}{7}\times 25 = 157.14 \text{ cm}^2 \quad ...(ii)$$

Area of ring $= \pi R_2^2 - \pi R_1^2 = \pi(R_2^2 - R_1^2)$

$$= \frac{22}{7}(16-9) = \frac{22}{7}\times 7$$

$$= 22 \text{ cm}^2 \quad ...(iii)$$

By adding (i), (ii) and (iii) we get

TSA $= 616 + 157.14 + 22$

$= 795.14 \text{ cm}^2$

3. Given :

Diameter of the hemisphere, $d = 14$ cm

Radius of the hemisphere, $r = 7$ cm $\left[\because r = \frac{d}{2}\right]$

Height of cylindrical portion, $h = 13 - 7 = 6$ cm

Inner Surface area of vessel = CSA of cylinder + CSA of hemisphere

Now, Curved surface area of cylindrical portion is:

$$= 2\pi rh = 2\times\frac{22}{7}\times 7\times 6$$

$$= 2\times 22\times 6$$

$$= 264 \text{ cm}^2 \quad ...(i)$$

Curved surface area of hemispherical portion is:

$$= 2\pi r^2$$

$$= 2\times\frac{22}{7}\times 7^2$$

$$= 308 \text{ cm}^2 \quad ...(ii)$$

By adding (i) and (ii) we get,

Total inner surface area = 308 cm^2 + 264 cm^2 = 572 cm^2

Hence, the inner surface area of the vessel is 572 cm^2.

4. Volume of a cone $= \frac{1}{3}\neq r^2h$

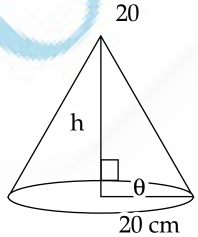
$$\frac{1}{3}\times 3\times 20\times 20\times h = 13600 \quad (\because \pi = 3)$$

$400\,h = 13600$

$\Rightarrow h = 34$ cm

Let the angle, be θ, which the slant height makes with the base radius.

$$\tan\theta = \frac{34}{20}$$



$\Rightarrow \tan\theta = 1.7$

$\tan\theta = \sqrt{3}$

$\Rightarrow \tan\theta = \tan 60°$ $\quad (\because \tan 60° = \sqrt{3})$

$\Rightarrow \theta = 60°$

$\therefore$ The angle which the slant height makes with the base radius is 60°.

5. The radius r of the sphere is half of the side of cube.

$$r = \frac{21}{2} = 10.5 \text{ cm}$$

The volume V of a sphere is:

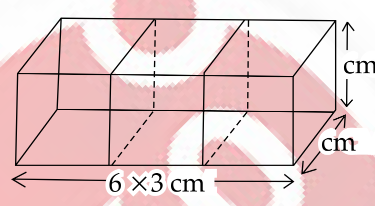
$$V = \frac{4}{3}\neq r^3$$

$$V = \frac{4}{3}\neq(10.5)^3$$

$$= \frac{4}{3}\times\frac{22}{7}\times 10.5\times 10.5\times 10.5$$

$$= 4851 \text{ cm}^3$$

6.



The dimension of the cuboids so formed are length = 18 cm, breadth = 6 cm and height = 6 cm.

Surface area of cuboids $= 2\,(l\times b + b + h + l\times h)$

$= 2\times[18\times 6 + 6\times 6 + 18\times 6]$

$= 2\times(108 + 36 + 108)$

$= 2\times 252$

$= 504 \text{ cm}^2$

7. Volume of each cube V = 64 cm^3

The volume of a cube V = a^3

Given V = 64 cm^3:

$a^3 = 64$

$\Rightarrow a = \sqrt[3]{64}$

$a = 4$ cm

Now, Dimensions of cuboid are :

L $= 3\times a = 3\times 4 = 12$ cm

W $= a = 4$ cm

H $= a = 4$ cm

Surface Area, S = 2(LW + LH + WH)

S $= 2[(12\times 4) + (12\times 4) + (4\times 4)]$

S $= 2(48 + 48 + 16)$

S $= 2\times 112$

S $= 224 \text{ cm}^2$

The surface area of the resulting cuboid is 224 cm^2.

8. Volume of cone = Volume of sphere

Volume of a cone :

$$V_{cone} = \frac{1}{3}\neq r^2h$$

where,

$r = 7$ cm (radius of the base of the cone)

$h = 28$ cm (height of the cone)

$$V_{cone} = \frac{1}{3}\neq(7)^2(28)$$

$$= \frac{1}{3}\pi\times 49\times 28 = \frac{1}{3}\pi\times 1372$$

$$V_{cone} = \frac{1372}{3}\neq cm^3 \quad ...(i)$$

$$V_{sphere} = \frac{4}{3}\neq r^3 \quad ...(ii)$$

From (i) and (ii)

$$\frac{1372}{3}\neq = \frac{4}{3}\neq R^3$$

$$\frac{1372}{3} = \frac{4}{3}R^3$$

Multiply both sides by 3 to get rid of the denominator:

$$1372 = 4R^3$$

$$R^3 = \frac{1372}{4} = 343$$

$$R = \sqrt[3]{343} = 7cm$$

Hence, radius of the sphere is 7 cm.

