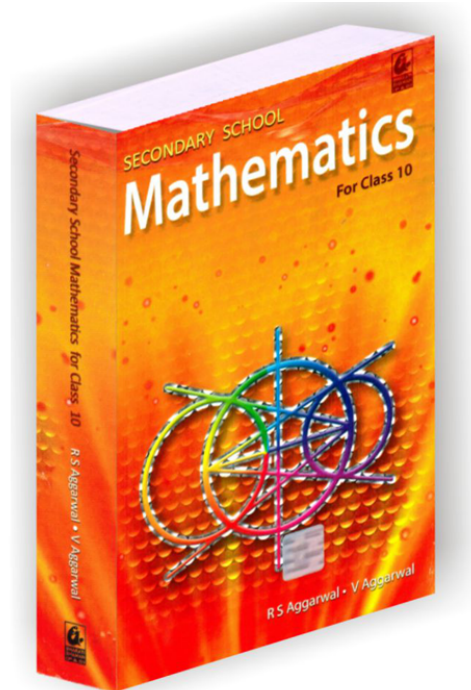


RS Aggarwal Solutions for Class 10 Maths Chapter 17–Volume and Surface Areas of Solids

Class 10 - Chapter 17 Volume and Surface Areas of Solids



For any clarifications or questions you can write to info@indcareer.com

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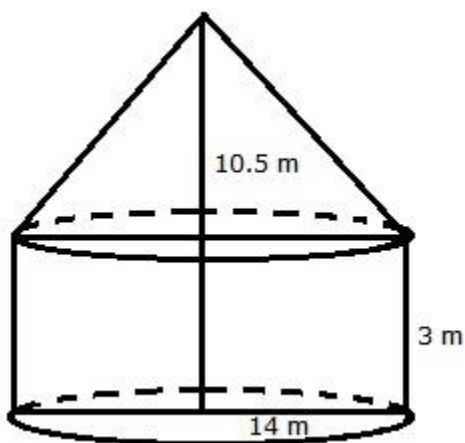
RS Aggarwal Solutions for Class 10 Maths Chapter 17–Volume and Surface Areas of Solids

Class 10: Maths Chapter 17 solutions. Complete Class 10 Maths Chapter 17 Notes.

RS Aggarwal Solutions for Class 10 Maths Chapter 17–Volume and Surface Areas of Solids

RS Aggarwal 10th Maths Chapter 17, Class 10 Maths Chapter 17 solutions

Question 1:



Radius of the cylinder = 14 m

And its height = 3 m

Radius of cone = 14 m

And its height = 10.5 m

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Let l be the slant height

$$\begin{aligned}\therefore l^2 &= (14)^2 + (10.5)^2 \\ l^2 &= (196 + 110.25) \text{ m}^2 \\ l^2 &= 306.25 \text{ m}^2 \\ l &= \sqrt{306.25} \text{ m} \\ &= 17.5 \text{ m}\end{aligned}$$

Curved surface area of tent

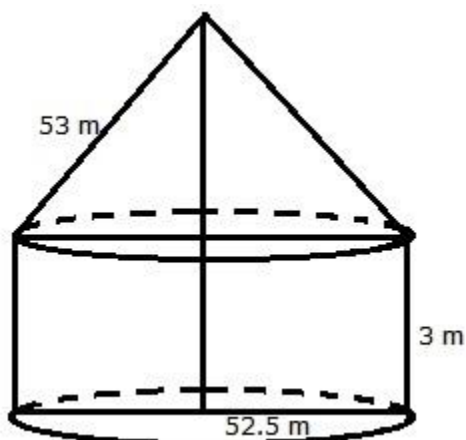
= (curved area of cylinder + curved surface area of cone)

$$\begin{aligned}&= 2\pi rh + \pi rl \\ &= \left[\left(2 \times \frac{22}{7} \times 14 \times 3 \right) + \left(\frac{22}{7} \times 14 \times 17.5 \right) \right] \text{ m}^2 \\ &= (264 + 770) \text{ m}^2 = 1034 \text{ m}^2\end{aligned}$$

Hence, the curved surface area of the tent = 1034

Cost of canvas = Rs. (1034×80) = Rs. 82720

Question 2:



For the cylindrical portion, we have radius = 52.5 m and height = 3 m

For the conical portion, we have radius = 52.5 m

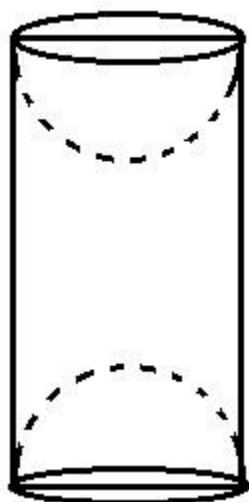
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And slant height = 53 m

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

$$= \left[\frac{22}{7} \times 52.5 \times (2 \times 3 + 53) \right] \text{m}^2$$
$$= \left(22 \times \frac{15}{2} \times 59 \right) \text{m}^2 = 9735 \text{m}^2$$

Question 3:



Height of cylinder = 20 cm

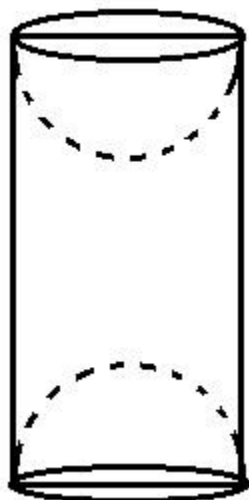
And diameter = 7 cm and then radius = 3.5 cm

Total surface area of article

= (lateral surface of cylinder with $r = 3.5$ cm and $h = 20$ cm)

$$= \left[2\pi rh + 2 \times (\pi r^2) \right] \text{sq. units}$$
$$= \left[\left(2 \times \frac{22}{7} \times \frac{7}{2} \times 20 \right) + \left(4 \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \right) \right] \text{cm}^2$$
$$= (440 + 154) \text{cm}^2 = 594 \text{cm}^2$$

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Question 4:

Radius of wooden cylinder = 4.2 cm

Height of wooden cylinder = 12 cm

Lateral surface area

$$\begin{aligned} &= 2\pi rh \text{ sq.cm} \\ &= 2 \times \pi \times 4.2 \times 12 \text{ cm}^2 \\ &= 100.8\pi \text{ cm}^2 \end{aligned}$$

