Chapter 17.
Mensuration

Exercise 17.1

1) Find the total surface area of a cylinder of radius 5cm and height 10cm. Leave your answer in terms of π.

$\longrightarrow$ Given that,

Radius of a cylinder $= r = 5$ cm

Height of a cylinder $= h = 10$ cm

We know that, TSA of a cylinder is given by

$$\left.\begin{array}{r}\text{Total surface area}\\ \text{of a cylinder}\end{array}\right\} = 2\pi r(h+r)$$

$$= 2\pi 5(10+5)$$

$$= 2\pi 5\times 15$$

$$= 10\times 15\pi$$

$\boxed{TSA = 150\pi \text{ cm}^2}$ is the required total surface area of a given cylinder.

2) An electric geyser is cylindrical in shape, having a diameter of 35cm and height 1.2m. Neglecting the thickness of its walls, calculate i) its outer lateral surface area
ii) its capacity in litres.

$\longrightarrow$ Given that, diameter of cylindrical geyser $= d = 35$cm

Radius of cylindrical geyser $= \frac{d}{2} = r = 17.5$ cm

Height of cylindrical geyser $= h = 1.2$m $= 120$cm

i) Then outer lateral surface area of cylindrical geyser is given by

$$LSA = 2\pi rh$$

$$= 2\times \frac{22}{7}\times 17.5\times 120$$

$$\boxed{LSA = 13200 \text{ cm}^2}$$

This is the required outer lateral surface area of cylinder.

ii) Capacity of a cylinder is given by

$$\left.\begin{array}{r}\text{Capacity / Volume of} \\ \text{cylindrical geyser}\end{array}\right\} = \pi r^2 h$$

$$= \frac{22}{7} \times (17.5)^2 \times 120$$

$$= 115500 \text{ cm}^3$$

$$\boxed{\text{Volume} = 115.5 \text{ litres}}$$

This is the required capacity of given cylindrical geyser.

3.) A school provides milk to the students daily in cylindrical glasses of diameter 7 cm. If the glass is filled with milk upto a height of 12 cm, find how many litres of milk is needed to serve 1600 students.

→ Given that, diameter of glass (cylindrical) $= d = 7$ cm

Then, Radius of cylindrical glass $= r = \frac{7}{2} = 3.5$ cm

Height of cylindrical glass $= h = 12$ cm

Total no. of students in a school $= 1600$

Then, volume of a cylindrical glass is given by

$$\text{Volume} = \pi r^2 h$$

$$= \frac{22}{7} \times (3.5)^2 \times 12$$

$\boxed{V = 462 \text{ cm}^3}$ This is the volume of a each glass.

But, there are total 1600 students in a school.

Then, amount of milk required for 1600 students is given by

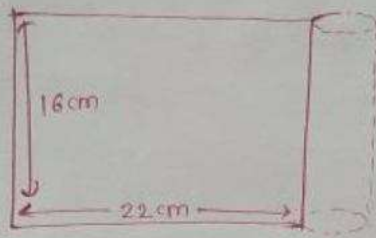
$$V = 1600 \times 462$$

$$V = 739200 \text{ cm}^3$$

$$\boxed{V = 739.2 \text{ litres}}$$

Thus, 739.2 litres of milk is needed to serve 1600 students daily.

4) In the given fig., a rectangular tin-foil of size 22 cm by 16 cm is wrapped around to form a cylinder of height 16 cm. Find the volume of the cylinder.



→ Given that,
Length of rectangular foil $(l) = 22$ cm
Breadth of rectangular foil $(b) = 16$ cm

When we are folding foil lengthwise, then cylinder is formed whose radius

$$2r = 22$$
$$r = \frac{22}{2} = 11 \text{ cm} \quad \boxed{r = 11 \text{ cm}}$$

Then, volume of the cylinder formed is given by

$$V = \pi r^2 h$$
$$= \left(\frac{22}{7}\right) \times (11)^2 \times 16$$
$$\boxed{V = 6084 \text{ cm}^3}$$ is the required volume of a given cylinder.

6) A road roller (in the shape of a cylinder) has a diameter 0.7 m and its width is 1.2 m. Find the least number of revolutions that the roller must make in order to level a playground of size 120 m by 44 m.

→ Given that, diameter of a road roller $= d = 0.7$ m
Radius of a road roller $= r = 0.35$ m
Width $(h) = 1.2$ m

Then, Curved surface area of the road roller is given by

$$CSA = 2\pi r h$$
$$= 2 \times \frac{22}{7} \times 0.35 \times 1.2$$
$$\boxed{CSA = 2.64 \text{ m}^2}$$

Now, Area of the playground is given by,

$$\text{Area} = l \times b = 120 \times 44 = 5280 \text{ m}^2$$

Thus, No. of revolutions $= \dfrac{\text{Area of playground}}{\text{Curved S. Area}} = \dfrac{5280}{2.64}$

$$= 2000$$

Thus, the revolutions that the roller must make in order to level a playground are 2000.

7) i) If the volume of a cylinder of height 7cm is $448\pi\ cm^3$, find the lateral surface area and total surface area.

ii) A wooden pole is 7m high and 20cm in diameter. Find its weight, if the wood weighs 225 kg per m^3.

→ i) Given that,

Volume of a cylinder $= V = 448\pi\ cm^3$

Height of a cylinder $= h = 7\ cm$

We have, Volume of a cylinder is given by,

$$V = \pi r^2 h$$

$$448\pi = \pi r^2 (7)$$

$$\frac{448}{7} = r^2$$

$$r^2 = 64$$

$$\boxed{r = 8\ cm}$$

is the required radius of the given cylinder.