9. Let 'r' be the radius (same for both the cylinder and cone)

h_c be the height of the cone

h_{cy} be the height of the cylinder.

Volume of the Cone

$$V_{cone} = \frac{1}{3}\neq r^2 h_c$$

Volume fo the Cylinder:

$$V_{cylinder} = \pi r^2 h_{cy}$$

As, per the given information

$$\frac{1}{3}\neq r^2 h_c = \pi r^2 h_{cy}$$

$$\Rightarrow \quad \frac{1}{3}h_c = h_{cy}$$

Thus, the height of the cylinder is actually $\frac{1}{3}$ times the height of the cone. Thus, the statement is false.

10. Volume of Cuboid = $l \times b \times h$

Height, $h = \dfrac{3\times 100\times 100\times 100}{7200}$ = 416.67 cm

$$\Rightarrow \quad h = 4.1667 \text{ m}$$

$$\Rightarrow \quad h \sim 4.2 \text{ m}$$

SHORT ANSWER TYPE QUESTIONS (3 Marks)

1. The total volume of the room = The volumes of the cylindrical + The volume of hemisphere.

Volume of the cylinder is:

$$V_{cylinder} = \pi r^2 h = \frac{22}{7}\times r^2 \times h$$

Volume of the hemisphere is:

$$V_{hemisphere} = \frac{2}{3}\pi r^3 = \frac{2}{3}\times\frac{22}{7}\times r^3$$

The total volume of the room is:

$$V_{total} = V_{cylinder} + V_{hemisphere}$$

$$= \frac{22}{7}\times r^2\times h + \frac{2}{3}\times\frac{22}{7}\times r^3$$

Given that the total volume is $\frac{1408}{21}$ m^2, so:

On substituting Total Volume

$$\frac{22}{7}\times r^2\times h + \frac{2}{3}\times\frac{22}{7}\times r^3 = \frac{1408}{21}$$

Since the radius r is half the height of the cylindrical part h, we substitute $r = \frac{h}{2}$ into the equation.

$$\text{Total volume} = \frac{22}{7}\times h\times\left(\frac{h}{2}\right)^2 + \frac{2}{3}\times\frac{22}{7}\times\left(\frac{h}{2}\right)^3$$

$$= \frac{22}{7}\times\frac{h^3}{4} + \frac{2}{3}\times\frac{22}{7}\times\frac{h^3}{8}$$

Now, the total volume

$$\Rightarrow \quad \frac{22}{7}\times\frac{h^3}{4} + \frac{22}{7}\times\frac{h^3}{12} = \frac{1408}{21}$$

$$\frac{22}{7}\times h^3\left(\frac{1}{4}+\frac{1}{12}\right) = \frac{1408}{21}$$

$$\Rightarrow \quad \frac{22}{7}\times h^3\times\frac{1}{3} = \frac{1408}{21}$$

$$\Rightarrow \quad \frac{22}{7}\times h^3 = \frac{1408\times 3}{21} = \frac{4224}{21} = 201.14$$

$$\Rightarrow \quad h^3 = \frac{201.14\times 7}{22} = \frac{1407.98}{22} = 64$$

$$\Rightarrow \quad h = \sqrt[3]{64} = 4.$$

Since $r = \frac{h}{2} = \frac{4}{2} = 2,$

Thus, Total height = $h + r$ = 4 + 2 = 6 meters.

2. Volume of the cone

$$= \frac{1}{3}\pi r^2 I/F = \frac{1}{3}\pi\times(3)^2\times 12 = 36\pi$$

When Ice cream is filled in this cone, its $\frac{1}{6}$ th portion is unfilled and $\frac{5}{6}$ th gets filled.

Hence, volume of this $\frac{5}{6}$ th cone = $\frac{5}{6}\times 36\pi = 30\pi$

Volume of Ice-cream's hemispherical shape on top of the cone = $\frac{2}{3}\pi r^3 = \frac{2}{3}\pi\times(3)^3 = 18\pi$

Total Volume of Ice-cream = 30π + 18π = 48π = 48 × 3.14 = 150.72 cm^3

3. Given, radius of sphere = 105 cm

radius of cone = 15 cm

height of cone = 3 cm

No. of cones formed = $\frac{\text{volume of sphere}}{\text{volume of cone}}$

$$\Rightarrow \frac{\frac{4}{3}\neq r^3}{\frac{1}{3}\neq r^2 h} = \frac{4r^3}{r^2 h} = \frac{4\times105\times105\times105}{15\times15\times3}$$