Radius of hemisphere = 4.2 cm

Surface area of two hemispheres

$$\begin{aligned} &= 2 \times 2\pi r^2 \text{ sq. unit} \\ &= 4\pi \times 4.2 \times 4.2 \text{ cm}^2 \\ &= 70.70\pi \text{ cm}^2 \end{aligned}$$

Total surface area = $(100.8 + 70.56)\pi \text{ cm}^2$

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$$= 538.56 \text{ cm}^2$$

$$= 171.36 \pi$$

$$= 171.36 \times 227 \text{ cm}^2$$

$$= 538.56 \text{ cm}^2$$

$$\text{Further, volume of cylinder} = \pi r^2 h = 4.2 \times 4.2 \times 12 \pi \text{ cm}^2$$

$$= 211.68 \pi \text{ cm}^2$$

$$\text{Volume of two hemispheres} = 2 \times \frac{4}{3} \pi r^3 \text{ cu.units}$$

$$= \frac{4}{3} \pi \times 4.2 \times 4.2 \times 4.2$$

$$= 98.784 \text{ cm}^3$$

$$\text{Volume of wood left} = (211.68 - 98.784) \pi$$

$$= 112.896 \pi \text{ cm}^3$$

$$= 112.896 \times 227 \text{ cm}^3$$

$$= 354.816 \text{ cm}^3$$

Question 5:

$$\text{Radius of cylinder} = 2.5 \text{ m}$$

$$\text{Height of cylinder} = 21 \text{ m}$$

$$\text{Slant height of cone} = 8 \text{ m}$$

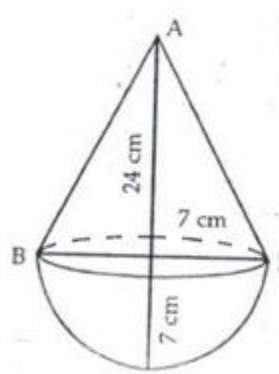
$$\text{Radius of cone} = 2.5 \text{ m}$$

$$\text{Total surface area of the rocket} = (\text{curved surface area of cone} + \text{curved surface area of cylinder} + \text{area of base})$$

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$$\begin{aligned}
 &= (\pi r l + 2\pi r h + \pi r^2) \\
 &\quad \text{where } l = 8 \text{ m, } h = 21 \text{ m, } r = 2.5 \text{ m} \\
 &= \left(\frac{22}{7} \times 2.5 \times 8 + 2 \times \frac{22}{7} \times 2.5 \times 21 + \frac{22}{7} \times 2.5 \times 2.5 \right) \text{ m}^2 \\
 &= (62.85 + 330 + 19.64) \text{ m}^2 = 412.5 \text{ m}^2
 \end{aligned}$$

Question 6:



Height of cone = $h = 24 \text{ cm}$

Its radius = 7 cm

$$\begin{aligned}
 \therefore \text{Slant height} &= \sqrt{(24)^2 + 7^2} \\
 &= \sqrt{576 + 49} \\
 &= \sqrt{625} = 25 \text{ cm}
 \end{aligned}$$

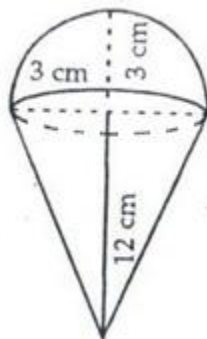
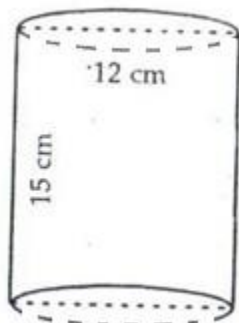
Total surface area of toy

$$\begin{aligned}
 &= (\pi r l + 2\pi r^2) \\
 &= \pi r (l + 2r) \\
 &= \frac{22}{7} \times 7 \times (25 + 14) \\
 &= 22 \times 39 = 858 \text{ cm}^2
 \end{aligned}$$

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<https://www.youtube.com/embed/YA0xN128QGg?feature=oembed>

Question 7:



Height of cylindrical container $h_1 = 15$ cm

Diameter of cylindrical container = 12 cm

Volume of container =

$$\pi r_1^2 h_1 = \pi \times 6 \times 6 \times 15 = 540\pi \text{ cm}^2$$

Height of cone $h_2 = 12$ cm

Diameter = 6 cm

Radius of $r_2 = 3$ cm

$$\begin{aligned} \text{Volume of cone} &= \frac{1}{3} \pi r_2^2 h_2 = \frac{1}{3} \pi \times 3 \times 3 \times 12 \\ &= 36 \pi \text{ m}^3 \end{aligned}$$

Radius of hemisphere = 3 cm

Volume of hemisphere =

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$$\frac{2}{3} \pi r^3 = \frac{2}{3} \pi \times 3 \times 3 \times 3 = 18\pi$$

Volume of cone + volume of hemisphere

$$= 36\pi + 18\pi = 54\pi$$

Number of cones

$$\begin{aligned} &= \frac{\text{Volume of container}}{\text{Volume of cone + Volume of hemisphere}} \\ &= \frac{540\pi}{54\pi} = 10 \end{aligned}$$

Number of cones that can be filled = 10

Question 8:

Diameter of cylindrical gulabjamun = 2.8 cm

Its radius = 1.4 cm

Total height of gulabjamun = AC + CD + DB = 5 cm

$$1.4 + CD + 1.4 = 5$$

$$2.8 + CD = 5$$

$$CD = 2.2 \text{ cm}$$

Height of cylindrical part h = 2.2 cm

Volume of 1 gulabjamun = Volume of cylindrical part + Volume of two hemispherical parts