• Lateral surface area of a cylinder is given by

$$LSA = 2\pi r h$$

$$= 2 \times \pi \times 8 \times 7$$

$$\boxed{LSA = 112\pi\ cm^2}$$

is the required Lateral Surface area of a cylinder.

• Total surface area of a cylinder is given by

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

$$= 2 \times \pi \times 8 \times (8+7)$$

$$= 2 \times \pi \times 8 \times 15$$

$$\boxed{TSA = 240\pi\ cm^2}$$

This is the required total surface area of a cylinder.

ii) Given that,

Heigh of wooden pole $(h) = 7m$

diameter of pole $(d) = 20cm$ ⇒ Radius of pole $= r = 10cm$

Then, Volume $= \pi r^2 h$

$$= \frac{22}{7} \times \frac{10 \times 10}{100 \times 100} \times 7\ m^3 = \frac{22}{100}\ m^3$$

Here, Weight of wood used $= 225\ kg/m^3$

Hence, total weight $= \frac{22}{100} \times 225\ kg = \frac{99}{2} = 49.5\ kg$

8) The circumference of the base of a cylinderical vessel is 132 cm and its height is 25cm. find i) radius of cylinder
ii) Volume of cylinder

→ Given that, height of cylindrical vessel $(h) = 25$ cm

Circumference of base $= 132$ cm

i) We have, $\left.\begin{array}{l}\text{Circumference of circular} \\ \text{base of a cylinder}\end{array}\right\} = 2\pi r$

$$132 = 2 \times \frac{22}{7} \times r$$

$\boxed{r = 21\,cm}$ is the required radius of the cylinder.

ii) Volume of a cylinder is given by,

$$V = \pi r^2 h$$
$$= \frac{22}{7} \times 21 \times 21 \times 25$$

$\boxed{V = 34650\,cm^3}$ is the required volume of given cylinder.

9) The area of the curved surface of a cylinder is $4400\,cm^2$. and the circumference of its base is 110 cm. Find
i) the height of the cylinder
ii) the volume of the cylinder

→ Given that, $\left.\begin{array}{l}\text{Area of Curved surface} \\ \text{of a cylinder}\end{array}\right\} = CSA = 4400\,cm^2$

Circumference of base of a cylinder $= 110$ cm

i) Curved surface area of a cylinder is given by

$$CSA = 2\pi r h$$
$$4400 = 2 \times \frac{22}{7} \times 17.5 \times h$$
$$h = \frac{4400 \times 7}{2 \times 22 \times 17.5} = 40cm$$

$\boxed{h = 40cm}$ is the required height of the cylinder.

Given that, Circumference of base $= 2\pi r$

$$110 = 2 \times \frac{22}{7} \times r$$

$$r = \frac{110 \times 7}{2 \times 22} = 17.5 cm$$

$\boxed{r = 17.5 cm}$ is the required radius of given cylinder

ii) Volume of a cylinder is given by,

$$V = \pi r^2 h$$

$$= \frac{22}{7} \times (17.5)^2 \times 40$$

$\boxed{V = 38500 cm^3}$ is the required volume of a given cylinder.

10.) A cylinder has a diameter of 20cm. The area of curved surface is $1000 cm^2$. find

i) the height of the cylinder correct to one decimal place.

ii) the volume of the cylinder correct to one decimal place.

→ Given that, diameter of a cylinder $(d) = 20$ cm

Then, Radius of a cylinder $(r) = 10$ cm

Curved Surface Area $= 1000 cm^2$

i) The Curved surface area of a cylinder is given by

$$CSA = 2\pi r h$$

$$1000 = 2 \times 3.14 \times 10 \times h$$

$$h = 1000/62.8 = 15.9 cm$$

$\boxed{h = 15.9 cm}$ is the required height of the given cylinder.

ii) Volume of the cylinder is given by,

$$V = \pi r^2 h$$

$$= 3.14 \times 10 \times 10 \times 15.9$$

$$\boxed{V = 4992.6 cm^2}$$

This is the required volume of the given cylinder.

11) The barrel of a fountain pen, cylindrical in shape, 7cm long and 5mm in diameter. A full barrel of ink in the pen will be used up when writing 310 words on an average. How many words would use up a bottle of ink containing one-fifth of a litre?

→ Given that, Height of cylindrical barrel of pen $(h) = 7$ cm

diameter —||— $(d) = 5$ mm

Radius $(r) = 2.5$ mm $= 0.25$ cm

Then, Volume of a barrel is given by,

$$V = \pi r^2 h$$

$$= \frac{22}{7} \times 0.25 \times 0.25 \times 7$$

$$\boxed{V = 1.375 \text{ cm}^3}$$

Given that, Ink in a bottle = one fifth of a litre

$= \frac{1}{5} \times 1000$

$= 200$ml

And, No. of words written using full barrel of ink $= 310$

No. of words written using 200ml of ink $= \frac{200}{1.375} \times 310$

$= 45090.90$ words.

Thus, the no. of words written using the ink are found to be 45100 words.

12.) find the ratio between the total surface area of a cylinder to its curved surface area given that its height and radius are 7.5cm and 3.5cm.

→ Given that, Radius of a cylinder $(r) = 3.5$ cm

Height of a cylinder $(h) = 7.5$ cm

Total Surface Area of a Cylinder $= 2\pi(r+h)r$

Curved Surface area of a cylinder $= 2\pi rh$

Then, $\frac{TSA}{CSA} = \frac{2\pi r(r+h)}{2\pi rh} = \frac{r+h}{h} = \frac{(3.5+7.5)}{7.5}$

$$\frac{TSA}{CSA} = \frac{11}{7.5} = \frac{22}{15}$$

Thus, the ratio of total surface area of a cylinder and curved surface area of a cylinder is found to be 22:15.