= 6860 cones

4. Width of the canal = 300 cm = 3 m

Depth of the canal = 120 cm = 1.2 m

Speed of water flow = 20 km/ h = 20000 m/h

Distance covered by water in 1 hour or 60 min = 20000 m

Distance covered by the water in 20 min

$$= \frac{20}{60}\times 20000 = \frac{20000}{3} \text{ m}$$

Amount of water irrigated in 20 minutes

$$= 3 \times 1.2 \times \frac{20000}{3}$$

$$= 24000 \text{ m}^3$$

Area irrigated by this water if 8 cm of standing water is desired will be

$$\frac{24000}{\frac{8}{100}} = 300000 \text{ m}^2$$

So, area irrigated will be 300000 m^2

5. The curved surface area of a right circular cylinder

$$A_{cylinder} = 2\pi rh$$

The curved surface area of a right circular cone

$$A_{cone} = \pi rl$$

l is the slant height of the cone,

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

The ratio of their curved surface areas is given as 8 : 5. Hence,

$$\frac{A_{cylinder}}{A_{cone}} = \frac{8}{5}$$

$$\Rightarrow \frac{2\pi rh}{\pi r\sqrt{r^2+h^2}} = \frac{8}{5}$$

$$\Rightarrow \frac{2h}{\sqrt{r^2+h^2}} = \frac{8}{5}$$

$$\Rightarrow 5\times 2h = 8\sqrt{r^2+h^2}$$

$$\Rightarrow 10h = 8\sqrt{r^2+h^2}$$

$$\Rightarrow \frac{10h}{8} = \sqrt{r^2+h^2}$$

$$\frac{5h}{4} = \sqrt{r^2+h^2}$$

On squaring both sides we get,

$$\left(\frac{5h}{4}\right)^2 = r^2 + h^2$$

$$\frac{25h^2}{16} = r^2 + h^2$$

$$25h^2 = 16r^2 + 16h^2$$

$$25h^2 - 16h^2 = 16r^2$$

$$9h^2 = 16r^2$$

$$h^2 = \frac{16r^2}{9}$$

$$h = \frac{4r}{3}$$

Ratio of the radius of their bases r to their heights h is:

$$\frac{r}{h} = \frac{r}{\frac{4r}{3}}$$

Ratio between the radius of their bases to their heights is:

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

6. We have, the total height of the toy = 90 cm and the radius of the toy, $r = \frac{42}{2} = 21$ cm

Also, the height of the cylinder = 90 – 42 = 48 cm

Now, the total surface area of the toy = CSA of cylinder + 2 × CSA of a hemisphere

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

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

$$= 2\times\frac{22}{7}\times 21 \times (48 + 2\times 21)$$

$$= 44 \times 3 \times (48 + 42)$$

$$= 44 \times 3 \times 90$$

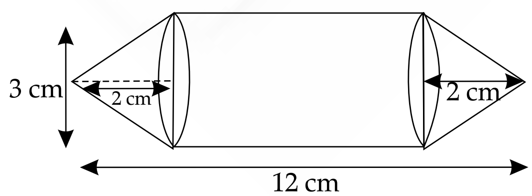
$$= 11880 \text{ cm}^2$$

So, the cost of painting the toy = $\frac{11880\times70}{100}$

= ₹ 8,316.

LONG ANSWER TYPE QUESTIONS (5 Marks)

1.



Given, height of each cone (h) = 2 cm

Total Length of model = 12 cm

Diameter of model = 3 cm

Now, Length of cylinder (H) = Total length of model – 2 × height of cone

= 12 – 2 × 2

= 12 – 4

= 8 cm

and radius of cone = radius of cylinder (s)

$$= \frac{\text{Diameter of model}}{2}$$

$$= \frac{3}{2} \text{ cm}$$

Now, volume of the model = Volume of cylinder + 2 × Volume of cone

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

$$= \pi r^2 \left(H + \frac{2}{3} h \right)$$

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

$$= \frac{22}{7} \times \frac{9}{4} \times \frac{24+4}{3}$$

$$= \frac{3 \times 22 \times 28}{7 \times 4}$$

$$= 66 \text{ cm}^3$$

2. Given,

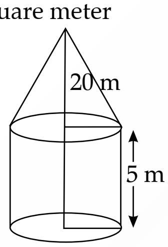
Radius of the cylindrical base r = 21 m

Height of the cylindrical part $h_{cylinder}$ = 5 m

Height of the conical part h_{cone} = 20 m

Cost of white fabric for the cylindrical part = 60 per square meter

Cost of blue PVC fabric for the conical part = 70 per square meter



Lateral surface area of a cone is :

$$A_{cone} = \pi r l$$

where l is the slant height of the cone, calculated using the Pythagorean theorem:

$$l = \sqrt{r^2 + h_{cone}^2}$$

Subsitute the given values:

$$l = \sqrt{21^2 + 20^2} = \sqrt{441 + 400}$$

$$= \sqrt{841} = 29 \text{ m}$$

Now, the lateral surface area of the conical part:

$$A_{cone} = \pi \times 21 \times 29 = 609\,\pi \text{ sq. m}$$

$$\approx 609 \times 3.14 = 1912.26 \text{ sq.m}$$

The lateral surface area of a cylinder is :

$$A_{cylinder} = 2\pi r h_{cylinder}$$

Substitute the given values:

$$A_{cylinder} = 2\pi \times 21 \times 5$$

$$= 210\pi \text{ sq. m} \approx 210 \times 3.14$$

$$= 659.4 \text{ sq.m}$$

Cost of :

(A) Blue PVC fabric for the conical part:

Area required = 1912.26 sq. m

Cost per square meter = ₹ 70

Total cost for the conical part :

Total cost = 1912.26 × 70 = ₹ 1,33,858.20

(B) White fabric for the cylindrical part:

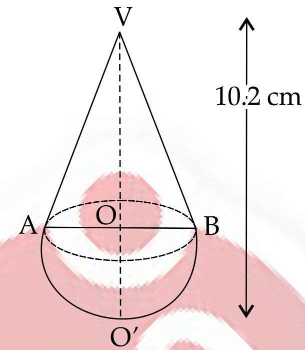
Area required = 659.4 sq.m

Cost per square meter = ₹ 60

Total cost for the cylindrical part:

Total cost = 659.73 × 60 = ₹ 39564

3.