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$$\begin{aligned} &= \pi r^2 h + \frac{2}{3} \pi r^2 + \frac{2}{3} \pi r^3 \\ &= \pi r^2 h + \frac{4}{3} \pi r^3 = \pi r^2 \left(h + \frac{4}{3} r \right) \\ &= \frac{22}{7} \times 1.4 \times 1.4 \times \left(2.2 + \frac{4}{3} \times 1.4 \right) \\ &= 22 \times 0.2 \times 1.4 \times (2.2 + 1.87) \\ &= 4.4 \times 1.4 \times 4.07 = 25.07 \text{ cm}^3 \end{aligned}$$

$$\text{Volume of 45 gulabjamuns} = 45 \times 25.07 \text{ cm}^3$$

$$\text{Quantity of syrup} = 30\% \text{ of volume of gulabjamuns}$$

$$= 0.3 \times 45 \times 25.07 = 338.46 \text{ cm}^3$$

Question 9:

$$\text{Diameter} = 7 \text{ cm, radius} = 3.5 \text{ cm}$$

$$\text{Height of cone} = 14.5 \text{ cm} - 3.5 \text{ cm} = 11 \text{ cm}$$

$$\begin{aligned} l &= \sqrt{\left(\frac{7}{2}\right)^2 + (11)^2} \text{ cm} = \sqrt{\frac{49}{4} + 121} \text{ cm} = \sqrt{\frac{533}{4}} \text{ cm} \\ l &= \frac{23.08}{2} \text{ cm} = 11.54 \text{ cm} \end{aligned}$$

$$\begin{aligned} \text{Volume of toy} &= \frac{2}{3} \pi r^3 + \frac{1}{3} \pi r^2 h \\ &= \left[\frac{1}{3} \pi r^2 (2r + h) \right] \\ &\quad \text{where } r = \frac{7}{2} \text{ and } h = 11 \\ &= \left[\frac{1}{3} \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times \left(2 \times \frac{7}{2} + 11 \right) \right] \text{ cm}^3 \\ &= (12.83 \times 18) \text{ cm}^3 = 230.94 \text{ cm}^3 \end{aligned}$$

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Total surface area of toy =

$$(2\pi r^2 + \pi r l) \text{ cm}^2 = \pi r (2r + l) \text{ cm}^2$$

Question 10:

Diameter of cylinder = 24 m

Radius of cylinder = $24 \div 2 = 12$ cm

Height of the cylinder = 11 m

Height of cone = $(16 - 11)$ cm = 5 cm

Slant height of the cone l =

$$\sqrt{r^2 + h^2} = \sqrt{12^2 + 5^2} \text{ m} = 13 \text{ m}$$

Area of canvas required = (curved surface area of the cylindrical part) + (curved surface area of the conical part)

$$= (2\pi r h + \pi r l) \text{ m}^2 = \pi r (2h + l) \text{ m}^2$$

$$= \left[\frac{22}{7} \times 12 \times (2 \times 11 + 13) \right] \text{ m}^2$$

$$= \left(\frac{22}{7} \times 12 \times 35 \right) \text{ m}^2 = 1320 \text{ m}^2$$

Question 11:

Radius of hemisphere = 10.5 cm

Height of cylinder = $(14.5 - 10.5)$ cm = 4 cm

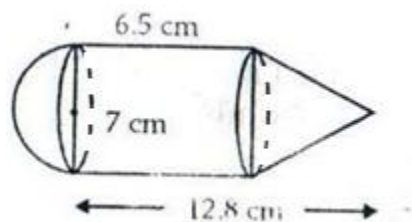
Radius of cylinder = 10.5 cm

Capacity = Volume of cylinder + Volume of hemisphere

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$$\begin{aligned}
 &= \left(\pi r^2 h + \frac{2}{3} \pi r^3 \right) \text{cm}^3 = \pi r^2 \left(h + \frac{2}{3} r \right) \text{cm}^3 \\
 &= \left[\frac{22}{7} \times 10.5 \times 10.5 \times \left(4 + \frac{2}{3} \times 10.5 \right) \right] \text{cm}^3 \\
 &= (346.5 \times 11) \text{cm}^2 = 3811.5 \text{cm}^2
 \end{aligned}$$

Question 12:



Height of cylinder = 6.5 cm

Height of cone = $h_2 = (12.8 - 6.5) \text{ cm} = 6.3 \text{ cm}$

Radius of cylinder = radius of cone

= radius of hemisphere

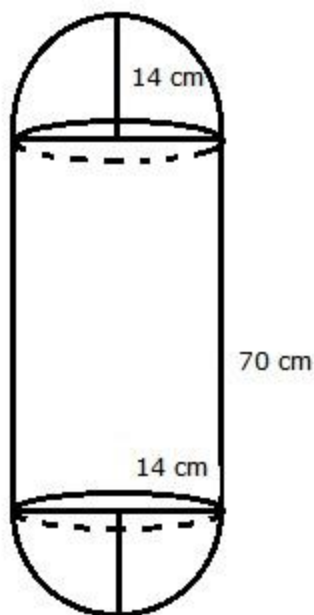
= 7 cm

Volume of solid = Volume of cylinder + Volume of cone + Volume of hemisphere

$$\begin{aligned}
 &= \pi r^2 h_1 + \frac{1}{3} \pi r^2 h_2 + \frac{2}{3} \pi r^3 = \pi r^2 \left(h_1 + \frac{1}{3} h_2 + \frac{2}{3} r \right) \\
 &= \left[\frac{22}{7} \times 3.5 \times 3.5 \times \left(6.5 + 6.3 \times \frac{1}{3} + \frac{2}{3} \times 3.5 \right) \right] \\
 &= [(38.5) \times (6.5 + 2.1 + 2.33)] \text{cm}^3 \\
 &= (38.5 \times 10.93) \text{cm}^3 = 420.80 \text{cm}^3
 \end{aligned}$$

Question 13:

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Radius of each hemispherical end = $28.2 = 14$ cm

Height of each hemispherical part = Its Radius

Height of cylindrical part = $(98 - 2 \times 14) = 70$ cm

Area of surface to be polished = $2(\text{curved surface area of hemisphere}) + (\text{curved surface area of cylinder})$

$$\begin{aligned}
 &= [2(2\pi r^2) + 2\pi rh] \text{ sq. unit} \\
 &= 2\pi r(2r + h) \text{ cm}^2 \\
 &= 2 \times \frac{22}{7} \times 14 \times [2 \times 14 + 70] \text{ cm}^2 \\
 &= (88 \times 98) = 8624 \text{ cm}^2
 \end{aligned}$$

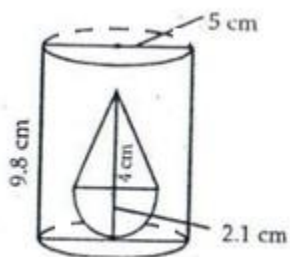
Cost of polishing the surface of the solid

$$= \text{Rs. } (0.15 \times 8624)$$

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= Rs. 1293. 60

Question 14:



