OBJECTIVE Type Questions

[1 mark]

Multiple Choice Questions

1. A surahi is a combination of:

(a) a sphere and a cylinder

(b) a hemisphere and a cylinder

(c) two hemispheres

(d) a cylinder and a cone. [NCERT Exemplar]

2. Two identical solid cubes of side k units are joined end to end. What is the volume, in cubic units, of the resulting cuboid?

(a) k^3 (b) $2k^3$

(c) $3k^3$ (d) $6k^3$

[CBSE Question Bank 2022]

Ans. *(b) $2k^3$*

Exaplanation:

Length of resulting cuboid, $l = k + k = 2k$

Height of resulting cuboid, $h = k$

Breadth of resulting cuboid, $b = k$

Volume of cuboid $= l \times b \times h$

$= 2k \times k \times k$

$= 2k^3$

3. Shown below is a solid made by joining a right circular cylinder and a hemisphere of equal radius (r *cm*). The total surface area of the solid is equal to the surface area of a sphere with twice the radius of this solid.

Which of the following gives the height of the cylinder in the above solid?

(a) $6r$ cm (b) $6.5r$ cm

(c) $7r$ cm (d) $17.5r$ cm

[CBSE Question Bank 2023]

Ans. *(c) $7r$ cm*

Explanation: Total surface area of solid = CSA of cylinder + CSA of hemisphere

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

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

Now, according to the question,

TSA of solid = Surface area of sphere

where, radius of sphere,

$R = 2r$

So, TSA of solid = Surface area of sphere

$$2\pi r(h + r) = 4\pi R^2$$
$$2\pi r(h + r) = 4\pi(2r)^2$$
$$2\pi rh + 2\pi r^2 = 16\pi r^2$$
$$2\pi rh = 14\pi r^2$$
$$2h = 14r$$
$$h = 7r \text{ cm}$$

4. A hollow cube of internal edge 22 cm is filled with spherical marbles of diameter 0.5 cm and it is assumed that $\frac{1}{8}$ space of the cube remains unfilled. Then the number of marbles that the cube can accomodate is:

(a) 142296 (b) 142396

(c) 142496 (d) 142596

[NCERT Exemplar]

5. A medicine-capsule is in the shape of a cylinder of diameter 0.5 cm with two hemispheres stuck to each of its ends. The length of the entire capsule is 2 cm. The capacity of the capsule is:

(a) 0.36 cm^3 (b) 0.35 cm^3

(c) 0.34 cm^3 (d) 0.33 cm^3

[NCERT Exemplar]

6. Volumes of two spheres are in the ratio 64 : 27. The ratio of their surface areas is:

(a) 3 : 4 (b) 4 : 3

(c) 9 : 16 (d) 16 : 9

[CBSE 2010, NCERT Exemplar]

Ans. *(d) 16 : 9*

Explanation: Let r_1 and r_2 be the radii of two spheres respectively.

We know that,

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

Given: Ratio of volumes of two spheres is 64 : 27.

$$\therefore \frac{\text{Volume of } 1^{st} \text{ sphere}}{\text{Volume of } 2^{nd} \text{ sphere}} = \frac{64}{27}$$

$$\Rightarrow \frac{\frac{4}{3}\pi r_1^3}{\frac{4}{3}\pi r_2^3} = \frac{64}{27}$$

$$\Rightarrow \frac{r_1^3}{r_2^3} = \frac{64}{27}$$

$$\Rightarrow \frac{r_1}{r_2} = \frac{4}{3}$$

Surface area of sphere = $4\pi r^2$

$$\therefore \frac{\text{Surface area of } 1^{st} \text{ sphere}}{\text{Surface area of } 2^{nd} \text{ sphere}} = \frac{4\pi r_1^2}{4\pi r_2^2} = \frac{r_1^2}{r_2^2} = \left(\frac{r_1}{r_2}\right)^2 = \left(\frac{4}{3}\right)^2 = \frac{16}{9}$$

Hence, the ratio of their surface areas is 16 : 9.

7. If the radius of a sphere is increased by 100%, the volume of the corresponding sphere is increased by:

(a) 200% (b) 500%

(c) 700% (d) 800% [Diksha]

Ans. *(c) 700%*

Explanation: Let r be the original radius of the sphere.

When, it is increased by 100% then it becomes twice of its original value, then new radius becomes $2r$.

So, new volume $(V') = \frac{4\pi}{3}(2r)^3$

$$= 8 \times \frac{4}{3}\pi r^3$$
$$= 8V$$

So, increase in volume $= \frac{V' - V}{V} \times 100\%$

$$= \frac{8V - V}{V} \times 100$$
$$= \frac{7V}{V} \times 100$$
$$= 700\%$$

8. The sum of the length, breadth and height of a cuboid is $6\sqrt{3}$ cm and the length of its diagonal is $2\sqrt{3}$ cm. The total surface area of the cuboid is:

(a) 48 cm^2 (b) 72 cm^2

(c) 96 cm^2 (d) 108 cm^2

[CBSE SQP Std. 2022]

Ans. *(c) 96 cm^2*

[CBSE Marking Scheme SQP Std. 2022]

Explanation: According to condition,

$$\sqrt{(l^2 + b^2 + h^2)} = 2\sqrt{3}$$
$$\Rightarrow l^2 + b^2 + h^2 = 12$$

Again, $l + b + h = 6\sqrt{3}$

$$\Rightarrow (l + b + h)^2 = 108$$
$$\Rightarrow l^2 + b^2 + h^2 + 2(lb + bh + hl) = 108$$
$$\Rightarrow 2(lb + bh + hl) = 108 - 12$$
$$\Rightarrow 2(lb + bh + hl) = 96$$

$\therefore$ The total surface area of cuboid = 96 cm^2

9. **The base radii of a cone and a cylinder are equal. If their curved surface areas are also equal, then the ratio of the slant height of the cone to the height of the cylinder is:**

(a) 2 : 1 **(b) 1 : 2**
(c) 1 : 3 **(d) 3 : 1** **[Diksha]**

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

(a) 60π cm^2 **(b) 68π cm^2**
(c) 120π cm^2 **(d) 136π cm^2**

Ans. *(d) 136π cm^2*

Explanation: Curved surface area of a cone = πrl

Here, $r = 8$ cm and $h = 15$ cm

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

C.S.A. = πrl

$\therefore$ C.S.A. = $\pi(8)\sqrt{8^2 + 15^2}$

$= \pi(8)\,(17)$

$= 136\pi$ cm^2

11. **A solid is hemishpherical at the bottom and conical at the top. If the surface areas of the two parts are equal then the ratio of its radius and the slant height of the conical part is:**

(a) 2 : 1 **(b) 1 : 2**
(c) 1 : 4 **(d) 4 : 1**
[CBSE 2011]

Ans. *(b) 1 : 2*

Explanation: Here, r is the radius of hemispherical and conical part.

Let, 'l' be the slant height of the cone.

Then, according to the question,

Surface area of hemisphere = Surface area of cone

$\Rightarrow \quad 2\pi r^2 = \pi rl$

$\Rightarrow \quad 2r = l$

$\Rightarrow \quad \frac{r}{l} = \frac{1}{2}$

$\square \quad r : l = 1 : 2$

12. **The total surface area of a solid hemisphere of radius 7 cm is:**

(a) 447 π cm^2 **(b) 239 π cm^2**
(c) 174 π cm^2 **(d) 147 π cm^2**
[CBSE SQP Basic 2022]

Ans. *(d) 147 π cm^2*
[CBSE Marking Scheme SQP Basic 2022]

Explanation: Total surface of hemisphere of radius $r = 3\pi r^2$

$= 3\pi \times 7 \times 7$

$= 147\pi$ cm^2

13. **Ayushi went to the store which sells trendy home decor items. She saw beautiful multicoloured spherical lampshades and bought two of them for her room.**

The radius of the lampshade (in cm) whose volume is 12π cm^3, is:

(a) 3 **(b) $3\sqrt{3}$**
(c) $3^{2/3}$ **(d) $3^{1/3}$**
[Mod. CBSE 2020]

Ans. *(c) $3^{2/3}$*

Explanation: Let 'r' cm be the radius of the sphere. Then,

$\frac{4}{3}\pi r^3 = 12\pi$

$\Rightarrow \quad r^3 = 9$

i.e., $\quad r^3 = 3^2$

$\Rightarrow \quad r = (3^2)^{1/3}$

$= 3^{2/3}$

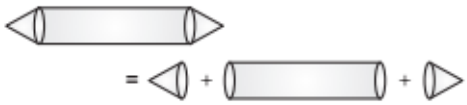
14. **Our Maths teacher was telling us stories about his childhood days spent in a village in North India. He told us about gilli danda, which is an ancient desi sport in which the game is played with two sticks, a large stick and a small stick. The large stick is called a danda and the small stick is called gilli. It is played in many rural areas and small towns mainly in the Indian subcontinent.**

The shape of a gilli, in the gilli danda game (see the given figure), is a combination of:

(a) two cylinders
(b) a cone and a cylinder
(c) two cones and a cylinder
(d) two cylinders and a cone
[NCERT Exemplar]

Ans. *(c) two cones and a cylinder*

Explanation:



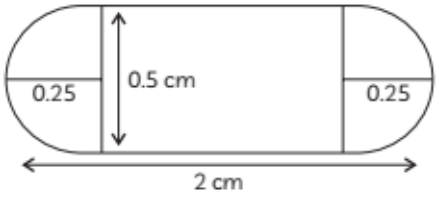
As the corner parts of a gilli are conical and the central part is cylindrical,
Therefore,
Given figure = Cone + Cylinder + Cone
= Two cones and a cylinder