VO′ = 10.2 cm, OA = OO′ = 4.2 cm

Let r be the radius of the hemisphere and h be the height of the conical part of the toy.

r = OA = 4.2 cm

h = VO = VO′ – OO′

= (10.2 – 4.2) cm

= 6 cm

Volume of the wooden toy

= Volume of the conical part + Volume of the hemispherical part

$$= \left(\frac{1}{3} \pi r^2 h + \frac{2\pi}{3} r^3 \right)$$

$$= \frac{\pi r^2}{3} (h + 2r)$$

$$= \frac{1}{3} \times \frac{22}{7} \times 4.2 \times 4.2 \times [6 + (2 \times 4.2)]$$

$$= \frac{1}{3} \times \frac{22}{7} \times 4.2 \times 4.2 \times 14.4$$

$$= 266.11 \text{ cm}^3$$

4. Let the vertical length of the cuboid in orientation I = h cm.

Then, the height of water as (h – 4) cm.

Now, length of cuboid in orientation II = Height of cuboid in orientation I

⇒ l of orientation II = h

b of orientation II = 5

Height of water in orientation II is $\frac{1}{2}$ (h – 4) cm.

Thus, Volume of water is:

$$5 \times h \times \frac{1}{2} (h - 4) = 480$$

$$\Rightarrow \quad h^2 - 4h - 192 = 0$$

$$h^2 - 16h + 12h - 192 = 0$$

$$h(h - 16) + 12(h - 16) = 0$$

$\therefore \quad h = -12$ or $+ 16$

(Reject $h = (-12)$ as height cannot be negative)

Height of water in

orientation I = 16 – 4 = 12 cm

orientation II = $\frac{1}{2} \times 12 = 6$ cm

5. (i) Surface Area of Solid (Hemisphere + Cylinder)

Given:

Radius of the hemisphere and cylinder, $r = 7$ cm

Height of the cylinder, $h = 14$ cm

The surface area of the curved part of the hemisphere is given by :

$$A_{hemisphere} = 2\pi r^2 = 2 \times \frac{22}{7} \times 7^2 = 308 \text{ cm}^2$$

Curved Surface Area of the Cylinder:

$$A_{cylinder} = 2\pi rh = 2 \times \frac{22}{7} \times 7 \times 14$$

$$= 616 \text{ cm}^2$$

Area of the Base of the Cylinder:

$$A_{base} = \pi r^2 = \frac{22}{7} \times 7^2 = 154 \text{ cm}^2$$

The total surface area of Solid I = the surface areas of the hemisphere + the curved part of the cylinder, + the base:

$$A_{total} = A_{hemisphere} + A_{cylinder} + A_{base}$$

$$= 308 + 616 + 154 = 1078 \text{ cm}^2$$

Surface Area of Solid III Painted Red:

The red-painted surface area of solid III is half of the total surface area :

$$A_{red} = \frac{1}{2} \times (308 + 616 + 154)$$

$$= \frac{1}{2} \times 1078 = 539 \text{ cm}^2$$

(ii) The surface area painted yellow. Consists of semi circle and a rectangle.

Area of the Semi circle

The area of a semi circle with radius $r = 7$ cm is:

$$A_{semicircle} = \frac{1}{2}\pi r^2 = \frac{1}{2} \times \frac{22}{7} \times 7^2 = 77 \text{ cm}^2$$

Area of the Rectangle:

The rectangle has dimensions equal to the height of the cylinder and the diameter of the base, i.e. $14 \times 14 = 196$ cm^2

Total Surface Area Painted Yellow:

The total surface area painted yellow area of the semicircle + the area of rectangle:

$$A_{yellow} = A_{semicircle} + A_{rectangle}$$

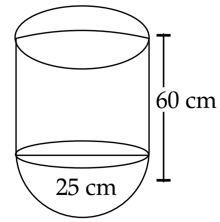
$$= 77 + 196 = 273 \text{ cm}^2$$

6. Total length of the jackfruit = 60 cm

Diameter = 25 cm

radius $r = \frac{25}{2} = 12.5$ cm

Volume of the jackfruit = volume of cylinder + volume of 2 hemishere



Length of the cylindrical part = 60 – 2 × 12.5 = 60 – 25 = 35 cm

$$V_{cylinder} = \pi r^2 h,$$

r is the radius and h is the height (or length) of the cylinder.

$$V_{cylinder} = 3.14 \times (12.5)^2 \times 35$$

$$= 3.14 \times 156.25 \times 35$$

$$= 17{,}171.875 \text{ cm}^3$$

The volume V_{sphere} of a full sphere

$$V_{sphere} = \frac{4}{3} \neq r^3 \quad (\because \text{ 2 hemisphere = 1 sphere})$$