Radius of cylinder $r_1 = 5$ cm

And height of cylinder $h_1 = 9.8$ cm

Radius of cone $r = 2.1$ cm

And height of cone $h_2 = 4$ cm

Volume of water left in tub = (volume of cylindrical tub – volume of solid)

$$\begin{aligned} &= \left(\pi r_1^2 h_1 - \frac{2}{3} \pi r^3 - \frac{1}{3} \pi r^2 h_2 \right) \\ &= \left(\frac{22}{7} \times 5 \times 5 \times 9.8 - \frac{2}{3} \times \frac{22}{7} \times 2.1 \times 2.1 \times 2.1 - \frac{1}{3} \times \frac{22}{7} \times 2.1 \times 2.1 \times 4 \right) \\ &= [(770 - 19.404) - 18.48] \text{ cm}^3 \\ &= 732.116 \text{ cm}^3 \end{aligned}$$

Question 15:

(i) Radius of cylinder = 6 cm

Height of cylinder = 8 cm

Volume of cylinder

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$$\begin{aligned}\Rightarrow \pi r^2 \times 10800 &= 972\pi \\ r^2 &= \frac{972\pi}{10800\pi} = 0.09 \text{ cm}^2 \\ r &= \sqrt{0.09} \text{ cm} = 0.3\end{aligned}$$

Volume of cone removed

$$\begin{aligned}&= \frac{1}{3} \pi r^2 h \\ &= \frac{1}{3} \times \pi \times 6 \times 6 \times 8 \text{ cm}^3 \\ &= 96 \pi \text{ cm}^3\end{aligned}$$

$$(ii) \text{ Surface area of cylinder} = 2\pi r h = 2\pi \times 6 \times 8 \text{ cm}^2 = 96 \pi \text{ cm}^2$$

$$\begin{aligned}\text{Slant height of cone} &= \sqrt{6^2 + 8^2} = \sqrt{36 + 64} \text{ cm} \\ &= \sqrt{100} \text{ cm} = 10 \text{ cm}\end{aligned}$$

$$\text{Curved surface area of cone} = \pi r l = \pi \times 6 \times 10 = 60 \pi$$

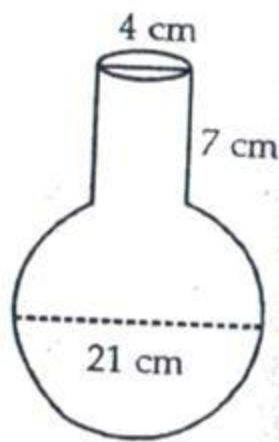
$$\text{Area of base of cylinder} = \pi r^2 = \pi \times 6 \times 6 = 36 \pi$$

Total surface area of remaining solid

$$\begin{aligned}&= (96\pi + 60\pi + 36\pi) \text{ cm}^2 \\ &= 192 \pi \text{ cm}^2 = 602.88 \text{ cm}^2\end{aligned}$$

Question 16:

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Diameter of spherical part of vessel = 21 cm

Its radius = $\frac{21}{2}$ cm

$$\begin{aligned}\text{Its volume} &= \frac{4}{3} \pi r^3 \\ &= \frac{4}{3} \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \times \frac{21}{2} \\ &= 11 \times 21 \times 21 \text{ cm}^3 = 4851 \text{ cm}^3\end{aligned}$$

Volume of cylindrical part of vessel

$$\begin{aligned}&= \pi r^2 h = \frac{22}{7} \times 2 \times 2 \times 7 \text{ cm}^3 \\ &= 88 \text{ cm}^3\end{aligned}$$

$$\therefore \text{Volume of whole vessel} = (4851 + 88) \text{ cm}^3 = 4939 \text{ cm}^3$$

Question 17:

Height of cylindrical tank = 2.5 m

Its diameter = 12 m, Radius = 6 m

Volume of tank =

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$$\pi r^2 h = \frac{22}{7} \times 6 \times 6 \times 2.5 \text{ m}^3 = \frac{1980}{7} \text{ m}^3$$

Water is flowing at the rate of 3.6 km/ hr = 3600 m/hr

Diameter of pipe = 25 cm, radius = 0.125 m

Volume of water flowing per hour

$$= \frac{22}{7} \times 0.125 \times 0.125 \times 3600 \text{ m}^3$$

$$= \frac{22 \times 3600}{7 \times 8 \times 8} \text{ m}^3 = \frac{2475}{14} \text{ m}^3$$

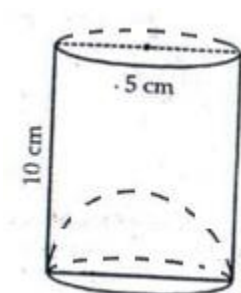
$$\text{Time taken to fill the tank} = \frac{1980}{7} + \frac{2475}{14} \text{ hr}$$

$$= \frac{1980}{7} \times \frac{14}{2475} \text{ hr} = \frac{792}{495} \text{ hr}$$

$$= 1.36 \text{ hr} = 1 \text{ hr } 36 \text{ min.}$$

$$\text{Water charges} = \text{Rs.} \frac{1980}{7} \times 0.07 = \text{Rs.} 19.80$$

Question 18:



Diameter of cylinder = 5 cm

Radius = 2.5 cm

Height of cylinder = 10 cm

$$\text{Volume of cylinder} = \pi r^2 h \text{ cu.units} = 3.14 \times 2.5 \times 2.5 \times 10 \text{ cm}^3 = 196.25 \text{ cm}^3$$

Apparent capacity of glass = 196.25

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Radius of hemisphere = 2.5 cm

Volume of hemisphere

$$\begin{aligned} &= \frac{2}{3} \pi r^3 \\ &= \frac{2}{3} \times 3.14 \times 2.5 \times 2.5 \times 2.5 \text{ cm}^3 \\ &= 32.708 \text{ cm}^3 \end{aligned}$$

Actual capacity of glass = (196.25 – 32.608) cm^3 = 163.54 cm^3

Exercise 17B

https://www.youtube.com/embed/6KpStN_0mjE?feature=oembed

Question 1:

Radius of the cone = 12 cm and its height = 24 cm

Volume of cone = $\frac{1}{3} \pi r^2 h = \left(\frac{1}{3} \times 12 \times 12 \times 24 \right) \pi \text{ cm}^3 = (48 \times 24) \pi \text{ cm}^3$

$$= (48 \times 24) \pi \text{ cm}^3$$

$$\text{Volume of each ball} = \frac{4}{3} \pi R^3 = \frac{4}{3} \pi \times 3 \times 3 \times 3 = (36\pi) \text{ cm}^3$$

$$\begin{aligned} \text{Number of balls formed} &= \frac{\text{Volume of solid cone}}{\text{Volume of each ball}} \\ &= \frac{(48 \times 24\pi)}{36\pi} = 32 \end{aligned}$$