13.) The radius of the base of a right circular cylinder is halved and the height is doubled. What is the ratio of the volume of a new cylinder to that of the original cylinder?

→ Let us consider, r is the radius of circular base of right circular cylinder.

Height be 'h'.

Then, Volume of a cylinder $= V = \pi r^2 h$

Given that, Radius of circular base of cylinder is halved & height is doubled then

$$r \longrightarrow r/2 \quad \text{and} \quad h \longrightarrow 2h$$

Then, Volume of new cylinder $= V' = \pi r^2 h$

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

$$\boxed{V' = \frac{1}{2}\pi r^2 h}$$

The ratio of new cylinder's volume to the volume of original cylinder is given by

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

$\Rightarrow \boxed{V' : V = 1:2}$ is the required ratio.

15) The ratio between the curved surface & the total surface of a cylinder is 1:2. Find the volume of the cylinder, given that its total surface area is 616 cm².

→ Given that,

The ratio between the curved surface area & the total surface area of a cylinder is 1:2.

And, total surface area $= 616\,cm^2$.

$$\frac{CSA}{TSA} = \frac{1}{2} \Rightarrow \quad CSA = \frac{1}{2}(TSA) = \frac{1}{2} \times 616$$

$$\boxed{CSA = 308\,cm^2}$$

We have, Curved Surface Area $= 2\pi rh$

$$308 = 2\pi rh$$

$$\pi rh = 308/2$$

$$\boxed{rh = 49} \longrightarrow (1)$$

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

$$616 = 308 + 2\pi r^2$$

$$308 = 2\pi r^2$$

$$154 = \pi r^2$$

$$r^2 = 154 \times \frac{7}{22} = 49$$

$$\Rightarrow \boxed{r = 7\,cm} \text{ put in (1)} \Rightarrow \quad h = \frac{49}{7} = 7 \quad \boxed{h = 7\,cm}$$

Now, Volume of a cylinder is given by,

$$V = \pi r^2 h = \frac{22}{7} \times 7^2 \times 7 = 1078\,cm^3$$

$\boxed{V = 1078\,cm^3}$ this is the required volume of the given cylinder.

16) Two cylindrical jars contain the same amount of milk. If their diameters are in the ratio 3:4, find the ratio of their heights.

→ Given that,

The two cylindrical jars contains the same amount of milk

diameter of both cylinders are in the ratio $d_1 : d_2 = 3:4$

And also, ratio of their radius $r_1 : r_2 = 3:4$

from given condition,

$$V_1 = V_2$$

$$\pi r_1^2 h_1 = \pi r_2^2 h_2$$

$$\frac{h_1}{h_2} = \frac{r_2^2}{r_1^2} = \left(\frac{r_2}{r_1}\right)^2 = \left(\frac{4}{3}\right)^2 = \frac{16}{9}$$

$\boxed{\frac{h_1}{h_2} = \frac{16}{9}}$ is the required ratio of heights two given cylinders.

18) A cylindrical tube open at both ends is made of metal. The internal diameter of the tube is 11.2 cm and its length is 21 cm. The metal thickness is 0.4 cm. Calculate the volume of the metal.

→ Given that,

Internal diameter of cylindrical tube $= 11.2$ cm

Then, Internal radius $= r = 5.6$ cm

Length of the tube $(h) = 21$ cm

Thickness of metal $= 0.4$ cm

Thus, outer radius of cylindrical tube $= 5.6 + 0.4 = 6$ cm $= R$

Then, Volume of the metal is given by

$$V = \pi R^2 h - \pi r^2 h$$
$$= \pi h (R^2 - r^2)$$
$$= \frac{22}{7} \times 21 \times (6^2 - 5.6^2)$$
$$= 66 \times (6 + 5.6)(6 - 5.6) = 66 \times 11.6 \times 0.4$$

$\boxed{V = 306.24\ cm^3}$ This is the required volume of the metal.

19) A lead pencil consists of a cylinder of wood with a solid cylinder of graphite filled in the interior. The diameter of the pencil is 7 mm and the diameter of the graphite is 1 mm. If the length of the pencil is 14 cm, find the volume of the wood and that of the graphite.

→ Given that, diameter of the pencil $= 7$ mm

Radius of the pencil $= \frac{7}{2}$ mm $= \frac{7}{20}$ cm $= R$

And, Diameter of graphite $= 1$ mm

Then Radius of graphite $= r = \frac{1}{2}$ mm $= \frac{1}{20}$ cm

Thus, Volume of a graphite is given by

$$V = \pi r^2 h$$
$$= \frac{22}{7} \times \left(\frac{1}{20}\right)^2 \times 14 = \frac{11}{100}$$

$\boxed{V = 0.11\ cm^3}$

Now, Volume of the wood is given by,

$$V = \pi R^2 h - \pi r^2 h$$

$$= \pi h (R^2 - r^2)$$

$$= \frac{22}{7} \times 14 \left[\left(\frac{7}{20}\right)^2 - \left(\frac{1}{20}\right)^2 \right]$$

$$= 44 \times \frac{48}{400}$$

$\boxed{V = 5.28 \text{ cm}^3}$ This is the required volume of the wood.

20.) A cylindrical roller made of iron is 2m long. Its inner diameter is 35 cm and the thickness is 7cm all round. find the weight of the roller in kg, if 1 cm³ of iron weigh 8g.