Volume equals the volume of one full sphere:

$$V_{hemispheres} = \frac{4}{3} \neq (12.5)^3 = \frac{4}{3} \times 3.14 \times (12.5)^3$$

$$= \frac{4}{3} \times 3.14 \times 1{,}953.125$$

$$= 8177.08 \text{ cm}^3$$

Total volume of the jackfruit:

$$V_{jackfruit} = V_{cylinder} + V_{hemispheres}$$

$$= 17171.875 + 8177.08$$

$$= 25{,}348.955 \text{ cm}^3$$

Volume of the jackfruit is approximately 25,369.17 cm^3

Now,

Length = 60 cm (total length of the jackfruit)

Width = 25 cm (equal to the diameter)

Height = 25 cm (equal to the diameter)

The volume V_{box} of the cuboidal container is:

$$V_{box} = \text{length} \times \text{width} \times \text{height}$$

$$= 60 \times 25 \times 25$$

$$= 37{,}500 \text{ cm}^3$$

Volume of the smallest cuboidal box is 37,500 cm^3

7. Diameter of Sphere = d = 8.5 cm

Radius of Sphere = $r = \frac{d}{2} = \frac{8.5}{2}$

$= 4.25$ cm

Volume of Sphere

$$= \frac{4}{3} \neq r^3 = \frac{4}{3} \times 3.14 \times (4.25)^3$$

$$= 321.392 \text{ cm}^3$$

Diameter of Cylinder = d_1 = 2 cm

Radius of Cylinder = $r_1 = \frac{d_1}{2} = 1$ cm

Height of Cylinder = h = 8 cm

Volume of Cylinder

$$= \pi.(r_1)^2.h = 3.14 \times (1)^2 \times 8$$

$$= 25.12 \text{ cm}^3$$

Volume of Water in the Vessel

= Volume of Sphere + Volume of Cylinder

$= 321.392 + 25.12$

$= 346.512$ cm^3

It means, he was not correct.

Level - 2 ADVANCED COMPETENCY FOCUSED QUESTIONS

MULTIPLE CHOICE QUESTIONS (MCQs) (1 Mark)

1. Option (A) is correct

Explanation: Each hemisphere has a radius $= 0.25$ cm.

So combined length of two hemispheres $= 2 \times 0.25 = 0.5$ cm

Length of cylindrical part $= 2 - 0.5 = 1.5$ cm

TSA = Curved Surface Area of Cylinder + Surface Area of Sphere

CSA of cylinder:

$2\pi rh = 2 \times 3.14 \times 0.25 \times 1.5 = 2.355\,\text{cm}^2$

Surface area of the sphere (2 hemispheres):

$4\pi r^2 = 4 \times 3.14 \times (0.25)^2 = 4 \times 3.14 \times 0.0625 = 0.785\,\text{cm}^2$

TSA $= 2.355 + 0.785 = 3.14\,\text{cm}^2$

2. Option (D) is correct

Explanation: Since the hemisphere sits on top, its radius contributes to the total height:

Height of cylinder $= 5 - 3.5 = 1.5$ m

Saksham will polish the curved surface area of the cylinder and the curved surface area of the hemisphere.

Curved Surface Area (CSA) of Cylinder:

$$2\pi rh = 2 \times \frac{22}{7} \times \frac{7}{2} \times 1.5 = 22 \times 1.5 = 33\,\text{m}^2$$

CSA of Hemisphere:

$$2\pi r^2 = 2 \times \frac{22}{7} \times (3.5)^2 = \frac{22 \times 24.5}{7} = \frac{539}{7} = 77\,\text{m}^2$$

Total surface area to be polished

TSA $= 33 + 77 = 110\,\text{m}^2$

Cost of polishing $= 110 \times 0.50 = ₹\,55$

3. Option (C) is correct

Explanation: Volume = volume of cylinder + volume of hemisphere.

Volume of cylinder

$$V_{cyl} = \pi r^2 h = \frac{22}{7} \times (4.2)^2 \times 10.8 = \frac{22}{7} \times 17.64 \times 10.8 = \frac{22}{7} \times 190.512 = 598.75\,\text{cm}^3$$

Volume of hemisphere

$$V_{hemi} = \frac{2}{3}\pi r^3 = \frac{2}{3} \times \frac{22}{7} \times (4.2)^3 = \frac{2}{3} \times \frac{22}{7} \times 74.088 = \frac{2}{3} \times \frac{1627.94}{7} = \frac{2}{3} \times 232.848 = 155.1629.94\,\text{cm}^3$$

Total Volume of One Glass

$V_{total} = 598.75 + 155.23 = 753.98\,\text{cm}^3$

Volume of 8 Glasses

$8 \times 753.98 \approx 6031.84 \sim 6032\,\text{cm}^3$

So, option (C) is the nearest.

4. Option (B) is correct

Explanation: Volume of one cube:

$V = k^3$ cubic units

Volume of two such cubes

$V_{total} = 2 \times k^3 = 2k^3$

5. Option (C) is correct

Explanation: Volume of earth dug out (volume of cylinder)

Volume $= \pi r^2 h = 3.14 \times 1^2 \times 14 = 3.14 \times 14 = 43.96\,\text{m}^3$

Cost of digging

Cost $= 43.96 \times 50 = ₹\,2198$

ASSERTION-REASON QUESTIONS (1 Mark)

1. Option (D) is correct

Explanation: Assertion is false because if the entire outer surface is to be painted, then both circular ends must be included.