Question 2:

Internal radius = 3 cm and external radius = 5 cm

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$$\begin{aligned}\text{Volume of material in the shell} &= \frac{2}{3} \pi \times [(5)^3 - (3)^3] \text{ cm}^3 \\ &= \frac{2}{3} \times \frac{22}{7} \times 98 = \frac{616}{3} \text{ cm}^3\end{aligned}$$

Radius of the cone = 7 cm

Let height of cone be h cm

$$\text{Volume of cone} = \left(\frac{1}{3} \times \frac{22}{7} \times 7 \times 7 \times h \right) \text{ cm}^3 = \frac{154h}{3} \text{ cm}^3$$

$$\therefore \frac{154h}{3} = \frac{616}{3}$$

$$\Rightarrow h = \frac{616}{154} = 4 \text{ cm}$$

Hence, height of the cone = 4 cm

Question 3:

Inner radius of the bowl = 15 cm

Volume of liquid in it =

$$\frac{2}{3} \pi r^3 = \left(\frac{2}{3} \pi \times (15)^3 \right) \text{ cm}^3$$

Radius of each cylindrical bottle = 2.5 cm and its height = 6 cm

Volume of each cylindrical bottle

$$\begin{aligned}&= \pi r^2 h = \left(\pi \times \left(\frac{5}{2} \right)^2 \times 6 \right) \text{ cm}^3 \\ &= \left(\frac{25}{4} \times 6\pi \right) = \left(\frac{75\pi}{2} \right) \text{ cm}^3\end{aligned}$$

Required number of bottles =

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$$\frac{\text{Volume of liquid}}{\text{Volume of each cylindrical bottle}} = \frac{\frac{2}{3} \times \pi \times 15 \times 15 \times 15}{\frac{75}{2} \times \pi} = 60$$

Hence, bottles required = 60

Question 4:

Radius of the sphere = 21 cm

$$\text{Volume of the sphere} = \left(\frac{4}{3} \pi r^3 \right) = \left[\frac{4}{3} \pi \times \left(\frac{21}{2} \right)^3 \right] \text{ cm}^3$$

Radius of cone = $\frac{7}{4}$ cm and height 3 cm

$$\text{Volume of cone} = \frac{1}{3} \pi r^2 h = \left(\frac{1}{3} \times \pi \times \left(\frac{7}{4} \right)^2 \times 3 \right) \text{ cm}^3$$

Let the number of cones formed be n, then

$$\begin{aligned} n \times \frac{1}{3} \pi \times \left(\frac{7}{4} \right)^2 \times 3 &= \frac{4}{3} \pi \times \left(\frac{21}{2} \right)^3 \\ n &= \frac{4}{3} \pi \times \frac{21}{2} \times \frac{21}{2} \times \frac{21}{2} \times \frac{3}{\pi} \times \frac{4}{7} \times \frac{4}{7} \times \frac{1}{3} \\ n &= 504 \end{aligned}$$

Hence, number of cones formed = 504

Question 5:

Radius of the cannon ball = 14 cm

Volume of cannon ball =

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$$\frac{4}{3} \pi r^3 = \left[\frac{4}{3} \pi \times (14)^3 \right] \text{cm}^3$$

Radius of the cone = 352 cm

Let the height of cone be h cm

Volume of cone =

$$\begin{aligned} \therefore \frac{4}{3} \pi \times (14)^3 &= \frac{1}{3} \pi \times \left(\frac{35}{2} \right)^2 \times h \\ \left[\frac{1}{3} \pi \times \left(\frac{35}{2} \right)^2 \times h \right] \text{cm}^3 & \quad h = \frac{4}{3} \pi \times 14 \times 14 \times 14 \times \frac{3}{\pi} \times \frac{2}{35} \times \frac{2}{35} \\ &= 35.84 \text{ cm} \end{aligned}$$

Hence, height of the cone = 35.84 cm

Question 6:

Let the radius of the third ball be r cm, then,

Volume of third ball = Volume of spherical ball – volume of 2 small balls

$$\begin{aligned} \text{Volume of third ball} &= \left[\frac{4}{3} \pi (3)^3 - \left\{ \frac{4}{3} \pi \left(\frac{3}{2} \right)^3 + \frac{4}{3} \pi (2)^3 \right\} \right] \\ &= \left[36\pi - \left(\frac{9\pi}{2} + \frac{32\pi}{3} \right) \right] \text{cm}^3 = \frac{125\pi}{6} \text{cm}^3 \\ \therefore \frac{4}{3} \pi r^3 &= \frac{125\pi}{6} \\ r^3 &= \frac{125\pi \times 3}{6 \times 4 \times \pi} = \frac{125}{8} \\ r &= \left(\frac{5}{2} \right) \text{cm} = 2.5 \text{ cm} \end{aligned}$$

Question 7:

External radius of shell = 12 cm and internal radius = 9 cm

Volume of lead in the shell =

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$$\frac{4}{3} \pi [(12)^3 - (9)^3] \text{ cm}^3$$

Let the radius of the cylinder be r cm

Its height = 37 cm

Volume of cylinder = $\pi r^2 h = (\pi r^2 \times 37)$

$$\therefore \frac{4}{3} \pi [(12)^3 - (9)^3] = \pi r^2 \times 37$$

$$\frac{4}{3} \times \pi \times 999 = \pi r^2 \times 37$$

$$r^2 = \frac{4}{3} \times \pi \times 999 \times \frac{1}{37\pi} = 36 \text{ cm}^2$$

$$r = \sqrt{36} \text{ cm}^2 = 6 \text{ cm}$$

Hence diameter of the base of the cylinder = 12 cm

Question 8:

Volume of hemisphere of radius 9 cm

$$= \left(\frac{2}{3} \times \pi \times 9 \times 9 \times 9 \right) \text{ cm}^3$$

Volume of circular cone (height = 72 cm)

$$= \frac{1}{3} (\pi \times r^2 \times 72) \text{ cm}$$

Volume of cone = Volume of hemisphere

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$$\therefore \frac{1}{3} \times \pi r^2 \times 72 = \frac{2}{3} \pi \times 9 \times 9 \times 9$$

$$r^2 = \frac{2\pi}{3} \times 9 \times 9 \times 9 \times \frac{1}{24\pi} = 20.25$$

$$r = \sqrt{20.25} = 4.5 \text{ cm}$$

Hence radius of the base of the cone = 4.5 cm

Question 9:

Diameter of sphere = 21 cm

Hence, radius of sphere = 192 cm

Volume of sphere = $\frac{4}{3} \pi r^3 = (43 \times 227 \times 212 \times 212 \times 212)$

Volume of cube = $a^3 = (1 \times 1 \times 1)$

Let number of cubes formed be n

$\therefore$ Volume of sphere = n $\times$ Volume of cube

$$\therefore \frac{4}{3} \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \times \frac{21}{2} = n \times 1$$

$$= (441 \times 11) = n$$

$$4851 = n$$

Hence, number of cubes is 4851.