15. **Two cones of equal heights have their radii in the ratio 3 : 2. The ratio of their volumes will be equal to:**
(a) 3 : 2 (b) 9 : 4
(c) 27 : 8 (d) 81 : 16
[British Council 2022]

16. **A medicine-capsule is in the shape of a cylinder of radius 0.25 cm with two hemispheres stuck to each of its ends. The length of the entire capsule is 2 cm. What is the total surface area of the capsule?**
(a) 3.14 cm^2 (b) 2.7475 cm^2
(c) 0.98125 cm^2 (d) 0.785 cm^2
[CBSE Question Bank 2022]

Ans. *(a) 3.14 cm^2*

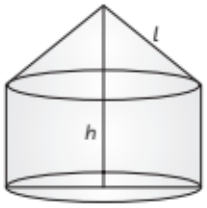
Explanation: It is given that,
Radius of cylinder = Radius of hemisphere
= 0.25 cm



Total length of capsule = 2 cm
Here, the length of cylindrical part of capsule, h
= length of capsule - radius of both hemispheres
= 2 – 2 × 0.25
= 1.5
Total surface area of capsule = CSA of cylindrical part + 2 x CSA of hemisphere
$= 2\pi rh + 2(2\pi r^2)$
$= 2\pi r\,(h + 2r)$
$= 2 \times \frac{22}{7} \times 0.25\,[1.5 + 2 \times 0.25]$
$= 2 \times \frac{22}{7} \times \frac{25}{100} \times 2$
$= \frac{22}{7}$
$= 3.14\ cm^2$
Therefore, the TSA of the capsule is 3.14 cm^2

Fill in the Blanks

17. **The total surface area of the given solid figure is ..... .**



[CBSE 2019]

Ans. $\pi rl + 2\pi rh + \pi r^2$

Explanation : Here,
TSA = CSA of conical part + CSA of cylindrical part + Area of base
$= \pi rl + 2\pi rh + \pi r^2$

18. **The ratio between the volumes of two spheres is 8 : 27. Then, the ratio between their surface areas is ..... .**

19. **If the radius of the base of a right circular cylinder is halved, keeping the height same, then the ratio of the volume of the reduced cylinder to that of the original cylinder is ..... .**

Ans. 1 : 4

Explanation : Volume of the original cylinder $= \pi r^2 h$
Volume of the reduced cylinder $= \pi\left(\frac{r}{2}\right)^2 h$,
$= \frac{\pi}{4} r^2 h$.
So required ratio
$= \frac{\text{Volume of reduced cylinder}}{\text{Volume of original cylinder}}$
$= \frac{\frac{\pi}{4} r^2 h}{\pi r^2 h} = \frac{1}{4}$

20. **If the length of each edge of a cube is doubled, then its volume become ..... times.**

Ans. 8

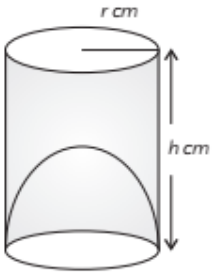
Explanation : Let edge of cube is a.
$\therefore$ Volume of cube = a^3
By doubling the length of edge of the cube, the side of new cube $= a \times 2 = 2a$
$\therefore$ New volume = $V' = (2a)^3 = 8a^3$
So, the volume of cube become 8 times.

True/False

21. **Two identical solid hemispheres of equal base radius r cm are stuck together along their bases. The total surface area of the combination is $6\pi r^2$. [CBSE 2011]**

22. **A solid ball is exactly fitted inside a cubical box of side a. The volume of the ball is $\frac{4}{3}\pi r^2$. [CBSE 2013, NCERT Exemplar]**

23. **The capacity of a cylindrical vessel with a hemispherical portion raised upwards at the bottom as shown in the given figure is $\frac{\pi r^2}{3}[3h - 2r]$.**



[NCERT Exemplar]

Ans. True.

Explanation: Capacity of given shape = Volume of cylinder − Volume of hemispherical portion

Base radius of cylinder = Radius of hemisphere

$\Rightarrow$ Capacity of given shape $= \pi r^2 h - \frac{2}{3}\pi r^3$

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

So, the given statement is true.

Assertion Reason

Direction for questions 24 to 28: In question number 24 to 28, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

24. **Assertion (A): Total surface area of the cylinder having radius of the base 14 cm and height 30 cm is 3872 cm^2.**

Reason (R): If r be the radius and h be the height of the cylinder, then total surface area = $(2\pi rh + 2\pi r^2)$.

Ans. *(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).*

Explanation : Total surface area $= 2\pi rh + 2\pi r^2$

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

$= 2 \times \frac{22}{7} \times 14\,(30 + 14) = 88\,(44)$

$= 3872\ cm^2$

Hence, both assertion and reason are true and reason is the correct explanation of assertion.

25. **Assertion (A): If the height of the cone is 5 cm and diameter of the base is 24 cm, then the slant height of the cone is 25 cm.**

Reason (R): If r be the radius and h be the slant height of the cone, then slant height = $\sqrt{h^2 + r^2}$.

Ans. *(d) Assertion (A) is false but reason (R) is true.*

Explanation : Height of cone = 5 cm

Diameter of cone = 24 cm

$\therefore$ Radius of cone $= \frac{24}{2} = 12$ cm

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

$= \sqrt{(5)^2 + (12)^2}$

$= \sqrt{25 + 144}$

$= \sqrt{169}$

$= 13$ cm

Hence, assertion is false but reason is true.

26. **Assertion (A): If two identical solid cube of side 7 cm are joined end to end. Then the total surface area of the resulting cuboid is 490 cm^2.**

Reason (R): Total surface area of cuboid = $lb + bh + hl$

Ans. (c) *Assertion (A) is true but reason (R) is false.*

Explanation : When cubes are joined end to end, it forms a cuboid.

where, $l = 2 \times 7 = 14$ cm

$b = 7$ cm

and $h = 7$ cm

Total surface area of cuboid $= 2(lb + bh + hl)$

$= 2\,(14 \times 7 + 7 \times 7 + 7 \times 14)$

$= 490\ cm^2$

Hence, assertion is true but reason is false.

27. **Assertion (A):** If the volumes of two spheres area in the ratio 64 : 125. Then their surface areas are in the ratio 16 : 25.

Reason (R): Volume of sphere = $\frac{4}{3}\pi r^2$ and the surface area of sphere = $4\pi r^2$.

28. **Assertion (A):** The radii of two cones are in the ratio 2 : 3 and their volumes in the ratio 1 : 3. Then the ratio of their heights is 3 : 2.

Reason (R): Volume of the cone = $\frac{1}{3}\pi r^2 h$.

Ans. *(d) Assertion (A) is false but reason (R) is true.*

Explanation : We have,

$$\text{ratio of volume} = \frac{\frac{1}{3}\pi\times(2x)^2\times h_1}{\frac{1}{3}\pi\times(3x)^2\times h_1}$$

$$\frac{1}{3} = \frac{4}{9}\times\frac{h_1}{h_2}$$

$$\frac{h_1}{h_2} = \frac{3}{4}$$

$h_1 : h_2 = 3 : 4$

Hence, assertion is false but reason is true.

CASE BASED Type Questions (CBQs)

[**4** & **5** marks]

Read the passages and answer the questions that follow:

29. *A baby tent house is a dream come true for this little princess. It was her birthday gift and look at the way she is enjoying herself inside the tent house placed in their garden. The tent house is cylindrical in shape with a conical top and is made of high quality water resistant fabric. The diameter of the base of the cylindrical portion is 7 feet and total height of the tent is equal to its diameter. The height of the cylindrical portion is 4 feet.*

(A) **The surface area of the cylindrical portion of the tent is:**
(a) 66 sq. ft. (b) 88 sq. ft.
(c) 104.5 sq. ft. (d) 209 sq. ft.

(B) **The formula for the total surface area of the tent is:**
(a) $[\pi r\,(2h + l) + \pi r]$ sq. units
(b) $[2\pi r\,(r + h) + \pi r]$ sq. units
(c) $\pi r(2h + l)$ sq. units
(d) $2\pi r\left(r + h + \frac{l}{2}\right)$ sq. units

(C) **The total volume of the tent is:**
(a) 154 cu. ft. (b) 192.5 cu. ft.
(c) 269 cu. ft. (d) 115.5 cu. ft.

(D) **The ratio of volume of air contained in cylindrical portion to the volume of air in conical portion of the tent, is:**
(a) 4 : 1 (b) 1 : 4
(c) 3 : 1 (d) 1 : 3

(E) **If each child occupies a surface area of 3.5 sq. ft, then the maximum number of children that can be accommodated in the tent is:**
(a) 44 (b) 33
(c) 22 (d) 11

Ans. (A) *(b) 88 sq. ft*

Explanation: We have, radius of the cylinder, $r = \frac{7}{2}$ ft

and height of the cylinder h = 4 ft.

Now, CSA of cylinder = $2\pi rh$

$$= 2\times\frac{22}{7}\times\frac{7}{2}\times 4$$

= 88 sq. ft.

(C) *(b) 192.5 cu. ft.*

Explanation: Total volume of the tent (V) = Volume of cylindrical portion + Volume of conical portion

Since, the height of cylindrical part, $h = 4$ ft and total height of the tent is 7 ft *i.e.* equal to diameter of the tent.