Reason is true and a correct mathematical fact.

2. Option (A) is correct

Explanation: Assertion is true, since the bottles are cylindrical and the box is cuboidal, the bottles won't perfectly fill the box without gaps. So, the box volume must be greater than the sum of the volumes of all 10 bottles.

Because of the shape difference and packing arrangement, there will be empty space (wasted volume).So, the Reason is true.

3. Option (A) is correct

Explanation:
$$V = \pi r^2 h = \frac{22}{7} \times (1.4)^2 \times 3 = \frac{22}{7} \times 1.96 \times 3 = \frac{22}{7} \times 5.88 = \frac{129.39}{7} = 18.48\,\text{m}^3 \approx 18.5\,\text{m}^3$$

So, Assertion is true.

Reason is also true because the volume of a cylinder is given by $\pi r^2 h$.

Both assertion and reason are true and reason is the correct explanation of the assertion.

4. Option (A) is correct

Explanation: Assertion is true because labels are typically wrapped around the curved surface of the can, not the top or bottom.

Reason is also true because this is the correct formula and explains how labeling area is calculated.

Both assertion and reason are correct and the reason correctly explains the assertion.

VERY SHORT ANSWER TYPE QUESTIONS (2 Marks)

1. Since top is excluded, we need to calculate Curved

Sur face Area (CSA) $= 2\pi rh$ and bottom area

$= \pi r^2$

Total area to be painted = CSA + bottom area

$= 2 \times 3.14 \times 0.5 \times 1.2 + 3.14 \times (0.5)^2$

$= 3.768 + 0.78 = 4.553 \text{ m}^2$

Cost of painting $= 4.55 \times 25 = ₹ 113$.

2. CSA $= 2\pi rh$

Substituting the values:

CSA $= 2 \times 3.14 \times 0.5 \times 1.2$

$= 3.768 \text{ m}^2$

The total area to be painted is 3.768 m^2

3. Only curved surfaces (not base) are to be coated.

Surface area of a single hemisphere (curved part only)

Curved surface area of a hemisphere:

CSA $= 2\pi r^2$

So, Outer surface area $= 2 \times 3.14 \times (10)^2$

$= 2 \times 3.14 \times 100$

$= 628 \text{ cm}^2$

Same for the inner surface (assuming same radius):

Inner surface area $= 628 \text{ cm}^2$

Total area to be coated

Total area = Outer + Inner

$= 628 + 628 = 1256 \text{ cm}^2$

Total surface area to be coated $= 1256 \text{ cm}^2$

4. The glass is composed of a cylinder of height 8 cm and a hemisphere at the base (bottom)

Volume of the cylindrical part:

Vaglinder $= \pi r^2 h$

$= \frac{22}{7} \times (3.5)^2 \times 8$

$= \frac{22}{7} \times 12.25 \times 8$

$= 308 \text{ cm}^3$

Volume of hemispherical base:

$V_{hemisphere} = \frac{2}{3}\pi r^3 = \frac{2}{3} \times \frac{22}{7} \times (3.5)^3$

$= \frac{2}{3} \times \frac{22}{7} \times 42.875$

$= \frac{2}{3} \times \frac{943.25}{7} = \frac{2}{3} \times 134.75$

$= 89.83 \text{ cm}^3$

Total volume of the glass

$V_{total} = 308 + 89.83 = 397.83 \text{ cm}^3$

Total volume of the juice glass is 397.83 cm^3

SHORT ANSWER TYPE QUESTIONS (3 Marks)

1. Curved surface area of the tank:

CSA $= 2\pi rh = 2 \times \frac{22}{7} \times 2 \times 3.5$

$= \frac{308}{7} = 44 \text{ m}^2$

Area of the base $= \pi r^2 = \frac{22}{7} \times (2)^2 = 12.57 \text{ m}^2$

Total area to be coated $= 44 + 12.57 = 56.57 \text{ m}^2$

Cost of painting $= 56.57 \times 85 = ₹ 4{,}808.45$

2. Curved Surface Area of Cylinder:

$CSA_{cylinder} = 2\pi rh = 2 \times \frac{22}{7} \times 3.5 \times 4$

$= 2 \times \frac{22}{7} \times 14 = \frac{616}{7}$

$= 88 \text{ cm}^2$

Curved surface area of hemisphere

$CSA_{hemisphere} = 2\pi r^2 = 2 \times \frac{22}{7} \times (3.5)^2$

$= 2 \times \frac{22}{7} \times 12.25$

$= \frac{539}{7} = 77 \text{ cm}^2$

Total surface area of one cup $= 88 + 77 = 165 \text{ cm}^2$

Material required for 100 cups $= 100 \times 165$

$= 16{,}500 \text{ cm}^2$

3. (i) Curved surface area of a hemisphere

CSA $= 2\pi r^2 = 2 \times \frac{22}{7} \times (2.8)^2$

$= 2 \times \frac{22}{7} \times 7.84 = \frac{344.96}{7}$

$= 49.28 \text{ m}^2$

So, the inner surface area to be painted is 49.28 m^2.