Question 10:

Volume of sphere (when r = 1 cm) = $\frac{4}{3} \pi r^3 = \left(\frac{4}{3} \times 1 \times 1 \times 1\right) \pi \text{ cm}^3$

Volume of sphere (when r = 8 cm) = $\frac{4}{3} \pi r^3 = \left(\frac{4}{3} \times 8 \times 8 \times 8\right) \pi \text{ cm}^3$

Let the number of balls = n

$$n \times \left(\frac{4}{3} \times 1 \times 1 \times 1\right) \pi = \left(\frac{4}{3} \times 8 \times 8 \times 8\right) \pi$$

$$n = \frac{4 \times 8 \times 8 \times 8 \times 3}{3 \times 4} = 512$$

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Question 11:

Radius of marbles = Diameter² = 1.42 cm

$$\begin{aligned}\text{Volume of marbles} &= \frac{4}{3} \pi r^3 \\ &= \left[\frac{4}{3} \times \pi \times \left(\frac{1.4}{2} \right) \times \left(\frac{1.4}{2} \right) \times \left(\frac{1.4}{2} \right) \right] \text{cm}^3\end{aligned}$$

$$\text{Radius of beaker} = \left(\frac{7}{2} \right) \text{cm}$$

Volume of rising water in beaker

$$= \pi r^2 h = \left(\pi \times \left(\frac{7}{2} \right)^2 \times \left(\frac{56}{10} \right) \right) \text{cm}^3$$

Let the number of marbles be n

$\therefore n \times \text{volume of marble} = \text{volume of rising water in beaker}$

$$\begin{aligned}n \times \left(\frac{4}{3} \pi \times \frac{1.4}{2} \times \frac{1.4}{2} \times \frac{1.4}{2} \right) &= \pi \times \frac{7}{2} \times \frac{7}{2} \times \frac{56}{10} \\ n &= 150\end{aligned}$$

Hence the number of marbles is 150

Question 12:

Radius of sphere = 3 cm

$$\text{Volume of sphere} = \frac{4}{3} \pi r^3 = \left(\frac{4}{3} \times \pi \times 3 \times 3 \times 3 \right) \text{cm}^3 = 36\pi \text{cm}^3$$

Radius of small sphere = 0.62 cm = 0.3 cm

$$\text{Volume of small sphere} = \left(\frac{4}{3} \times \pi \times 0.3 \times 0.3 \times 0.3 \right) \text{cm}^3$$

$$\begin{aligned}&= \left(\frac{4}{3} \times \pi \times \frac{3}{10} \times \frac{3}{10} \times \frac{3}{10} \right) \text{cm}^3 \\ &= \left(\frac{4\pi}{3} \times \frac{3}{10} \times \frac{3}{10} \times \frac{3}{10} \right) \text{cm}^2\end{aligned}$$

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Let number of small balls be n

$$n \times \left(\frac{4\pi}{3} \times \frac{3}{10} \times \frac{3}{10} \times \frac{3}{10} \right) = \frac{4}{3} \pi \times 3 \times 3 \times 3$$
$$n = 1000$$

Hence, the number of small balls = 1000.

Question 13:

Diameter of sphere = 42 cm

Radius of sphere = 42 cm = 21 cm

Volume of sphere = $\frac{4}{3} \pi r^3 = \left(\frac{4}{3} \times \pi \times 21 \times 21 \times 21 \right) \text{ cm}^3$

Diameter of cylindrical wire = 2.8 cm

Radius of cylindrical wire = 2.8 cm = 1.4 cm

Volume of cylindrical wire = $\pi r^2 h = (\pi \times 1.4 \times 1.4 \times h) \text{ cm}^3 = (1.96\pi h) \text{ cm}^3$

Volume of cylindrical wire = volume of sphere

$$\therefore 1.96\pi h = \frac{4}{3} \times \pi \times 21 \times 21 \times 21$$
$$h = \left(\frac{4}{3} \times \pi \times 21 \times 21 \times 21 \times \frac{1}{1.96} \times \frac{1}{\pi} \right) \text{ cm}$$
$$h = 6300$$
$$h \left(\frac{6300}{100} \right) \text{ m} = 63 \text{ m}$$

Hence length of the wire 63 m.

Question 14:

Diameter of sphere = 6 cm

Radius of sphere = 6 cm = 3 cm

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$$\text{Volume of sphere} = \frac{4}{3} \pi r^3 = \left(\frac{4}{3} \times 3 \times 3 \times 3 \right) \pi \text{ cm}^3 = 36\pi \text{ cm}^3$$

$$\text{Radius of wire} = 22 \text{ mm} = 1 \text{ mm} = 0.1 \text{ cm}$$

$$\text{Volume of wire} = \pi r^2 l = (\pi \times 0.1 \times 0.1 \times l) \text{ cm}^2 = (0.01 \pi l) \text{ cm}^2$$

$$36\pi = 0.01 \pi l$$

$$\therefore l = 3600.01 = 3600 \text{ cm}$$

$$\text{Length of wire} = 3600100 \text{ m} = 36 \text{ m}$$

Question 15:

$$\text{Diameter of sphere} = 18 \text{ cm}$$

$$\text{Radius of copper sphere} = 3600100 \text{ m} = 36 \text{ m}$$

$$\begin{aligned} \text{Volume of sphere} &= \left(\frac{4}{3} \times \pi \times r^3 \right) \text{ cm}^3 \\ &= \left(\frac{4}{3} \times \pi \times 9 \times 9 \times 9 \right) \text{ cm}^3 = 972 \pi \text{ cm}^3 \end{aligned}$$

$$\text{Length of wire} = 108 \text{ m} = 10800 \text{ cm}$$

Let the radius of wire be r cm

$$= \pi r^2 l \text{ cm}^3 = (\pi r^2 \times 10800) \text{ cm}^3$$

But the volume of wire = Volume of sphere

$$\begin{aligned} \Rightarrow \pi r^2 \times 10800 &= 972\pi \\ r^2 &= \frac{972\pi}{10800\pi} = 0.09 \text{ cm}^2 \\ r &= \sqrt{0.09} \text{ cm} = 0.3 \end{aligned}$$

$$\text{Hence the diameter} = 2r = (0.3 \times 2) \text{ cm} = 0.6 \text{ cm}$$

Question 16:

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The radii of three metallic spheres are 3 cm, 4 cm and 5 cm respectively.