Then height of conical part = $h' = 7 - 4 = 3$ ft.

$$\therefore V = \pi r^2 h + \frac{1}{3}\pi r^2 h'$$

$$= \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 4 + \frac{1}{3} \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 3$$

$$= 192.5 \text{ cu. ft.}$$

(E) *(d) 11*

Explanation: The maximum number of children that can be accommodated in the tent

$$= \frac{\text{Area of base of tent}}{\text{Area occupied by one child}}$$

$$= \frac{\pi r^2}{3.5}$$

$$= \frac{\frac{22}{7} \times \frac{7}{2} \times \frac{7}{2}}{3.5}$$

$$= \frac{\frac{77}{2}}{3.5} = 11$$

10. *Consider stack of gold coins as shown below. Let the diameter of each coin be 2 cm and thickness be 5 mm.*

(A) Find the volume of one coin.

(B) What is the formula used for calculating the total surface area of one coin?

(C) Suppose forty such coins have been stacked, then, find their total surface area.

ns. (A) Each coin is shaped like a cylinder having height = thickness = 5 mm = 0.5 cm and

$$\text{radius} = \frac{2}{2} \text{ cm} = 1 \text{ cm.}$$

$\therefore$ Volume of a coin = $\pi r^2 h$

$$= \pi \times 1 \times 1 \times 0.5 = \frac{\pi}{2} \text{ cm}^3.$$

(B) Since, each coin is shape as cylinder [from (A)]

We know that,

total surface area of cylinder = $2\pi r(r + h)$

Thus, total surface area of one coin

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

31. *Adventure camps are the perfect place for the children to practice decision making for themselves without parents and teachers guiding their every move. Some students of a school reached for adventure at Sakleshpur. At the camp, the waiters served some students with a welcome drink in a cylindrical glass and some students in a hemispherical cup whose dimensions are shown below. After that they went for a jungle trek. The jungle trek was enjoyable but tiring.*

As dusk fell, it was time to take shelter. Each group of four students was given a canvas of area 551 m^2. Each group had to make a conical tent to accommodate all the four students. Assuming that all the wasting incurred while cutting and stitching, would amount to 1 m^2, the students put the tents. The radius of the tent is 7 m.

(A) The volume of cylindrical glass is:

(a) 295.75 cm^3 **(b) 7415.5 cm^3**

(c) 384.88 cm^3 **(d) 404.25 cm^3**

(B) The volume of hemispherical cup is:

(a) 179.67 cm^3 **(b) 89.83 cm^3**

(c) 172.25 cm^3 **(d) 210.60 cm^3**

(C) Which container had more juice and by how much?

(a) Hemispherical cup, 195 cm^3

(b) Cylindrical glass, 207 cm^3

(c) Hemispherical cup, 280.85 cm^3

(d) Cylindrical glass, 314.42 cm^3

(D) **The height of the conical tent prepared to accommodate four students is:**

(a) 18m (b) 10m

(c) 24m (d) 14m

(E) **How much space on the ground is occupied by each student in the conical tent?**

(a) 54 m^2 (b) 38.5 m^2

(c) 86 m^2 (d) 24 m^2

[CBSE Question Bank 2021]

Ans. (A) *(d) 404.25 cm^3*

Explanation: Here,

Radius of cup, $r = \frac{7}{2}$ cm

and, Height of cup, h = 10.5 cm

$\therefore$ Volume of cylindrical glass = $\pi r^2 h$

$= \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 10.5$

$= 404.25 \text{ cm}^3$

(B) *(b) 89.83 cm^3*

Explanation: Here,

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

$\therefore$ Volume of hemispherical cup = $\frac{2}{3}\pi r^3$

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

$= 89.83 \text{ cm}^3$

(C) *(d) Cylindrical glass, 314.42 cm^3*

Explanation: From parts (A) and (B), we have volume of cylindrical glass = 404.25 cm^3

and, volume of hemispherical cup = 89.83 cm^3

$\therefore$ Cylindrical glass holds more juice.

Required difference = 404.25 – 89.83

$= 314.42 \text{ cm}^3$

32. *A 'circus' is a company of performers who put on shows of acrobats, clowns etc. to entertain people started around 250 years back in open field, now generally performed in tents.*
On such 'Circus Tent' is shown below:

The tent is the shape of a cylinder surmounted by a conical top. If the height and diameter of cylindrical part are 9 m and 30 m respectively and height of conical part is 8 m with same diameter as that of the cylindrical part, then find:

(A) **the slant height of the tent.**

(B) **the area of the canvas used in making the tent;**

(C) **the cost of the canvas brough for the tent at the rate ₹ 200 per sq m, if 30 sq m canvas was wasted during stitching**

[CBSE Term-2 2022]

Ans. (A) Height of a cylindrical part = 9m

Diameter of a cylindrical part = 30m

radius = $\frac{30}{2}$ = 15m

Height of conical part = 8m

slant height (l) = $\sqrt{h^2 + r^2}$

$= \sqrt{8^2 + 15^2}$

$= \sqrt{64 + 225}$

$= \sqrt{289}$

l = 17m

(B) *Area of canvas used in making tent = CSA of cylinder + CSA of cone*

$= 2\pi rh + = \pi rl$

$= \frac{22}{7} \times 15 \ (2 \times 9 + 17)$

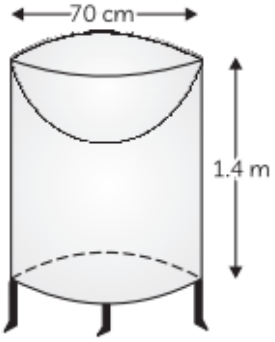
$= \frac{22}{7} \times 15 \times 35$

$= 1650 \text{ m}^2$

33. *A bird bath is a small shallow pond, or fountain, created like a basin in which birds may drink, bathe and cool themselves.*
One day, Aniket, a student of class IV, saw some birds drinking water from potholes. He feels sad for them and asked his elder brother, Anshumann, who is in class X, to make a bird-bath. His brother bought some material from their store and prepare a bird bath in the shape of a cylinder with a hemispherical depression at one end.

If the height of cylindrical part of bird-bath is 1.4 m and diameter of base is 70 cm, then answer the following questions:

$\left[\text{Use } \pi = \frac{22}{7}\right]$



(A) Find the total surface area of the bird-bath.

(B) Find the ratio of the volumes of cylindrical part and the hemispherical part of the bird bath.

(C) If the base radius of the cylinder is decreased to 30 cm then find the difference in the total surface area of the bird bath.

Ans. (A) We have,

Radius of hemisphere

$= \text{Radius of cylinder} = \frac{70}{2} = 35 \text{ cm}$

and, Height of cylinder $= 1.4 \text{ m}$

$= 140 \text{ cm}$

$\therefore$ TSA of bird bath = CSA of cylindrical part + CSA of hemispherical part

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

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

$= 2 \times \frac{22}{7} \times 35\,(140 + 35)$

$= 2 \times \frac{22}{7} \times 35 \times 175$

$= 38500 \text{ cm}^2$

(C) TSA of bird bath, when $r = 35$ cm is 38500 cm^2 [from (A)]

Now, TSA of bird bath, when $r = 30$ cm

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

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

$= 2 \times \frac{22}{7} \times 30\,(140 + 30)$

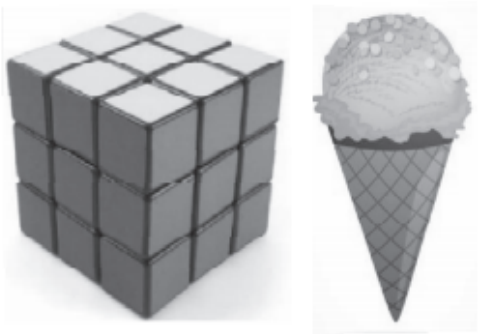
$= 2 \times \frac{22}{7} \times 30 \times 170$

$= 32057.14 \text{ cm}^2$

Difference of total surface area = 38500 − 32057.14

$= 6442.85 \text{ cm}^2$

34. *On a Sunday, your parents took you to a fair. You could see lot of toys displayed, and you wanted them to buy a RUBIK's cube and strawberry ice-cream for you. Observe the figures and answer the questions.*



(A) The length of the diagonal of the rubik's cube if each edge measures 6 cm is:

(a) $3\sqrt{3}$ cm (b) $3\sqrt{6}$ cm

(c) $\sqrt{12}$ cm (d) $6\sqrt{3}$ cm

(B) Volume of the rubik's cube if the length of the edge is 7 cm, is:

(a) 256 cm^3 (b) 196 cm^3

(c) 343 cm^3 (d) 434 cm^3

(C) What is the curved surface area of hemisphere (ice cream) if the base radius is 7 cm?

(a) 309 cm^2 (b) 308 cm^2

(c) 803 cm^2 (d) 903 cm^2

(D) Slant height of a cone if the radius is 7 cm and the height is 24 cm, is:

(a) 26 cm (b) 25 cm

(c) 52 cm (d) 62 cm

(E) The total surface area of cone with hemispherical ice cream is:

(a) 858 cm^2 (b) 885 cm^2

(c) 588 cm^2 (d) 855 cm^2

[CBSE Question Bank 2021]

Ans. (A) *(d)* $6\sqrt{3}$

Explanation: We know,

Length of diagonal of a cube

$= \sqrt{3} \times \text{Edge of the cube}$

$= \sqrt{3} \times 6$

$= 6\sqrt{3} \text{ cm}$

(C) *(b) 308 cm^2*

Explanation:

CSA of hemisphere $= 2\pi r^2$

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

$= 308\ cm^2$

(D) *(b) 25 cm*

Explanation: Slant height of a cone,

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

$= \sqrt{(24)^2 + 7^2} = \sqrt{576 + 49}$

$= \sqrt{625} = 25$ cm

VERY SHORT ANSWER Type Questions (VSA)

[**1** mark]

35. **The volume and surface area of a solid hemisphere are numerically equal. What is the diameter of hemisphere ? [CBSE 2017]**

36. **A cone and a cylinder have the same radii but the height of the cone is 3 times that of the cylinder. Find the ratio of their volumes. [CBSE 2020]**

Ans. Let, r be the height of the cone as well as the cylinder both.