→ Given that, Length of cylindrical roller (h) = 2m = 200cm

diameter = 35cm

Inner radius = $\frac{35}{2} = 17.5$ cm $= r$

Thickness = 7 cm

Then, Outer radius = R = 17.5 + 7 = 24.5 cm

Thus, Volume of iron used in roller is given by

$$V = \pi R^2 h - \pi r^2 h$$

$$= \pi h (R^2 - r^2)$$

$$= \frac{22}{7} \times 200 \left[(49/2)^2 - (35/2)^2 \right]$$

$$= \frac{22}{7} \times 50 (49^2 - 35^2) = \frac{22}{7} \times 50 \times 1176$$

$\boxed{V = 184800 \text{ cm}^3}$

But given that, 1 cm³ of iron weighs 8g.

Then, weight of the roller = 184800 × 8

= 1478400 g

= 1478.4 kg

Thus, the weight of the roller is found to be 1478.4 kg.

Exercise 17.2

1.) Find the curved surface area of a right circular cone whose slant height is 10cm and base radius is 7 cm.

→ Given that, Slant height of RCC = 10 cm

Base Radius of RCC = r = 7 cm

Then, Curved surface area of RCC is given by,

$$CSA \text{ of } RCC = \pi r l$$
$$= \frac{22}{7} \times 7 \times 10$$
$$\boxed{CSA = 220 \text{ cm}^2}$$

This is the required Curved Surface Area of Right Circular Cone.

2) Diameter of the base of a cone is 10.5cm and slant height is 10 cm. Find its curved surface area.

→ Given that, diameter of base of a cone (d) = 10.5cm

⇒ Radius of base of a cone (r) = 5.25 cm

Slant height of a cone (l) = 10 cm

Then, Curved Surface area of a cone is given by,

$$CSA = \pi r l$$
$$= \frac{22}{7} \times 5.25 \times 10$$
$$\boxed{CSA = 165 \text{ cm}^2}$$

This is the required curved surface area of a cone.

3) Curved surface area of a cone is 308 cm² and its slant height is 14 cm. Find, i) Radius of the base

ii) total surface area of the cone

→ Given that, Curved surface area of a cone = 308 cm²

Slant height of a cone (l) = 14 cm

i) We have, $\left.\begin{matrix}\text{Curved surface area} \\ \text{of a cone}\end{matrix}\right\} = \pi r l$

$$308 = \frac{22}{7} \times r \times 14$$

$$r = \frac{308 \times 7}{22 \times 14}$$

$\boxed{r = 7\text{ cm}}$ this is the required radius of a cone.

ii) Now, total surface area of a cone is given by

TSA of a Cone = Base Area + CSA

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

$$= \left(\frac{22}{7} \times 7^2\right) + 308$$

$$= \frac{22}{7} \times 49 + 308$$

$$= 154 + 308$$

$\boxed{TSA = 462\text{ cm}^2}$ this is the required total surface area of a cone.

4.) Find the volume of the right circular cone with

i) Radius 6 cm and height 7 cm

ii) Radius 3.5 cm and height 12 cm

→ i) Given that,

Radius of RCC (r) = 6 cm

Height of RCC (h) = 7 cm

We have, Volume of RCC is given by

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

$$V = \frac{1}{3} \times \left(\frac{22}{7}\right)(6)^2 \times 7$$

$$= 22 \times 12$$

$$\boxed{V = 264\text{ cm}^3}$$

This is the required volume of a given RCC.

ii) Given that,

Radius of RCC (r) = 3.5 cm

Height of RCC (h) = 12 cm

We have, Volume of RCC is given by,

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

$$= \left(\frac{1}{3}\right)\left(\frac{22}{7}\right)(3.5)^2(12)$$

$$= \frac{22}{7} \times 12.25 \times 4$$

$$\boxed{V = 154\text{ cm}^3}$$

This is the required volume of a given RCC.

6.) A conical pit of top diameter 3.5m is 12m deep. What is its capacity in kiloliters?

→ Given that, diameter of conical pit = 3.5m

⇒ Radius of conical pit $(r) = 1.75$ m

depth $(h) = 12$m

Then, capacity of conical pit (volume of a cone) is given by,

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

$$= \frac{1}{3} \times \left(\frac{22}{7}\right) \times (1.75)^2 \times 12$$

$$V = 38.5\ m^3$$

$$\boxed{V = 38.5 \text{ kilolitres}} \quad \because 1m^3 = 1 \text{ klitre}$$

This is the required capacity of conical pit in kiloliters.

7.) If the volume of a right circular cone of height 9cm is 48π cm³, find the diameter of its base.

→ Given that, Height of RCC $= h = 9$ cm

Volume of RCC $= V = 48\pi$ cm³

We have, Volume of Right Circular cone is given by

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

$$48\left(\frac{22}{7}\right) = \left(\frac{1}{3}\right) \times \left(\frac{22}{7}\right) \times r^2 \times 9$$

$$3r^2 = 48$$

$$r^2 = 16$$

$$\boxed{r = 16 \text{ cm}}$$

This is the required radius of the given RCC.

8.) The height of a cone is 15cm. If its volume is 1570 cm³, find the radius of the base.

→ Given that, Height of a cone $(h) = 15$ cm

Volume of a cone $(V) = 1570$ cm³

We have, Volume of a cone is given by

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

$1570 = \left(\frac{1}{3}\right)(3.14)\, r^2 \times 15$

$5 \times 3.14 \times r^2 = 1570$

$r^2 = \frac{1570}{5 \times 3.14} = 100$

$\boxed{r = 10cm}$ This is the required radius of given cone.