Sum of their volumes

$$= \frac{4}{3} \pi (3^3 + 4^3 + 5^3) \text{ cm}^3 = \frac{4}{3} \pi (27 + 64 + 125) = \frac{4}{3} \pi \times 216$$

Let r be the radius of sphere whose volume is equal to the total volume of three spheres.

$$\frac{4}{3} \pi r^3 = \frac{4}{3} \pi \times 216$$

$$\Rightarrow r^3 = 216$$

$$\therefore r = 6 \text{ cm}$$

$$\therefore \text{Diameter} = 6 \times 2 = 12 \text{ cm}$$

Exercise 17C

Question 1:

Here $h = 42 \text{ cm}$, $R = 16 \text{ cm}$, and $r = 11 \text{ cm}$

Capacity =

$$\begin{aligned} \frac{1}{3} \pi h (R^2 + r^2 + Rr) \text{ cm}^3 &= \frac{1}{3} \times \frac{22}{7} \times 42 [(16)^2 + (11)^2 + 16 \times 11] \text{ cm}^3 \\ \frac{1}{3} \pi h (R^2 + r^2 + Rr) \text{ cm}^3 &= (44 \times 553) \text{ cm}^3 = 24332 \text{ cm}^3 \end{aligned}$$

Question 2:

Here $R = 33 \text{ cm}$, $r = 27 \text{ cm}$ and $l = 10 \text{ cm}$

$$\begin{aligned} \therefore h &= \sqrt{l^2 - (R^2 - r^2)} \text{ cm} = \sqrt{(10)^2 - (33 - 27)^2} \text{ cm} \\ &= \sqrt{(10)^2 - (6)^2} = \sqrt{64} \text{ cm} = 8 \text{ cm} \end{aligned}$$

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Capacity of the frustum

$$= \frac{1}{3} \pi h (R^2 + r^2 + Rr) \text{ cm}^3 = \frac{1}{3} \times \frac{22}{7} \times 8 [(33)^2 + (27)^2 + 33 \times 27] \text{ cm}^3$$

$$= \frac{1}{3} \pi h (R^2 + r^2 + Rr) \text{ cm}^3 = (8.38 \times 2709) \text{ cm}^3 = 22701.4 \text{ cm}^3$$

Total surface area

=

$$= \pi [R^2 + r^2 + l(R + r)] \text{ cm}^2$$

$$= \frac{22}{7} [(33)^2 + (27)^2 + 10 \times (33 + 27)] \text{ cm}^2$$

$$[\pi R^2 + \pi r^2 + \pi l(R + r)] \text{ cm}^2 = \left(\frac{22}{7} \times 2418 \right) \text{ cm}^2 = 7599.43 \text{ cm}^2$$

Question 3:

Height = 15 cm, R = 562 cm = 28 cm and r = 422 cm = 21 cm

Capacity of the bucket =

$$= \frac{1}{3} \times \frac{22}{7} \times 15 [(28)^2 + (21)^2 + 28 \times 21] \text{ cm}^3$$

$$= \frac{1}{3} \pi h (R^2 + r^2 + Rr) \text{ cm}^3 = (15.71 \times 1831) \text{ cm}^3$$

$$= \frac{1}{3} \pi h (R^2 + r^2 + Rr) \text{ cm}^3 = (28482.23) \text{ cm}^3$$

Quantity of water in bucket = 28.49 litres

Question 4:

R = 20 cm, r = 8 cm and h = 16 cm

$$\therefore l = \sqrt{h^2 + (R - r)^2} = \sqrt{(16)^2 + (20 - 8)^2}$$

$$= \sqrt{256 + 144} \text{ cm} = 20 \text{ cm}$$

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Total surface area of container = $\pi l (R+r) + \pi r^2$

$$= [3.14 \times 20 \times (20 + 8) + 3.14 \times 8 \times 8] \text{ cm}^2$$

$$= (3.14 \times 20 \times 28 + 3.14 \times 8 \times 8) \text{ cm}^2$$

$$= (1758.4 + 200.96) \text{ cm}^2$$

$$= 1959.36 \text{ cm}^2$$

Cost of metal sheet used = Rs. $(1959.36 \times 15100) = \text{Rs. } 293.90$

Question 5:

$R = 15 \text{ cm}$, $r = 5 \text{ cm}$ and $h = 24 \text{ cm}$

$$\begin{aligned} \therefore l &= \sqrt{h^2 + (R - r)^2} = \sqrt{(24)^2 + (10)^2} \text{ cm} \\ &= \sqrt{576 + 100} \text{ cm} = \sqrt{676} \text{ cm} = 26 \text{ cm} \end{aligned}$$

(i) Volume of bucket =

$$\begin{aligned} &= \frac{1}{3} \times 3.14 \times 24 \times [(15)^2 + (5)^2 + 15 \times 5] \\ &= (25.12 \times 325) \text{ cm}^3 \\ \frac{1}{3} \pi h (R^2 + r^2 + Rr) &= 8164 \text{ cm}^3 = 8.164 \text{ litres} \end{aligned}$$

Cost of milk = Rs. $(8.164 \times 20) = \text{Rs. } 163.28$

(ii) Total surface area of the bucket

$$\begin{aligned} &= \pi l (R + r) + \pi r^2 \\ &= (3.14 \times 26 \times 20 + 3.14 \times 5 \times 5) \text{ cm}^2 \\ &= 1711.3 \text{ cm}^2 \end{aligned}$$

Cost of sheet = $(1711.3 \times 10100) = \text{Rs. } 171.13$

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Question 6:

$R = 10\text{cm}$, $r = 3\text{ m}$ and $h = 24\text{ m}$

Let l be the slant height of the frustum, then

$$\begin{aligned}l &= \sqrt{h^2 + (R - r)^2} \\&= \sqrt{(24)^2 + (10 - 3)^2} \\&= \sqrt{(24)^2 + (7)^2} \\&= \sqrt{576 + 49} \\&= \sqrt{625}\text{ m} = 25\text{ m}\end{aligned}$$