Let, h be the height of the cylinder. Then, the height of the cone will be '$3h$'

Now, V_1 (Volume of cone) : V_2 (Volume of cylinder)

$= \frac{1}{3}\pi r^2(3h) : \pi r^2 h$

$= 1 : 1$

Hence, the ratio of their volumes is 1 : 1.

37. **While surfing the internet, Misha and her friends came across several structures that resembled cones! One such picture was that of several conical structures of different radii and heights.**

Two cones have their heights in the ratio 1 : 3 and radii in the ratio 3 : 1. What is the ratio of their volumes? [CBSE 2020]

Ans. Let the heights of the two cones be h and $3h$; and their base radii be $3r$ and r.

We know, volume of cone, $V_1 = \frac{1}{3}\pi r^2 h$

Then, $V_1 : V_2 = \frac{1}{3}\pi(3r)^2(h) : \frac{1}{3}\pi(r)^2(3h)$

$= 9 : 3$

or $= 3 : 1$

Hence, the ratio of their volumes is 3 : 1.

38. **Chetna enrolled in a hobby class during her school summer vacations. She learnt candle making, baking and painting among other things. She made a few candles and gifted her first candles to her parents on their wedding anniversary. Parents were thrilled beyond words on receiving such a beautiful gift!**

The volume of a right circular cylinder with the height equal to the radius is $25\frac{1}{7}$ cm^3. Find the height of the cylinder. [CBSE 2020]

Ans. Let the height of the cylinder be 'h' cm. Then, as per the question.

$V = \pi(h)^2(h) = 25\frac{1}{7}$ $[\because r = h]$

$\Rightarrow \frac{22}{7}.h^3 = \frac{176}{7}$

$\Rightarrow h^3 = 8$

or $h = 2$

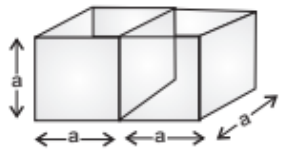
Thus, the height of the cylinder is 2 cm.

SHORT ANSWER Type Questions (SA-I)

[2 marks]

39. 2 cubes, each of volume 125 cm^3, are joined end to end. Find the surface area of the resulting cuboid. [CBSE 2020]

Ans. On joining two identical cubes, each of edge a we get a cuboid of dimensions $2a \times a \times a$.



We are given that

$$a^3 = 125 \text{ i.e., } a^3 = 5^3$$

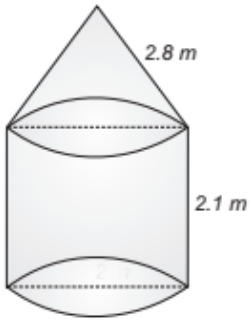
So, $a = 5$

Hence, the dimensions of the cuboid are 10 cm × 5 cm × 5 cm

So, surface area of the cuboid

$$= 2[10 \times 5 + 5 \times 5 + 5 \times 10]$$
$$= 2\,(50 + 25 + 50)$$
$$= 250 \text{ sq cm.}$$

40. In the figure, a tent is in the shape of a cylinder surmounted by a conical top. The cylindrical part is 2.1 m high and conical part has slant height 2.8 m. Both the parts have same radius 2 m. Find the area of the canvas used to make the tent.



[CBSE 2020]

Ans. Here, height of cylindrical part (h) = 2.1 m
Radii of cylindrical and conical part (r) = 2 m
Slant height of the conical part (l) = 2.8 m
Now area of the canvas used in making the tent
= curved surface area of the tent
= curved surface area of the cylindrical part
+ curved surface area of the conical part

$$= 2\pi rh + \pi rl$$
$$= 2 \times \frac{22}{7} \times 2 \times 2{\cdot}1 + \frac{22}{7} \times 2 \times 2{\cdot}8$$
$$= 26.4 + 17.6 = 44 \text{ m}^2$$

41. From a solid right circular cylinder of height 14 cm and base radius 6 cm, a right circular cone of same height and same base radius is removed. Find the volume of the remaining solid. [CBSE 2020]

42. The curved surface area of a cylinder is 264 m^2 and its volume is 924 m^3. Find the ratio of its height to its diameter. [Diksha]

Ans. Curved surface area of cylinder $= 2\pi rh$

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

Volume of cylinder $= \pi r^2 h$

$$= 924 \text{ m}^3 \quad \text{...(ii)}$$

Dividing (ii) by (i), we get

$$\frac{\pi r^2 h}{2\pi rh} = \frac{924}{264}$$

$$\Rightarrow \quad \frac{r}{2} = \frac{7}{2}$$

$$\Rightarrow \quad r = 7 \text{ m}$$

Putting the value of r in equation (i), we have

$$2 \times \frac{22}{7} \times 7 \times h = 264$$

$$\Rightarrow \quad h = 6 \text{ m}$$

Now, $\frac{h}{2r} = \frac{6}{14} = \frac{3}{7}$

Hence, the ratio of height and diameter of the cylinder is 3 : 7.

43. A solid is in the shape of a cone mounted on a hemisphere of same base radius. If the curved surface areas of the hemispherical part and the conical part are equal, find the ratio of the radius and the height of the conical part. [CBSE 2020]

Ans. Let the radius of the hemisphere be r, radius of the cone = r

Height of the cone = h

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

We know that, curved surface area of cone = πrl and CSA of hemisphere = $2\pi r^2$
Given that CSA of cone = CSA of hemisphere

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

Squaring both sides,

$$r^2 + h^2 = 4r^2$$
$$h^2 = 4r^2 - r^2$$
$$h^2 = 3r^2$$
$$h = \sqrt{3}r$$
$$\frac{r}{h} = \frac{1}{\sqrt{3}}$$

or $$\frac{r}{h} = \frac{\sqrt{3}}{3}$$

44. If the area of three adjacent faces of a cuboid are X Y, and Z respectively, then find the volume of cuboid. **[Diksha]**

45. The curved surface area of a right circular cone is 12320 cm^2. If the radius of its base is 56 cm, then find its height. **[CBSE Term-2 SQP 2022]**

Ans.

$$\text{CSA (cone)} = \pi rl = 12320$$
$$\frac{22}{7} \times 56 \times l = 12320$$
$$l = 70 \text{ cm}$$
$$h = \sqrt{70^2 - 56^2}$$
$$= 42 \text{ cm}$$

[CBSE Marking Scheme Term-2 SQP 2022]

Given: CSA of cone = 12320 cm^2
and radius (r) = 56 cm
Let height of the cone be h cm.
We know,
CSA of cone = πrl

$$\Rightarrow \quad 12320 = \frac{22}{7} \times 56 \times l$$
$$\Rightarrow \quad l = \frac{12320 \times 7}{22 \times 56} = 70 \text{ cm}$$

Also, we know that
$$l^2 = h^2 + r^2$$
$$\Rightarrow \quad (70)^2 = h^2 + (56)^2$$
$$\Rightarrow \quad h = \sqrt{4900 - 3136}$$
$$= \sqrt{1764}$$
$$= 42 \text{ cm}$$

Hence, height of the cone is 42 cm.

46. Find the ratio of the volume of a cube to that of the sphere which fits inside the cube.

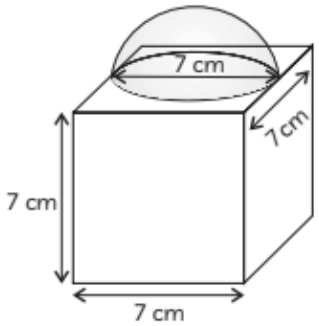
Ans. Let the length of an edge of the cube be a cm.
Then,
The radius of the sphere, which fits inside the cube, is $\frac{a}{2}$

Hence, Volume of cube : Volume of sphere

$$\Rightarrow \quad = a^3 : \frac{4}{3}\pi\left(\frac{a}{2}\right)^3$$
$$= 1 : \frac{\pi}{6}$$
$$\Rightarrow \quad = 6 : \pi$$

47. A cubical block of side 7 cm is surmounted by a hemisphere. What is the greatest diameter the hemisphere can have? Find the surface area of solid. **[Delhi Gov. 2022]**

Ans.



The hemisphere can occupy whole of the side of cube.

Hence, greatest diameter of hemisphere = side of cube = 7 cm

Here, base of hemisphere falls on cube, so that area should not from part of solid.

Surface area of solid = Total surface area of cube + Curved surface area of hemisphere – Base area of hemisphere

Total surface area of cube

Here, a = side = 7 cm

Total surface area of cube = $6a^2$
$$= 6(7)^2$$
$$= 6 \times (7 \times 7)$$
$$= 6 \times 49$$
$$= 294 \text{ cm}^2$$

Curved surface area of hemisphere

Diameter of hemisphere = 7 cm

Hence, radius = $r = \frac{\text{Diameter}}{2} = \frac{7}{2}$ cm

Curved surface area of hemisphere = $2\pi r^2$
$$= 2 \times \frac{22}{7} \times \left(\frac{7}{2}\right)^2$$
$$= 2 \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2}$$
$$= 77 \text{ cm}^2$$

Base area of hemisphere

Base of hemisphere is a circle with radius

= radius of hemisphere = $r = \frac{7}{2}$

Base area of hemisphere = πr^2

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

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

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

Now, Surface area of solid = Area of cube + Curved surface area of hemisphere – Base area of hemisphere

$$= 294 + 77 - \frac{77}{2}$$

$$= 294 + 77 - 38.5$$

$$= 371 - 38.5$$

$$= 332.5 \text{ cm}^2$$

Hence, surface area of solid = 332.5 cm^2

48. A cone, hemisphere and a cylinder stand on equal bases and have the same height. Find the ratio of their volumes.

Ans. Let the equal radii of the cone, hemisphere and the cylinder be r and their equal heights be h.