9) The slant height and base diameter of a conical tomb are 25m and 14m respectively. Find the cost of white washing its curved surface area at the rate of Rs. 210 per 100 m^2.

→ Given that, slant height of conical tomb $(l) = 25m$

Base diameter $(d) = 14m$

$\Rightarrow$ Base Radius $(r) = 7m$

We have, Curved surface area of a cone is given by

$CSA = \pi r l$

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

$\boxed{CSA = 550m^2}$ is the required curved surface area of given conical tomb.

Given that, Rate of washing its curved surface area per $100m^2$ = Rs. 210

Then, total cost $= \frac{550}{100} \times 210 =$ Rs. 1155

Thus, the total cost of washing its curved surface area is found to be Rs. 1155.

10) A conical tent is 10m high and the radius of its base is 24m. Find i) slant height of the tent

ii) cost of the canvas required to make the tent, if the cost of $1m^2$ canvas is Rs. 70

→ Given that, Height of conical tent $(h) = 10m$

Radius of base $(r) = 24m$

We have, $l^2 = h^2 + r^2$

$l^2 = 10^2 + 24^2 = 100 + 576 = 676$

$l^2 = 676$

$\boxed{l = 26\ m}$ is the required slant height of the tent.

ii) Curved surface area of a cone is given by,

$\pi r l = \frac{22}{7} \times 24 \times 26$

$= \frac{13728}{7}\ m^2$

Given that, the cost of $1\ m^2$ canvas is Rs. 70.

Then, total cost of $\frac{13728}{7}\ m^2$ canvas is found to be

Total cost $= \frac{13728}{7} \times 70 =$ Rs. 137280

11.) A Jocker's cap is in the form of a right circular cone of base radius 7 cm and height 24 cm. Find the area of the cloth required to make 10 such caps.

→ Given that, Base radius of conical cap $= r = 7$ cm

Height of conical cap $(h) = 24$ cm

We have, $l^2 = h^2 + r^2$

$l^2 = 24^2 + 7^2 = 576 + 49$

$l^2 = 625$

$\boxed{l = 25\ cm}$ is the required slant height.

We have, Curved surface area of a cone is given by

$CSA = \pi r l$

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

$= 22 \times 25$

$\boxed{CSA = 550\ cm^2}$

Thus, for one cap the cloth required is $550\ cm^2$.

Then, the area of the cloth required to make 10 such caps is found to be

$550 \times 10 = 5500\ cm^2$.

13.) find what length of canvas 2m in width is required to make a conical tent 20m in diameter and 42 m in slant height allowing 10% for folds and the stitching. Also find the cost of the canvas at the rate of Rs. 80 per meter.

→ Given that, diameter of base of conical tent $(d) = 20\,m$

$\Rightarrow$ Radius of base of conical tent $(r) = 10\,m$

slant height $(l) = 42\,m$

Then, curved surface area of conical tent is given by,

$$CSA = \pi r l$$

$$= \frac{22}{7} \times 10 \times 42$$

$\boxed{CSA = 1320\,m^2}$ This the area of the canvas required.

Now, 10% of this canvas is used for folds and stitches,

then actual cloth needed $= 1320 + 10\%$ of 1320

$$= 1320 + \frac{10}{100} \times 1320$$

$$= 1320 + 132$$

$$= 1452\,m^2$$

Width of cloth $= 2m$

Length of cloth $= \frac{\text{Area}}{\text{width}} = \frac{1452}{2} = 726\,m$

Given that, cost of canvas is Rs. 80 per meter.

Then, total cost required is $= 80 \times 726$

$= 58080$ Rs.

14.) The perimeter of the base of a cone is 44cm and the slant height is 25cm. find the volume and the curved surface area of the cone?

→ Given that, perimeter of base of cone $= 44\,cm$

$\Rightarrow 2\pi r = 44$

$$r = \frac{44}{2\pi} = \frac{44}{2} \times \frac{7}{22}$$

$\boxed{r = 7\,cm}$ is the base radius.

Now, slant height $(l) = 25$

We have, $l^2 = r^2 + h^2$

$h^2 = l^2 - r^2 = 25^2 - 7^2$

$h^2 = 625 - 49$

$h^2 = 576$

$\boxed{h = 24\,cm}$ is the required height of a cone.

Then, Volume of the cone is given by,

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

$= \frac{1}{3} \times \frac{22}{7} \times 49 \times 8$

$\boxed{V = 1232\,cm^3}$ is the required volume of a cone.

Now, Curved surface area of a cone is given by,

$CSA = \pi r l$

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

$= 22 \times 25$

$\boxed{CSA = 550\,cm^2}$ This is the curved surface area of a cone.

15) The volume of a right circular cone is $9856\ cm^3$ and the area of its base is $616\ cm^2$. Find

i) the slant height of cone

ii) total surface area of cone

→ Given that, Volume of RCC $= 9856\ cm^3$

Base area of RCC $= 616\ cm^2$

$\Rightarrow \pi r^2 = 616$

$r^2 = 616 \times \frac{7}{22} = 196$

$\boxed{r = 14\,cm}$ is the required base radius.

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

$9856 = \frac{1}{3} \times \frac{22}{7} \times 14 \times 14 \times h$

$h = \left(\frac{9856 \times 3 \times 7}{14 \times 14}\right)$

$\boxed{h = 48 \text{ cm}}$ is the required height of a cone

i) We have, $l^2 = h^2 + r^2$

$l^2 = 48^2 + 14^2$

$l^2 = 2304 + 196$

$l^2 = 2500$

$\boxed{l = 50 \text{ cm}}$ is the required slant height of a cone.

ii) Total surface area of a cone is given by

$TSA = \pi r (l + r)$

$= \frac{22}{7} \times 14 \times (50 + 14)$

$= 22 \times 2 \times 64$

$\boxed{TSA = 2816 \text{ cm}^2}$ This is the required total surface area of a cone.