(ii) Cost of painting $= 49.28 \times 80 = ₹ 3{,}942.40$

4. (i) Curved Surface Area (CSA) of the Cylinder

CSA $= 2\pi rh = 2 \times \frac{22}{7} \times 1.5 \times 4$

$= \frac{264}{7} = 37.71 \text{ m}^2$ (approx)

(ii) Cost of painting $= 37.71 \times 95 = ₹ 3{,}582.86$

CASE BASED QUESTIONS (4 Marks)

1. (i) Area of base of the cylindrical cup $= \pi r^2$

Radius of the cylindrical cup $= \frac{7}{2}$ cm

$\therefore$ Area of base of cylindrical cup $= \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2}$

$= 11 \times \frac{7}{2} = 38.5 \text{ cm}^2$

Therefore, Area of base of the cylindrical cup is 38.5 cm^2

(ii) (a) Capacity of the hemispherical cup = $\frac{2}{3} \neq r^3$

The radius of the hemispherical cup = $\frac{21}{2}$ cm

∴ The capacity of hemispherical cup

$$= \frac{2}{3} \times \frac{22}{7} \times \left(\frac{21}{2}\right)^3$$

$$= \frac{2}{3} \times \frac{22}{7} \times \frac{9261}{8}$$

$$= 2425.5 \text{ cm}^3$$

Therefore, capacity of the hemispherical cup is 2425.5 cm^3

OR

(ii) (b) Capacity of the cylindrical cup = $\pi r^2 h$

Given that the radius of the cylindrical cup = $\frac{7}{2}$ cm and the height of the cup is 14 cm

∴ The capacity of the cylindrical cup

$$= \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 14$$

$$= 11 \times 7 \times 7 = 539 \text{ cm}^3$$

Therefore, capacity of the cylindrical cup is 539 cm^3.

(iii) Curved surface area of the cylindrical cup = $2\pi rh$

Given that the radius of the cylindrical cup = $\frac{7}{2}$ cm

and the height of the cup is 14 cm

∴ The curved surface area of the cylindrical cup

$$= 2 \times \frac{22}{7} \times \frac{7}{2} \times 14$$

$$= 2 \times 11 \times 14 = 308 \text{ cm}^2$$

Therefore, curved surface area of the cylindrical cup is 308 cm^2.

2. Diameter of golf ball = 4.2 cm = 42 mm

Radius of golf ball, R = 2.1 cm = 21 mm

Radius of dimple, r = 2 mm = 0.2 cm

(i) Surface area of each dimple $= 2\pi r^2$

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

$$= 2 \times \frac{22}{7} \times 4 = 25.1 \text{ mm}^2$$

(ii) Volume of the material dug out to make one dimple

= Volume of 1 dimple

$$= \frac{2}{3} \neq r^3$$

$$= \frac{2}{3} \times \frac{22}{7} \times (2)^3$$

$$= \frac{2}{3} \times \frac{22}{7} \times 8$$

$$= \frac{352}{21} \text{ mm}^3$$

$$= 16.76 \text{ mm}^3$$

(iii) (a) Surface area exposed to the surroundings

= Surface area of golf ball – Area of 315 circles + CSA of 315 semi-circle balls.

$$= 4\pi R^2 - 315 \times \pi r^2 + 315 \times 2\pi r^2$$

$$= 4\pi R^2 + 315 \times \pi r^2$$

$$= 4\pi(21)^2 + 315 \times \pi \times (2)^2$$

$$= (1764 + 1260) \times \frac{22}{7}$$

$$= 9504 \text{ mm}^2$$

OR

(b) Volume of the golf ball = volume of sphere – volume of 315 dimples

$$= \frac{4}{3}\pi R^3 - 315 \times \frac{2}{3}\pi r^3$$

$$= \frac{2}{3}\pi(2 \times R^3 - 315 \times r^3)$$

$$= \frac{2}{3}\pi\left[(2 \times (2.1)^3 - 315 \times (0.2)^3\right]$$

$$= \frac{2}{3}\pi[18.522 - 2.52]$$

$$= \frac{2}{3}\pi \times 16.002 = 33.528 \text{ cm}^3$$

$$= 33528 \text{ mm}^3$$

3. (i) To find the inner surface area of the cylindrical part of the tank, we calculate the curved surface area (CSA) of the cylinder:

$$\text{CSA}_{\text{cylinder}} = 2\pi rh = 2 \times \frac{22}{7} \times 2 \times 3$$

$$= \frac{264}{7} = 37.71 \text{ m}^2$$

(ii) $\text{CSA}_{\text{hemispere}} = 2\pi r^2 = 2 \times \frac{22}{7} \times 2^2$

$$= 2 \times \frac{22}{7} \times 4 = \frac{176}{7} = 25.14 \text{ m}^2$$

(iii) (a) Total inner surface area = 37.71 + 25.14

= 62.85 m^2

Total cost = 62.85 × 90

= ₹ 5656.5

OR

(b) Painting only the outer curved surface of the cylindrical tank.