Now,

Volume of cone : Volume of hemisphere : Volume of cylinder

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

$$= \frac{1}{3} : \frac{2}{3} : 1$$

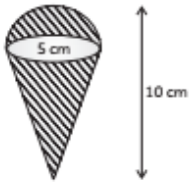
[For hemisphere, radius = height]

$$= 1 : 2 : 3$$

Hence, the ratio of volumes of cone, hemisphere and the cylinder is 1 : 2 : 3.

49. The sum of the radius of base and height of a solid right circular cylinder is 37 cm. If the total surface area of the solid cylinder is 1628 cm^2, find the volume of the cylinder. $\left(\text{use } \pi = \frac{22}{7}\right)$. **[Diksha]**

50. Find the total surface area of the solid, shown in the given figure.



[Diksha]

Ans. TSA of solid = Surface area of cube + CSA of hemisphere – Area of base of hemisphere

$$= 6a^2 + 2\pi r^2 - \pi r^2$$

$$= 6a^2 + \pi r^2$$

51. The ratio of the volumes of two spheres is 8 : 27. If r and R are the radii of spheres respectively, then find the (R – r) : r. [Diksha]

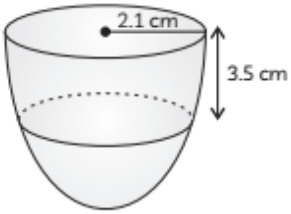
52. Students of Class XII presented a gift to their school in the form of an electric lamp in the shape of a glass hemispherical base surmounted by a metallic cylindrical top of same radius 21 cm and height 3.5 cm. The top was silver coated and the glass surface was painted red.

(A) What is the cost of silver coating the top at the rate of ₹ 5 per 100 cm^2?

(B) What is the surface area of glass to be painted red? [NCERT Exemplar]

Ans. Given: Radius of cylindrical top = Radius of hemispherical bottom = r = 21 cm

and, height of cylindrical top, h = 3.5 cm.



(A) Area to be coated silver = CSA of cylindrical portion + Area of upper end of cylindrical portion

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

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

$$= \frac{22}{7} \times 21(2 \times 3.5 + 21)$$

$$= 22 \times 3 \times 28$$

$$= 1848 \text{ cm}^2$$

Since, cost of silver coating = ₹ 5 per 100 cm^2

$$= ₹ \frac{5}{100} \text{ per cm}^2$$

∴ Total cost of silver coating 1848 cm^2 of area = ₹ $\frac{5}{100} \times 1848$

Thus, the cost of silver coating the top is ₹ 92.40.

(B) Surface area of glass to be painted red

= CSA of hemisphere

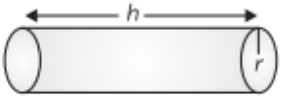
$$= 2\pi r^2$$

$$= 2 \times \frac{22}{7} \times 21 \times 21$$

$$= 2772 \text{ cm}^2$$

Thus, the surface area of glass to be painted red is 2772 cm^2.

53. The volume of a right circular cylinder with its height equal to the radius, is $25\frac{1}{7}\text{cm}^3$. Find the height of the cylinder.



Ans. Given: Radius of cylinder (r)
= Height of cylinder (h)

Also,

Volume of cylinder $= 25\frac{1}{7}\text{cm}^3$

$\Rightarrow \quad \pi r^2 h = \frac{176}{7}$

$\Rightarrow \quad \frac{22}{7} \times h^2 \times h = \frac{176}{7} \qquad [\because r = h]$

$\Rightarrow \quad h^3 = \frac{176}{22} = 8 = (2)^3$

$\Rightarrow \quad h = 2 \text{ cm}$

Hence, height of the cylinder is 2 cm.

54. If the area of base of a cone is 770 cm^2 and its curved surface area is 814 cm^2, find the slant height of the cone.

Ans. Let radius of base of cone be r cm.
Now, according to the question,

Area of base $= 770 \text{ cm}^2$

$\Rightarrow \quad \pi r^2 = 770$

$\Rightarrow \quad \frac{22}{7} \times r^2 = 770$

$\Rightarrow \quad r^2 = \frac{770 \times 7}{22}$

$= 35 \times 7$

$\Rightarrow \quad r = \sqrt{5 \times 7 \times 7} = 7\sqrt{5} \text{ cm}$

Also, CSA of cone $= 814 \text{ cm}^2$

$\Rightarrow \quad \pi r l = 814$

$\Rightarrow \quad \frac{22}{7} \times 7\sqrt{5} \times l = 814$

$\Rightarrow \quad l = \frac{814}{22 \times \sqrt{5}} = \frac{37}{\sqrt{5}} \times \frac{\sqrt{5}}{5}$

$= 7.4\sqrt{5} \text{ cm}$

Hence, slant height of the cone is $7.4\sqrt{5}$ cm.

55. The sum of the radius of base and height of a solid right circular cylinder is 37 cm. If the total surface area of the cylinder is 1628 sq. cm, find the volume of the cylinder.

Ans. Let r, h be the radius of base and height of solid right circular cylinder.

Then, according to the question

$r + h = 37 \text{ cm}$

and TSA of cylinder $= 1628 \text{ cm}^2$

$\Rightarrow \quad 2\pi r(h + r) = 1628$

$\Rightarrow \quad 2 \times \frac{22}{7} \times r \times 37 = 1628$

$\Rightarrow \quad r = \frac{1628 \times 7}{2 \times 22 \times 37} = 7$

So, $h = 37 - r$

$= 37 - 7$

$= 30 \text{ cm}$

$\therefore$ Volume of cylinder $= \pi r^2 h$

$= \frac{22}{7} \times (7)^2 \times 30$

$= 4620 \text{ cm}^3$

SHORT ANSWER Type Questions (SA-II)

[**3** marks]

56. A solid is in the form of a cylinder with hemispherical ends. The total height of the solid is 20 cm and the diameter of the cylinder is 7 cm. Find the total volume of the solid. $\left(\text{Use } \pi = \frac{22}{7}\right)$ **[CBSE 2019]**

Ans. Here, diameter of the cylinder, $d = 7$ cm

$\therefore$ radius of the cylinder,

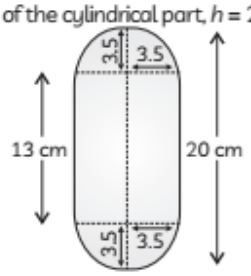
$r = \frac{d}{2} = \frac{7}{2}$

$= 3.5 \text{ cm}$

Radius of the hemispherical part, $r' = \frac{d}{2} = 3.5 \text{ cm}$

Also, total height of the solid = 20 cm

$\therefore$ Height of the cylindrical part, $h = 20 - 7 = 13$ cm



Total volume of the solid
= Volume of cylinder + 2 (Volume of hemisphere)

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

$$= \pi r^2\left[h + \frac{4}{3} \times r\right] \quad [\because r' = r]$$

$$= \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2}\left[13 + \frac{4}{3} \times \frac{7}{2}\right]$$

$$= \frac{77}{2}\left[13 + \frac{14}{3}\right]$$

$$= \frac{77 \times 53}{6} = 680.17$$

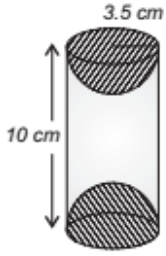
Hence, the total volume of the solid is 680.17 cm^3.

57. A wooden article was made by scooping out a hemisphere from each end of a solid cylinder, as shown in the figure. If the height of the cylinder is 10 cm and its base of radius is 3.5 cm. Find the total surface area of the article.

[CBSE 2018]

Ans. Given: height of the cylindrical part, h = 10 cm

Radius of the cylindrical part, r = 3.5 cm



Radius of the hemispherical part, r = 3.5 cm

Total surface area of the article

= CSA of the cylinder + CSA of 2 hemispheres

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

$= 2 \times \frac{22}{7} \times 3.5 \times 10 + 4 \times \frac{22}{7} \times 3.5 \times 3.5$

= 220 + 154

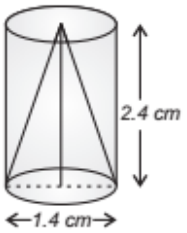
= 374 cm^2

Hence, the total surface area of the article is 374 cm^2.

58. Two cones with the same base radius 8 cm and height 15 cm are joined together along their bases. Find the surface area of the shape so formed. [NCERT Exemplar]

59. From a solid cylinder, whose height is 2.4 cm and diameter 1.4 cm, a conical cavity of the same height and same radius is hollowed out. Find the total surface area of the remaining solid. [CBSE 2017]

Ans. Here, the height of the cylinder (h) = height of the cone (h) = 2.4 cm.



Radius of cylinder (r) = Radius of cone (r)

$$= \frac{1.4}{2} = 0.7 \text{ cm}$$

Then, slant height of the cone,

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

$$= \sqrt{(2.4)^2 + (0.7)^2}$$

$$= \sqrt{5.76 + 0.49}$$

$$= \sqrt{6.25} = 2.5 \text{ cm}$$

T.S.A. of the solid = C.S.A. of cylinder + Area of top base of cylinder + C.S.A. of cone

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

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

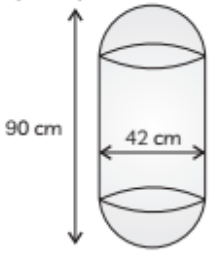
$$= \frac{22}{7} \times 0.7\,(2 \times 2.4 + 0.7 + 2.5)$$

$$= 2.2 \times 8$$

$$= 17.6 \text{ cm}^2$$

Hence, the total surface area of the remaining solid is 17.6 cm^2.