16) A right triangle with sides 6 cm, 8 cm and 10 cm is revolved about the side 8 cm. find the volume and the curved surface of the cone so formed.

→ Given that, A right triangle with sides: 6 cm, 8 cm, 10 cm.

It is revolved about the side 8 cm then cone is formed.

⇒ Radius $(r) = 6$ cm

Height $(h) = 8$ cm

Slant height $(l) = 10$ cm

Then, Volume of cone formed is given by,

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

$V = \frac{1}{3} \times 3.14 \times 6^2 \times 8$

$V = 3.14 \times 12 \times 8$

$\boxed{V = 301.44 \text{ cm}^3}$ is the required volume of the cone.

Now, Curved surface area of a cone is given by,

$CSA = \pi r l$

$= 3.14 \times 6 \times 10$

$\boxed{CSA = 188.4 \text{ cm}^2}$ is the required CSA of a cone.

17.) The height of a cone is 30 cm. A small cone is cut off at the top by a plane parallel to its base. If its volume be $\frac{1}{27}$th of the volume of the given cone, at what height above the base is the section cut?

→ Given that, Height of cone (H) = 30 cm

A small cone is cut off from the top of the big cone given.

Volume of given big cone $(V) = \frac{1}{3}\pi R^2 H$

Given that,

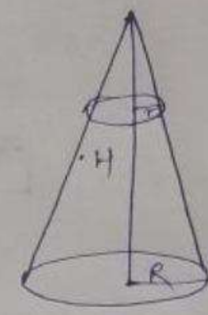
Volume of small cone $= \frac{1}{27}$th of the volume of big cone

$$\frac{1}{3}\pi r^2 h = \frac{1}{27}\left(\frac{1}{3}\pi R^2 H\right)$$

$$r^2 h = \frac{1}{27} R^2 H$$

$$r^2 h = \frac{30}{27} R^2$$

$$\frac{r^2 h}{R^2} = \frac{30}{27} = \frac{10}{9} \quad \text{——— ①}$$



Also, from fig, $\frac{r}{R} = \frac{h}{H}$

$$\frac{r}{R} = \frac{h}{30} \quad \text{——— ②}$$

from ① & ② ⇒ $\left(\frac{h}{30}\right)^2 \times h = \frac{10}{9}$

$$h^3/900 = 10/9$$

$$h^3 = 1000$$

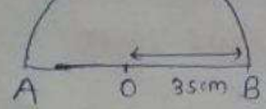
$\boxed{h = 10\text{ cm}}$ is the height of small cone.

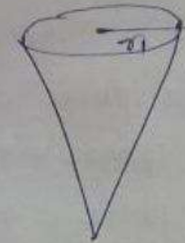
Now, $H - h = 30 - 10 = 20$ cm

Thus, the small cone is cut at height of 20 cm above the base of big cone.

18.) A semi-circular lamina of radius 35 cm is folded so that the two bounding radii are joined together to form a cone. Find i) the radius of cone

ii) the lateral surface area of cone.





i) Given that, Radius of semi-circular lamina $(r) = 35$ cm

After folding a semi-circular lamina a cone is formed,

The slant height of cone formed $(l) = 35$ cm

Let us consider, r_1 be the radius of a cone formed.

Now, $\left.\begin{array}{l}\text{Perimeter of semi-circular} \\ \text{lamina}\end{array}\right\} =$ base of cone

$$\pi r = 2\pi r_1$$
$$r = 2r_1$$
$$35 = 2r_1$$
$$\boxed{r_1 = 17.5\text{ cm}}$$ is the radius of a cone.

ii) Now, the curved surface area of the cone formed is given by

$$CSA = \pi r_1 l$$
$$= \frac{22}{7} \times 17.5 \times 35$$
$$\boxed{CSA = 1925\text{ cm}^2}$$ is the required curved surface area of a cone.

Exercise 17.3

1.) Find the surface area of a sphere of radius 14 cm.

→ Given that, Radius of a sphere $= r = 14\,cm$

Then, Surface area of a sphere is given by

$$SAS = 4\pi r^2$$

$$= 4 \times \frac{22}{7} \times 14 \times 14$$

$$= 4 \times 22 \times 2 \times 14$$

$\boxed{SAS = 2464\,cm^2}$ is the required surface area of a given sphere.

2.) Find the surface area of a sphere of diameter 21 cm.

→ Given that, diameter of a sphere $(d) = 21\,cm$

⇒ Radius of a sphere $(r) = 10.5\,cm$

Then, Surface area of a sphere is given by,

$$SAS = 4\pi r^2$$

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

$\boxed{SAS = 1386\,cm^2}$ is the required surface area of a given sphere.

3.) A shot-put is a metallic sphere of radius 4.9 cm. If the density of the metal is 7.8 g per cm^3, find the mass of the shot-put.

→ Given that, Radius of metallic shot-put $= r = 4.9\,cm$

We know that,

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

$$= \frac{4}{3} \times \frac{22}{7} \times (4.9)^3$$

$$V = 493.005$$

$\boxed{V = 493\,cm^3}$ is the required volume

Now, density $= 7.8$ g per cm^3

We have, $\text{density} = \frac{\text{mass}}{\text{Volume}}$

Then, Mass = density × volume

$= 7.8 \times 493$

$\boxed{Mass = 3845.4 g}$ is the required mass of shot-put.