$\text{CSA}_{\text{cylinder}}$ = 37.71 m^2 (already calculated)

Total cost = 37.71 × 60 = ₹ 2262.6

4. (i) To find the curved surface area (CSA) of the conical part of the bell, we will first, find slant height (l) of the cone:

$$l = \sqrt{r^2 + h^2} = \sqrt{(10.5)^2 + 24^2}$$

$$= \sqrt{110.25 + 576} = \sqrt{686.25}$$

$$= 26.2 \text{ cm}$$

$$CSA_{cone} = \pi rl = \frac{22}{7} \times 10.5 \times 26.2$$
$$= 864.6 \text{ cm}^2$$

(ii) $$CSA_{hemisphere} = 2\pi r^2 = 2 \times \frac{22}{7} \times 10.5^2$$
$$= \frac{44}{7} \times 110.25 = 693 \text{ cm}^2$$

(iii) (a) Total area to polish $= 864.6 + 693$
$= 1557.6 \text{ cm}^2$

Total cost $= 1557.6 \times 1.5 =$ ₹ 2,336.4

OR

(b) Total surface area for 1 bell $= 1557.6 \text{ cm}^2$

For 20 bells $= 20 \times 1557.6$
$= 31,152 \text{ cm}^2$

LONG ANSWER TYPE QUESTIONS (5 Marks)

1. (i) CSA of Cylinder

$$CSA_{cylinder} = 2\pi rh = 2 \times \frac{22}{7} \times 5 \times 12$$
$$= \frac{2640}{7} \approx 377.14 \text{ m}^2$$

CSA of Hemisphere (outer surface)

$$CSA_{hemisphere} = 2\pi r^2 = 2 \times \frac{22}{7} \times 5^2$$
$$= \frac{44 \times 25}{7} = \frac{1100}{7}$$
$$\approx 157.14 \text{ m}^2$$

Total Surface Area to be Painted

Total SA $= 377.14 + 157.14$
$= 534.28 \text{ m}^2$

(ii) Cost of painting $= 534.28 \times 150 =$ ₹ 80,142

(iii) Volume of water the tank can store

Volume = Volume of cylinder + Volume of hemisphere

Volume of Cylinder

$$V_{cylinder} = \pi r^2 h = \frac{22}{7} \times 5^2 \times 12$$
$$= \frac{6600}{7} \approx 942.86 \text{ m}^3$$

Volume of Hemisphere

$$V_{hemisphere} = \frac{2}{3}\pi r^3 = \frac{2}{3} \times \frac{22}{7} \times 5^3$$
$$= \frac{5500}{21} = 261.90 \text{ m}^3$$

Total Volume $= 942.86 + 261.90$
$= 1204.76 \text{ m}^3$

2. (i) To find the curved surface area (CSA) of the conical part, we will first, find the slant height (l) of the cone using Pythagoras theorem:

$$l = \sqrt{r^2 + h^2} = \sqrt{7^2 + 24^2}$$
$$= \sqrt{49 + 576} = \sqrt{625}$$
$$= 25 \text{ cm}$$

Now, CSA of cone:

$$CSA_{cone} = \pi rl = \frac{22}{7} \times 7 \times 25 = 550 \text{ cm}^2$$

(ii) Curved Surface Area of the Hemispherical Part

$$CSA_{hemisphere} = 2\pi r^2 = 2 \times \frac{22}{7} \times 7^2$$
$$= 2 \times \frac{22}{7} \times 49 = 308 \text{ cm}^2$$

(iii) Total Cost of Polishing One Bell

Total outer surface area (excluding base) = CSA of cone + CSA of hemisphere

$= 550 + 308 = 858 \text{ cm}^2$

Cost: $858 \times$ ₹ 2 = ₹ 1716

(iv) For one bell, surface area $= 858 \text{ cm}^2$

So, for 100 bells:

$100 \times 858 = 85,800 \text{ cm}^2$

3. (i) The glass is shaped like a cylinder (excluding base), and a hemisphere (forming the base)

Curved surface area of cylinder:

$$CSA_{cyl} = 2\pi rh = 2 \times \frac{22}{7} \times 4 \times 8 = \frac{1408}{7}$$
$$\approx 201.14 \text{ cm}^2$$

Curved surface area of hemisphere:

$$CSA_{hemi} = 2\pi r^2 = 2 \times \frac{22}{7} \times 16 = \frac{704}{7}$$
$$= 100.57 \text{ cm}^2$$

Total surface area of 1 glass to be wrapped:

$TSA_{glass} = 201.14 + 100.57 = 301.71 \text{ cm}^2$

(ii) Total surface area of 50 juice glasses to be wrapped

$301.71 \times 50 = 15,085.5 \text{ cm}^2$

(iii) Total cost of wrapping 50 glasses

$15,085.5 \times 0.75 =$ ₹ 11,314.13

(iv) Minimum volume of box required to pack all 50 glasses

Volume of one glass = volume of cylinder + volume of hemisphere

Volume of cylinder:

$$V_{cyl} = \pi r^2 h = \frac{22}{7} \times (4)^2 \times 8 = \frac{2816}{7}$$
$$= 402.29 \text{ cm}^3$$

Volume of hemisphere:

$$V_{hemi} = \frac{2}{3}\pi r^3 = \frac{22}{7} \times (4)^3 = \frac{2816}{21}$$
$$= 134.10 \text{ cm}^3$$

Total volume of one glass:

$402.29 + 134.10 = 536.39 \text{ cm}^3$

Volume for 50 glasses:

$536.39 \times 50 = 26,819.5 \text{ cm}^3$

Minimum volume of box required: $26,819.5 \text{ cm}^3$