60. A toy is in the form of a cylinder with hemispherical ends. If the whole length of the toy is 90 cm and its diameter is 42 cm, find the cost of painting the toy at the rate of 70 paise per square cm.



[British Council 2022]

Ans. Length of the cylinder = (90 – 42) cm

= 48 cm

Area to be painted = C.S.A. of cylinder + C.S.A. of 2 hemispheres

$$= 2\pi rh + 4\pi r^2 = 2\pi r(h + 2r)$$

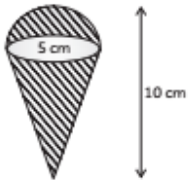
$$= 2 \times \frac{22}{7} \times 21\,(48 + 2 \times 21)$$

$$= 2 \times 22 \times 3\,(90) \text{ cm}^2$$

Cost of painting the toy = $\frac{132 \times 90 \times 70}{100}$

= ₹ 8316

61. **An ice cream cone full of ice cream has radius 5 cm and height 10 cm as, shown in the given figure. Calculate the volume of the ice cream, provided that its $\frac{1}{6}^{th}$ part is left unfilled with the ice cream.**



[NCERT Exemplar]

62. **A circus tent is in the shape of a cylinder surmounted by a conical top of the same diameter. If their common diameter is 56 m, the height of the cylindrical part is 6 m and the total height of the tent above the ground is 27 m, find the area of canvas used in making the tent.** **[CBSE 2017]**

63. **Marbles of diameter 1.4 cm are dropped into a cylindrical beaker of diameter 7 cm containing some water. Find the number of marbles that should be dropped into the beaker so that the water level rises by 5.6 cm.** **[CBSE 2014, NCERT Exemplar]**

Ans. When n marbles are dropped into the beaker filled partially with water, the volume of water raised in the beaker, will be equal to the volume of n marbles,

Now, For marble

Diameter = 1.4 cm

Radius = 0.7 cm

So Volume of one marble = $\frac{4}{3}\pi(0.7)^3$

$= \frac{4}{3}\pi \times 0.343$

[∵ Marbles are spherical in shape]

$= \frac{1.372\pi}{3}\ cm^3$

For beaker

Diameter = 7 cm

∴ Radius = 3.5 cm

Height of water level raised = 5.6 cm

∴ Volume of raised water in beaker

$= \pi r^2 h = \pi \times (3.5)^2 \times 5.6$

$= 68.6\ \pi\ cm^3$

Since, Volume of n spherical balls = Volume of water raised in beaker

Required number of marbles, n

$= \frac{\text{Volume of raised water in beaker}}{\text{Volume of one spherical marble}}$

$= \frac{68.6\pi}{1.372\pi} \times 3 = 150$

64. **Rampal decided to donate canvas for 10 tents, conical in shape with base diameter 14 m and height 24 m to a centre for handicapped persons' welfare. If the cost of 2 m wide canvas is ₹ 40, find the amount by which Rampal helped the centre.**

[CBSE 2017]

Ans. Given: Base diameter of the conical tent = 14 m

∴ Radius (r) of the conical tent = $\frac{14}{2} = 7$

Height (h) of the tent = 24 m

Slant height of the conical tent,

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

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

$= \sqrt{(24)^2 + 7^2}$

$= 25$ m

∴ C.S.A. of tent = πrl

$= \frac{22}{7} \times 7 \times 25 = 550\ m^2$

∴ C.S.A. of 10 tents = $550 \times 10 = 5500\ m^2$

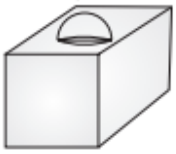
∴ Cost of 2 m wide canvas = ₹ 40

∴ Cost of 5500 m^2 canvas = ₹ $5500 \times \frac{40}{2}$

= ₹ 1,10,000

Hence, the amount given by Rampal to help the centre is ₹ 1,10,000.

65. **In the figure is a decorative block made up of two solids – a cube and a hemisphere. The base of the block is a cube of side 6 cm and the hemisphere fixed on the top has a diameter of 3.5 cm. Find the total surface area of the block.** $\left(\text{Use } \pi = \frac{22}{7}\right)$



[CBSE 2016]

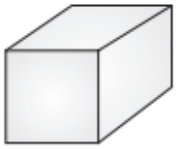
Ans. Given: Edge of a cube of side a = 6 cm

Diameter of hemisphere = 3.5 cm

∴ Radius (r) of hemisphere = $\frac{3.5}{2}$ cm

Now, the total surface area of the block
= Total surface area of cube – base area of hemisphere + curved surface of hemisphere

$= 6a^2 - \pi r^2 + 2\pi r^2$



$= 6a^2 + \pi r^2$

$= 6\times6\times6+\frac{22}{7}\times\frac{3.5}{2}\times\frac{3.5}{2}$

$= 216 + 9.625 = 225.625 \text{ cm}^2$

Hence, the total surface area of the block is 225.625 cm^2.

66. **Isha is 10 years old girl. On the result day, Isha and her father Suresh were very happy as she got first position in the class. While coming back to their home, Isha asked for a treat from her father as a reward for her success. They went to a juice shop and asked for two glasses of juice.**

Aisha, a juice seller, was serving juice to her customers in two types of glasses. Both the glasses had inner radius 3 cm. The height of both the glasses was 10 cm.

First type: A Glass with hemispherical raised bottom.

Second type: A glass with conical raised bottom of height 1.5 cm.

Isha insisted to have the juice in first type of glass and her father decided to have the juice in second type of glass. Out of the two, Isha or her father Suresh, who got more quantity of juice to drink and by how much?

[CBSE SQP 2019]

67. **Due to sudden floods, some welfare associations jointly requested the government to get 100 tents fixed immediately and offered to contribute 50% of the cost. If the lower part of each tent is of the form of a cylinder of diameter 4.2 m and height 4 m with the conical upper part of same diameter but of height 2.8 m, and the canvas to be used costs ₹ 100 per sq. m, find the amount, the associations will have to pay. What values are shown by these associations?** $\left(\text{Use } \pi = \frac{22}{7}\right)$ **[CBSE SQP 2015]**

Ans.

Slant height (l) = $\sqrt{(2.8)^2 + (2.1)^2}$ = 3.5 m

∴ Area of canvas for one tent

$= 2 \times \frac{22}{7} \times (2.1) \times 4 + \frac{22}{7} \times 2.1 \times 3.5$

$= 6.6(8 + 3.5)$

$= 6.6 \times 11.5 \text{ m}^2$

∴ Area for 100 tents = $66 \times 115 \text{ m}^2$

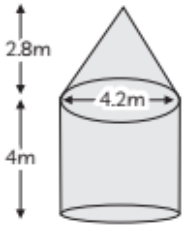
Cost of 100 tents = ₹ $66 \times 115 \times 100$

50% Cost = 33×11500 = ₹ 379500

Values: Helping the flood victims

[CBSE Marking Scheme SQP 2015]

Explanation : Given



Diameter of cylinder = diameter of cone = 4.2 m

⇒ Radius of cylinder = Radius of cone = R

$= \frac{4.2}{2} = 2.1 \text{ m}$

Height of cylinder (H) = 4 m

and, Height of cone (h) = 2.8 m

So, slant height of the cone

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

$= \sqrt{(2.1)^2 + (2.8)^2}$

$= \sqrt{4.41 + 7.84}$

$= \sqrt{12.25} = 3.5 \text{ m}$

Now, Area of one tent

= CSA of cylinder + CSA of cone

$= 2\pi rh + \pi rl$

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

$= \frac{22}{7} \times 2.1\,(2 \times 4 + 3.5)$

$= 22 \times 0.3 \times 11.5$

$= 75.9 \text{ m}^2$

∴ Areas of 100 such tents = $100 \times 75.9 = 750 \text{ m}^2$

So, total area of canvas to make the tents is 7590 m^2. Since cost of 1 m^2 of canvas = ₹ 100

∴ Cost of 7590 m^2 of canvas

= ₹ 100×7590

= ₹ 7,59,000

∴ Amount paid by association = 50% of the cost

$= \frac{1}{2} \times 7,59000$

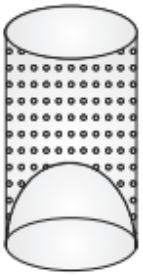
$= ₹\ 3,79500$

Value: Helping the people in need.

68. **A cubical block of side 10 cm is surmounted by a hemisphere. What is the largest diameter that the hemisphere can have ? Find the cost of painting the total surface area of the solid so formed, at the rate of ₹ 5 per 100 sq. cm. [Use $\pi = 3.14$]** **[CBSE SQP 2015]**

69. **In a cylindrical vessel of radius 10 cm, containing some water, 9000 small spherical balls are dropped which are completely immersed in water which raises the water level. If each spherical ball is of radius 0.5 cm, then the the rise in the level of water in the vessel.** **[CBSE 2020]**

70. **A juice seller was serving his costumers using glasses as shown in the figure. The inner diameter of the cylindrical glass was 5 cm but bottom of the glass had a hemispherical raised portion which reduced the capacity of the glass. If the height of a glass was 10 cm, find the apparent and actual capacity of the glass. (Use $\pi = 3.14$).**

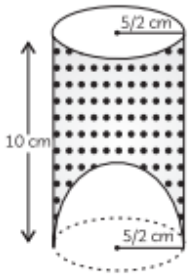


[CBSE 2019]

Ans. Radius of the cylindrical part (r) = $\frac{5}{2}$ cm

Height of the cylindrical part (h) = 10 cm

Radius of the hemispherical part (r) = $\frac{5}{2}$ cm



Now, apparent capacity of the glass

= Volume of cylindrical part

$= \pi r^2 h$

$= 3.14 \times \frac{5}{2} \times \frac{5}{2} \times 10$

$= 196.25\ cm^3$

And,

Actual capacity of the glass

= Volume of cylindrical part − Volume of hemispherical portion

$= \pi r^2 h - \frac{2}{3}\pi r^3$

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

$= 3.14 \times \frac{5}{2} \times \frac{5}{2}\left(10 - \frac{2}{3} \times \frac{5}{2}\right)$

$= 3.14 \times \frac{25}{4} \times \frac{25}{3}$

$= 163.54\ cm^3$

Hence, the apparent capacity of the glass is 196.25 cm^3 and the actual capacity of the glass is 163.54 cm^3.