4.) find the diameter of a sphere whose surface area is 154 cm

→ Given that, surface area of sphere = 154 cm^2

We have, Surface area of a sphere is given by,

$SAS = 4\pi r^2$

$154 = 4 \times \frac{22}{7} \times r^2$

$r^2 = 49/4$

$r = \sqrt{49}/2 = 7/2$ $\boxed{r = 7/2 \text{ cm}}$

Then, diameter of sphere $= d = 2r = 2 \times \frac{7}{2} = 7$ cm

5.) find i) the curved surface area

ii) the total surface area of a hemisphere of radius 21 cm

→ Given that, Radius of hemisphere $(r) = 21$ cm

i) The curved surface area of hemisphere is given by

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

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

$\boxed{CSA = 2772 cm^2}$

is the required curved surface area of given hemisphere.

ii) Now, total surface area of hemisphere is given by

TSA of hemisphere $= 3\pi r^2$

$= 3 \times \frac{22}{7} \times 21^2$

$= 4158 cm^2$

is the required total surface area of hemisphere.

lume

6.) A hemispherical brass bowl has inner-diameter 10.5 cm. Find the cost of tin-plating it on the inside at the rate of Rs 16 per 100 cm².

→ Given that,

the inner diameter of hemispherical bowl $(d) = 10.5\,cm$

$\Rightarrow$ Radius $(r) = 5.25\,cm$

Then, Curved surface area of hemispherical bowl is given by,

$$\text{CSA of hemisphere} = 2\pi r^2$$
$$= 2 \times \frac{22}{7} \times (5.25)^2$$
$$= 173.25\,cm^2$$

Given that, the rate of plating is Rs. 16 per 100 cm².

Then, total cost required for tin-plating the surface area of 173.25 cm² is given by

$$\text{Total cost} = 173.25 \times \frac{16}{100} = 27.72\text{ Rs.}$$

7) The radius of a spherical balloon increases from 7cm to 14cm as air is jumped into it. Find the ratio of the surface area of the balloon in two cases.

→ Given that, Original radius of balloon $(r) = 7cm$

Radius of balloon after air filling $= 14\,cm$

Then, Surface area of original balloon $= 4\pi r^2$

Surface area of new balloon $= 4\pi R^2$

$$\Rightarrow \frac{SAB_1}{SAB_2} = \frac{4\pi r^2}{4\pi R^2} = \frac{r^2}{R^2} = \frac{7^2}{14^2}$$

$$\frac{S_1}{S_2} = \frac{1}{4}$$

$$\boxed{S_1 : S_2 = 1:4}$$

This is the required ratio of balloons when it is empty & after filled with air.

8) A sphere and a cube have the same surface. Show that the volume of the sphere to that of the cube is ratio of $\sqrt{6}:\sqrt{\pi}$.

→ Let us consider, the side of the cube = 'a'

Then, Surface area of cube $= 6a^2$

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

$\Rightarrow$ SA of sphere = SA of cube

$$4\pi r^2 = 6a^2$$

$$\frac{\pi r^2}{a^2} = \frac{6}{4}$$

$$\therefore \boxed{\frac{r}{a} = \frac{\sqrt{6}}{2}\frac{1}{\sqrt{\pi}}}$$

Now, Volume of sphere $(V_1) = \frac{4}{3}\pi r^3$

and Volume of cube $(V_2) = a^3$

Then, $\frac{V_1}{V_2} = \frac{4\pi r^3}{3a^3}$

$$= \frac{4\pi \sqrt{6}^3}{3(2\sqrt{\pi})^3}$$

$$= (4\pi \times 6\sqrt{6}) / (3 \times 8\pi \times \sqrt{\pi})$$

$$\frac{V_1}{V_2} = \frac{\sqrt{6}}{\sqrt{\pi}} \Rightarrow \boxed{V_1 : V_2 = \sqrt{6} : \sqrt{\pi}}$$

Hence proved.

10) Find the volume of a sphere whose surface area is $154 cm^2$.

→ Given that, surface area of sphere $= 154 cm^2$

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

$$154 = 4 \times \frac{22}{7} \times r^2$$

$$r^2 = 49/4$$

$\boxed{r = 7/2 \text{ cm}}$ is the radius of sphere

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

$$= \frac{4}{3} \times \frac{22}{7} \times \left(\frac{7}{2}\right)^3 = 179.67 cm^3$$

Thus, Volume of a sphere is found to be $179.67 cm^3$.

11.) If the volume of a sphere is 179.2/3 . find the radius & surface area of sphere.

$\longrightarrow$ Given that, Volume of a sphere = 179.2/3 cm^3.

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

$$179.2/3 = \frac{4}{3}\pi r^3$$

$$\frac{539}{3} = \frac{4}{3} \times \left(\frac{22}{7}\right) r^3$$

$$r^3 = 49 \times 7/8 = \frac{(7 \times 7 \times 7)}{(2 \times 2 \times 2)}$$

$$\Rightarrow r = 7/2 = 3.5cm$$

$\boxed{r = 3.5cm}$ is the required radius of given sphere.

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

$$= 4 \times \frac{22}{7} \times \left(\frac{7}{2}\right)^2$$

$$= 22 \times 7$$

$$\boxed{SAS = 154 cm^2}$$

This is the required surface area of given sphere.

12.) A hemispherical bowl has a radius of 3.5 cm. What would be the volume of water it would contain?

$\longrightarrow$ Given that, Radius of hemispherical bowl $(r) = 3.5$ cm

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

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

$$= 11 \times 49/6$$

$$= 539/6$$

$$\boxed{V = 89.5/6 \ cm^3}$$

This is the required volume of a given hemispherical bowl.