Let l_1 be the slant height of conical part

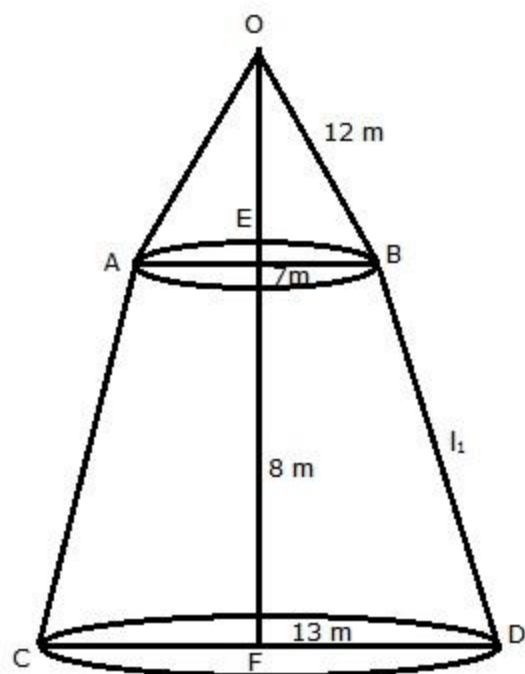
$$\begin{aligned}r &= 3\text{ m} \\ \text{and } h &= 4\text{ m} \\ \therefore l_1 &= \sqrt{3^2 + 4^2}\text{ m} \\ &= \sqrt{25}\text{ m} = 5\text{ m}\end{aligned}$$

Quantity of canvas = (Lateral surface area of the frustum) + (lateral surface area of the cone)

$$\begin{aligned}&= [\pi(R + r) + \pi r l_1]\text{ m}^2 \\&= \pi[25 \times (10 + 3) + (3 \times 5)]\text{ m}^2 \\&= \frac{22}{7} \times [(25 \times 13) + (3 \times 5)]\text{ m}^2 \\&= 1068.57\text{ m}^2\end{aligned}$$

Question 7:

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ABCD is the frustum in which upper and lower radii are $EB = 7\text{ m}$ and $FD = 13\text{ m}$

Height of frustum = 8 m

Slant height l_1 of frustum

$$\begin{aligned}
 &= \sqrt{h^2 + (R - r)^2} \\
 &= \sqrt{8^2 + (13 - 7)^2} \\
 &= \sqrt{64 + 36} \\
 &= \sqrt{100} = 10\text{ m}
 \end{aligned}$$

Radius of the cone = $EB = 7\text{ m}$

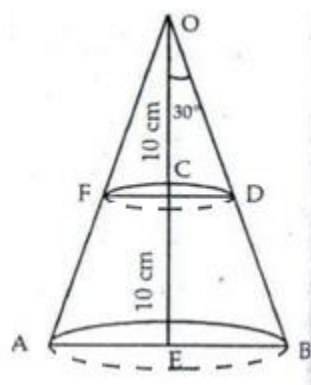
Slant height l_2 of cone = 12 m

Surface area of canvas required

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$$\begin{aligned}
 &= \pi(R+r)l_1 + \pi rl_2 \\
 &= \pi[(13+7) \times 10 + 7 \times 12] \\
 &= \frac{22}{7} \times [200 + 84] = \frac{22}{7} \times 284 \text{ m}^2 \\
 &= 892.6 \text{ m}^2
 \end{aligned}$$

Question 8:



In the given figure, we have

$$\angle COD = 30^\circ, OC = 10 \text{ cm}, OE = 20 \text{ cm}$$

Let $CD = r \text{ cm}$ and $EB = R \text{ cm}$

Also, $CE = 10 \text{ cm}$

Thus, ABDF is the frustum of a cone in which

Volume of wire of radius r and length l

$$= \pi r^2 l = \pi \left[\frac{1}{32} \right]^2 l$$

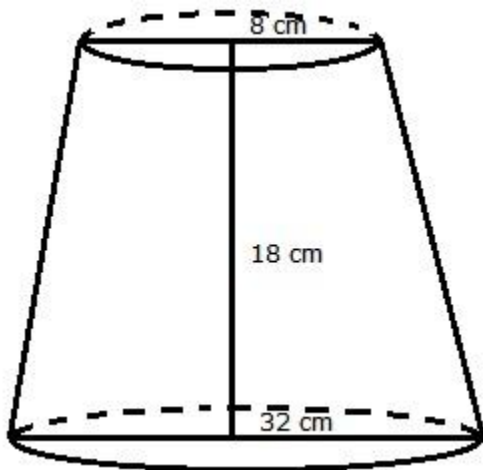
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Volume of wire = Volume of frustum

$$\begin{aligned}\pi \left(\frac{1}{32}\right)^2 l &= \frac{7000\pi}{9} \\ l &= \frac{7000 \times 32 \times 32}{9} \text{ cm} \\ &= \frac{70 \times 32 \times 32}{9} \text{ m} \\ &= 7964.44 \text{ m}\end{aligned}$$

Length of the wire is 7964.44 m

Question 9:



Radii of upper and lower end of frustum are $r = 8$ cm, $R = 32$ cm

Height of frustum $h = 18$ cm

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$$\begin{aligned}\text{Volume of frustum} &= \frac{1}{3} \pi h [R^2 + r^2 + R \times r] \\ &= \frac{1}{3} \times \frac{22}{7} \times 18 \times [32^2 + 8^2 + 32 \times 8] \text{ cm}^3 \\ &= \frac{22 \times 6}{7} [1024 + 64 + 256] \text{ cm}^3 \\ &= \frac{132}{7} \times 1344 \text{ cm}^3 = 25344 \text{ cm}^3 = 25.344 \text{ litres}\end{aligned}$$

Cost of milk at Rs 20 per litre = Rs. 25.344×20 = Rs. 506. 88



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He was born on January 2, 1946 in a village of Delhi. He graduated from Kirori Mal College, University of Delhi. After completing his M.Sc. in Mathematics in 1969, he joined N.A.S. College, Meerut, as a lecturer. In 1976, he was awarded a fellowship for 3 years and joined the University of Delhi for his Ph.D. Thereafter, he was promoted as a reader in N.A.S. College, Meerut. In 1999, he joined M.M.H. College, Ghaziabad, as a reader and took voluntary retirement in 2003. He has authored more than 75 titles ranging from Nursery to M. Sc. He has also written books for competitive examinations right from the clerical grade to the I.A.S. level.

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