LONG ANSWER Type Questions (LA)

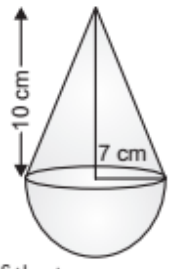
[**4** & **5** marks]

71. **A solid toy is in the form of a hemisphere surmounted by a right circular cone of same radius. The height of the cone is 10 cm and the radius of the base is 7 cm. Determine the volume of the toy. Also find the area of the coloured sheet required to cover the toy.**

(Use $\pi = \frac{22}{7}$ and $\sqrt{149} = 12.2$) [CBSE 2020]

Ans. Here, height of cone (h) = 10 cm

Radius of base of cone = Radius of hemisphere = (r) = 7cm



Now, volume of the toy

= Volume of the cone + Volume of the hemisphere

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

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

$$= \frac{1}{3}\times\frac{22}{7}\times 7\times 7(10+2\times 7)$$

$$= \frac{1}{3}\times 22\times 7\times 24$$

$$= 22 \times 7 \times 8$$

$$= 1232 \text{ cm}^3.$$

And, area of the coloured sheet required to cover the toy

= CSA of the toy

= Curved surface area of the hemisphere + curved surface area of the cone

$= 2\pi r^2 + \pi rl$, where $l = \sqrt{r^2+h^2}$

$$= 2\times\frac{22}{7}\times 7\times 7+\frac{22}{7}\times 7\times\sqrt{(7)^2+(10)^2}$$

$$= 2\times 22\times 7+22\times\sqrt{149}$$

$= 308 + 22 \times 12.2$ [$\because \sqrt{149} = 12.2$ (Given)]

$= 308 + 268.4$

$= 576.4 \text{ cm}^2$

72. Due to heavy floods in a state, thousands were rendered homeless. 50 schools collectively decided to provide place and the canvas for 1500 tents and share the whole expenditure equally. The lower part of each tent is cylindrical with base radius 2.8 m and height 3.5 m and the upper part is conical with the same base radius, but of height 2.1 m. If the canvas used to make the tents costs ₹120 per m^2, find the amount shared by each school to set up the tents.

[CBSE SQP Std. 2022]

Ans. Radius of the base of cylinder (r) = 2.8 m

= Radius of the base of the cone (r)

Height of the cylinder (h) = 3.5 m

Height of the cone (H) = 2.1 m.

Slant height of conical part (l) = $\sqrt{r^2+H^2}$

$$= \sqrt{(2.8)^2+(2.1)^2}$$

$$= \sqrt{7.84+4.41}$$

$$= \sqrt{12.25} = 3.5 \text{ m}$$

Area of canvas used to make tent

= CSA of cylinder + CSA of cone

$= 2 \times \pi \times 2.8 \times 3.5 + \pi \times 2.8 \times 3.5$

$= 61.6 + 30.8 = 92.4 \text{ m}^2$

Cost of 1500 tents at ₹ 120 per sq.m

$= 1500 \times 120 \times 92.4$

$= 16{,}632{,}000$

Share of each school to set up the tents

$$= \frac{16632000}{50}$$

= ₹ 332,640

[CBSE Marking Scheme SQP Std. 2022]

73. There are two identical solid cubical boxes of side 7cm. From the top face of the first cube a hemisphere of diameter equal to the side of the cube is scooped out. This hemisphere is inverted and placed on the top of the second cube's surface to form a dome. Find :

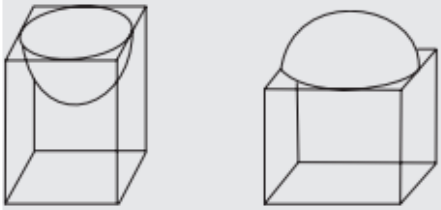
(A) the ratio of the total surface area of the two new solid formed.

(B) volume of each new solid formed.

[CBSE SQP Std. 2022]

Ans.

First Solid **Second Solid**



(A) SA for first new solid (S_1):

$6 \times 7 \times 7 + 2\pi \times 3.5^2 - \pi \times 3.5^2$

$= 294 + 77 - 38.5$

$= 332.5 \text{ cm}^2$

SA for second new solid (S_2):

$6 \times 7 \times 7 + 2\pi \times 3.52 - \pi \times 3.5^2$

$= 294 + 77 - 38.5$

$= 332.5 \text{ cm}^2$

So $S_1 : S_2 = 1:1$

(B) Volume for first new solid (V_1)

$$= 7 \times 7 \times 7 - \frac{2}{3}\pi \times 3.5^3$$

$$= 343 - \frac{539}{6}$$

$$= \frac{1519}{6} \text{ cm}^3$$

Volume for second new solid (V_2)

$$= 7 \times 7 \times 7 + \frac{2}{3}\pi \times 3.5^3$$

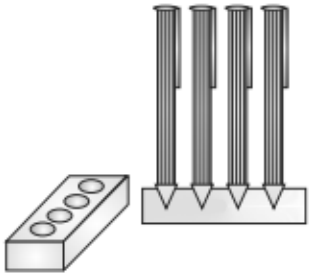
$$= 343 + \frac{539}{6} = \frac{2597}{6} \text{ cm}^3$$

[CBSE Marking Scheme SQP Std. 2022]

74. **A solid iron pole consists of a cylinder of height 220 cm and base diameter 24 cm, which is surmounted by another cylinder of height 60 cm and radius 8 cm. Find the volume of the pole. (Use $\pi = 3{\cdot}14$)**

[Mod. CBSE 2019]

75. **A pen stand made of wood is in the shape of a cuboid with four conical depressions to hold pens. The dimensions of the cuboid are 15 cm by 10 cm by 3.5 cm. The radius of each of the depressions is 0.5 cm and the depth is 1.4 cm. Find the volume of wood in the entire stand.**



[CBSE SQP Basic 2022]

Ans. Volume of one conical depression

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

$$= \frac{1}{3} \times \frac{22}{7} \times 0.5^2 \times 1.4 \text{ cm}^3$$

$$= 0.366 \text{ cm}^3$$

Volume of 4 conical depression

$$= 4 \times 0.366 \text{ cm}^3$$

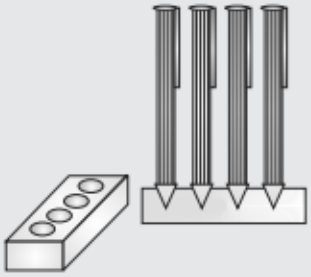
$$= 1.464 \text{ cm}^3$$

Volume of cuboidal box

$$= L \times B \times H$$

$$= 15 \times 10 \times 3.5 \text{ cm}^3$$

$$= 525 \text{ cm}^3$$



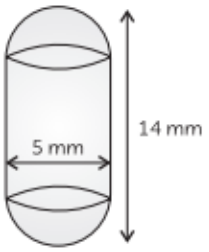
Remaining volume of box = Volume of cuboidal box – Volume of 4 conical depressions

$$= 525 \text{ cm}^3 - 1.464 \text{ cm}^3$$

$$= 523.5 \text{ cm}^3$$

[CBSE Marking Scheme SQP Basic 2022]

76. **A medicine capsule is in the shape of a cylinder with two hemispherical ends, as shown in the diagram.**
The length of the capsule is 14 mm, and the thickness is 5 mm.
Find its surface area (take $\pi = \frac{22}{7}$).



[British Council 2022]

Ans. C.S.A. of capsule = C.S.A. of 2 hemispheres + C.S.A. of cylinder

Radius of cylinder = radius of hemisphere = half of thickness

$$= \frac{5}{2} = 2.5 \text{ mm}$$

$$\text{C.S.A. of cylinder} = 2\pi rh = \frac{2 \times 22 \times 9 \times 5}{7 \times 2}$$

$$= \frac{990}{7} = 141.43$$

$$\text{C.S.A. of 2 hemispheres} = 2 \times 2\pi r^2$$

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

$$= \frac{550}{7} = 78.57$$

C.S.A. of capsule = 141.43 + 78.57 = 220.00

77. **A rocket is in the form of a right circular cylinder closed at the lower end and surmounted by a cone with the same radius as that of the cylinder. The diameter and the height of the cylinder are 6 cm and 12 cm, respectively. If the slant height of the conical portion is 5 cm, find the total surface area and volume of the rocket. [Use $\pi = 3.14$].**

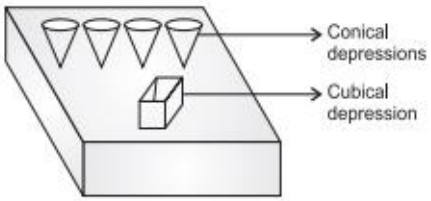
[CBSE 2011, NCERT Exemplar]

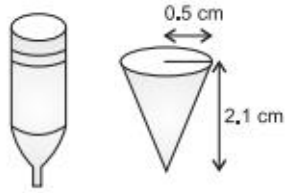
78. **A solid right circular cone of height 120 cm and radius 60 cm is placed in a right circular cylinder full of water of height 180 cm such that it touches the bottom. Find the volume of water left in the cylinder, if the radius of the cylinder is equal to the radius of the cone.** **[NCERT Exemplar]**

79. **A pen stand made of wood is in the shape of a cuboid with four conical depressions and a cubical depression to hold the pens and pins, respectively. The dimensions of the cuboid**

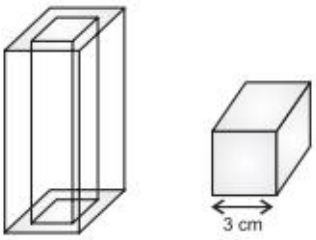
are 10 cm, 5 cm and 4 cm. The radius of each of the conical depressions is 0.5 cm and the depth is 2.1 cm. The edge of the cubical depression is 3 cm. Find the volume of the wood in the entire stand. [NCERT Exemplar]

Ans.





Pen with conical base



For cuboidal stand,

Length, l = 10 cm

Breadth, b = 5 cm

Height, h = 4 cm

Volume of cuboidal pen stand = lbh

$= 10 \times 5 \times 4 = 200 \text{ cm}^3$

For cuboidal depresssion,

Side, a = 3 cm

Volume of cube = a^3

∴ Volume of 1 cuboidal depression

$= (3)^3 = 27 \text{ cm}^3$

For conical depression,

Radius, r = 0.5 cm

Depth, h = 2.1 cm

∴ Volume of 1 conical depression = $\frac{1}{3}\pi r^2 h$

$= \frac{1}{3} \times \frac{22}{7} \times (0.5)^2 \times 2.1$

$= \frac{22}{7} \times 0.5 \times 0.5 \times 0.7$

$= 0.55 \text{ cm}^3$

∴ Volume of 4 conical depressions

$= 4 \times 0.55 = 2.2 \text{ cm}^3$

Volume of wood in entire pen stand

= Volume of cuboidal pen stand

− Volume of 4 conical depressions

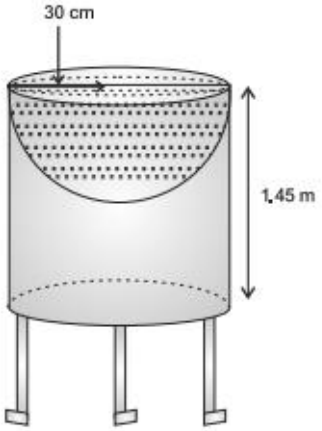
− Volume of cubical depression

$= 200 - 2.2 - 27$

$= 200 - 29.2 = 170.8 \text{ cm}^3$

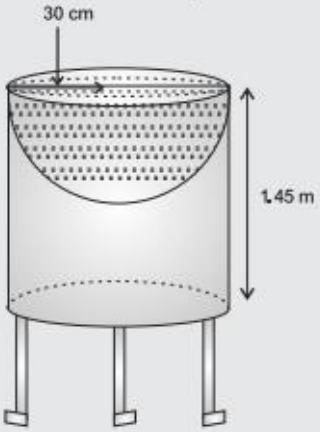
Hence, the required volume of wood in the entire stand is 170.8 cm^3

80. Ramesh made a bird-bath for his garden in the shape of a cylinder with a hemispherical depression at one end. The height of the cylinder is 1.45 m and its radius is 30 cm. Find the total surface area of the bird-bath.



[CBSE SQP Basic 2022]

Ans. Let h be height of the cylinder, and r the common radius of the cylinder and hemisphere.



Then, the total surface area = CSA of cylinder + CSA of hemisphre

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

$= \frac{22}{7} \times 390(145 + 30) \text{ cm}^2$

$= \frac{22}{7} \times 30 \times 175 \text{ cm}^2$

$= 33000 \text{ cm}^2 = 3.3 \text{ m}^2$

[CBSE Marking Scheme SQP Basic 2022]

Detailed Answer :

Given: The height of the cylinder is 1.45 m and its radius is 30 cm.

Let h be height of the cylinder, and r the common radius of the cylinder and hemisphere. Then,

The total surface area of the bird-bath = CSA of cylinder + CSA of hemisphere + Area of the circle in bottom

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

$= (2 \times \frac{22}{7} \times 30 \times 145) + (2 \times \frac{22}{7} \times 302)$

[$\because$ 1.45 m = 145 cm]

$= \frac{191400}{7} + \frac{39600}{7}$

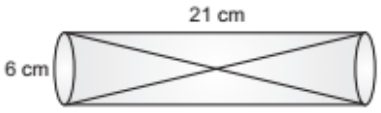
$= \frac{231000}{7}$

$= 33000 \text{ cm}^2$

$= 3.3 \text{ m}^2$

Hence, the total surface area of the birdbath is 3.3 m^2.

81. **Two solid cones A and B are placed in a cylindrical tube as shown in the given figure. The ratio of their capacities is 2 : 1. Find the heights and capacities of the cones. Also, find the volume of the remaining portion of the cylinder.**

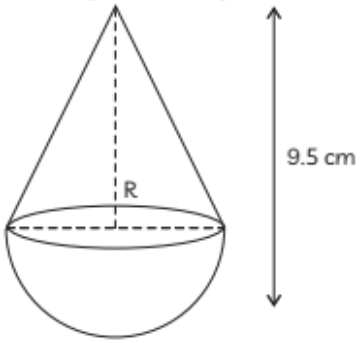


[NCERT Exemplar]

82. **A solid is in the shape of a cone surmounted on a hemisphere. The radius of each of them being 3.5 cm and the total height of the solid is 9.5 cm. Find the volume of the solid.**

[Delhi Gov. QB 2022, CBSE 2020]

Ans.



total height of the solid = 9.5 cm

Given, Radius of the cone =

Radius of the hemisphere = r = 3.5 cm

Radius of the hemisphere =

height of hemisphere = 3.5 cm

Height of cone, (h) = total height of the solid – height of the hemisphere h = 9.5 – 3.5 = 6 cm

The volume of the solid = volume of cone + volume of the hemisphere

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

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

$= \frac{1}{3} \times \frac{22}{7} \times 3.5 \times 3.5 \times (6 + 2 \times 3.5)$

$= \frac{1}{3} \times \frac{22}{7} \times 3.5 \times 3.5 \times (6 + 7)$

$= \frac{1}{3} \times \frac{22}{7} \times 3.5 \times 3.5 \times (13)$

$= \frac{1}{3} \times 22 \times .5 \times 3.5 \times (13)$

$= \frac{500.5}{3}$

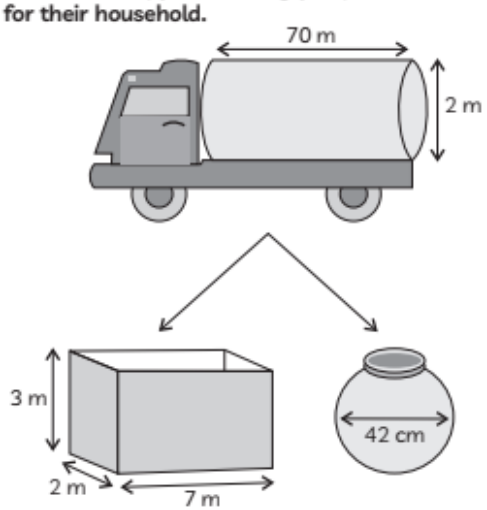
$= 166.83 \text{ cm}^3$

Hence, the volume of the solid is 166.83 cm^3.

83. **A hemispherical depression is cut out from one face of a cubical block of side 7 cm such that the diameter of the hemisphere is equal to the edge of the cube. Find the surface area of the remaining solid.**

[NCERT Exemplar]

84. **A right-circular cylindrical water tanker supplies water to colonies on the outskirts of a city and to nearby villages. Each colony has a cuboidal water tank. In villages, people come with matkas (spherical clay pots) to fill water for their household.**



(A) How many colonies in total would one full tanker be able to supply?

(B) If a tanker supplies water to 3 colonies and then goes to a village where 400 people fill thier matkas, roughly how much water is supplied by the tanker in all? Give your answer in m^3.

Show your work.

(Note: Assume all the tanks/matkas are completely filled without any loss of water: Take π as $\frac{22}{7}$: Use 1000000 cm^3 = 1 m^3.)

[CBSE Question Bank 2023]

Ans. (A) Given, diameter of tanker = 2 m

$\therefore$ radius of tanker, r = 1 m

Height of tanker, h = 70 m

Volume of tanker = $\pi r^2 h$

$= \frac{22}{7} \times 1 \times 1 \times 70$

$= 220\ m^3$

Now, length of cuboidal tank, l = 7m

Breadth of cuboidal tank, b = 2m

Height of cuboidal tank, h = 3m

$\therefore$ Volume of cuboidal tank = l × b × h

$= 7 \times 2 \times 3$

$= 42\ m^3$

Number of colonies = $\frac{\text{Volume of tanker}}{\text{Volume of cuboidal tank}}$

$= \frac{220}{42}$

$= 5.23$

$= 5$

Thus, the tanker can supply 5 colonies.

(B) Given, diameter of matka = 42 cm

$\therefore$ radius of matka = $\frac{42}{2} = 21$ cm

Volume of matka = $\frac{4}{3}\pi r^3$

$= \frac{4}{3} \times \frac{22}{7} \times 21 \times 21 \times 21$

$= 38{,}808\ cm^3$

Volume of one matka in m^3 = 0.04 m^3

Volume of 400 matkas = 400 × 0.04

$= 400 \times 0.04$

$= 16\ m^3$

Total volume of water supplied by the tanker and matkas = 126 + 16

$= 142\ m^3$

And volume of 3 cuboidal tanks

$= 42 \times 3$

$= 126\ m^3$