13.) The surface area of a solid sphere is $1256\ cm^2$. It is cut into two hemisphere. Find the total surface area and the volume of a hemisphere.

→ Given that, Surface area of a solid sphere $= 1256\ cm^2$

We have, Surface area of sphere $= 1256$

$$4\pi r^2 = 1256$$

$$4 \times 3.14 \times r^2 = 1256$$

$$r^2 = 1256 \div (4 \times 3.14)$$

$$r^2 = 100$$

$\boxed{r = 10\ cm}$ is the requred radius

Now, total surface area of hemisphere $= 3\pi r^2$

$$3\pi r^2 = 3 \times 3.14 \times 10^2$$

$$= 3 \times 3.14 \times 100$$

$\boxed{TSA\ of\ H = 942\ cm^2}$ is the requred total surface area of hemisphere

Now, Volume of the hemisphere $= \frac{2}{3}\pi r^3$

$$= \frac{2}{3} \times \frac{22}{7} \times 10^3$$

$$= \frac{2}{3} \times 3.14 \times 1000$$

$$= 6280/3$$

V = 2093.1[illegible] cm^3

This is the required volume of a given hemisphere.

Exercise 17.4

1) The following fig. shows a cuboidal block of wood through which a circular cylindrical hole of the biggest size is drilled. Find the volume of the wood left in the block.

→ Given that,

diameter of biggest hole = 30 cm

Then, Radius of hole $(r) = \frac{30}{2} = 15$ cm

Height of hole $(h) = 70$ cm

The volume of cuboidal block is given by,

$V = l \times b \times h$

$V = 70 \times 30 \times 30$

$\boxed{V = 63000 \text{ cm}^3}$ is the required volume of block.

Then, Volume of a cylindrical hole is given by,

$V = \pi r^2 h$

$= \frac{22}{7} \times 15^2 \times 70$

$= 22 \times 225 \times 70$

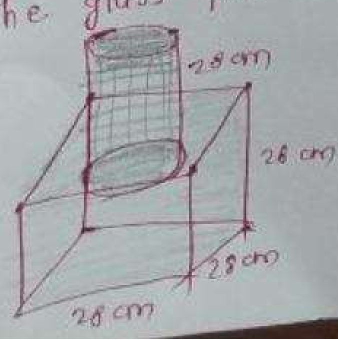
$\boxed{V = 49500 \text{ cm}^3}$ is the required volume of cylindrical hole.

Now, Volume of the wood left in the block $\} = 63000 - 49500$

$= 13500 \text{ cm}^3$

Hence, the volume of the wood left in the block is found to be 13500 cm^3.

2.) The given fig. shows a solid trophy made of shining glass. If one cubic centimeter of glass costs Rs. 0.75. find the cost of the glass for making the trophy.



Given that,

Side of cubical part = 28 cm

Radius of cylindrical part $(r) = \frac{28}{2} = 14$ cm

Height of cylinder $(h) = 28$ cm

Then, volume of a cube is given by,

$$\text{Volume of cube} = a^3$$
$$= 28^3$$
$$\boxed{V_1 = 21952 \text{ cm}^3}$$

Now, Volume of the cylindrical part is given by,

$$V_2 = \pi r^2 h$$
$$= \frac{22}{7} \times 14 \times 14 \times 28$$
$$\boxed{V_2 = 17248 \text{ cm}^3}$$

Then, total volume of the solid = (Volume of the cube) + (Volume of the cylinder)

$$= 21952 + 17248$$
$$\boxed{T.V = 39200 \text{ cm}^3}$$

The cost of 1 cm^3 glass is Rs. 0.75

Then, total cost of glass = 39200×0.75 = Rs. 29400.-

3) From a cube of edge 14cm, a cone of maximum size is carved out. Find the volume of the remaining material.

→ Given that, edge/side of the cube = 14cm

Volume of cube (V) = $(14)^3 = 2744 \text{ cm}^3$

diameter of cone cut from cube = 14 cm

Volume of cube = a^3

$V = 14^3$

$\boxed{V_1 = 2744 \text{ cm}^3}$

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

$= \frac{1}{3} \times \frac{22}{7} \times 7^2 \times 14$

$\boxed{V_2 = 2156/3 \text{ cm}^3}$

Volume of remaining material = (Volume of the cube) − (Volume of Cone)

$$= (3 \times 2744 - 2156)/3$$
$$= (8232 - 2156)/3$$
$$= 6076/3$$
$$\boxed{V = 2025.1/3 \text{ cm}^3}$$

This is the volume of remaining material.

4) A cone of maximum volume is curved out of a block of wood of size 20cm × 10cm × 10cm. find the volume of the remaining wood.

→ Given that,

The diemenisons of wooden block = 20cm × 10 cm × 10cm

Then, Volume of the wooden block = $20 \times 10 \times 10 = 2000\ cm^3$

diameter of cone (d) = 10cm

⇒ Radius of cone (r) = 5 cm

Height of cone (h) = 20 cm

Now, Volume of the cone is given by,

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

$$V = \frac{1}{3} \times \frac{22}{7} \times 5^2 \times 20$$

$$\boxed{V = 11000/21\ cm^3}$$

Now, Volume of remaining wood = (Volume of block of wood) − (Volume of cone)

$= (2000 - 11000)/21$

$= (21 \times 2000 - 11000)/21$

$= (42000 - 11000)/21$

$= 31000/21$

$$\boxed{V = 1476.19\ cm^3}$$

This is the required volume of remaining wood.

5) 16 glass spheres each of radius 2cm are packed in a cuboidal box of internal dimensions 16cm × 8cm × 8cm and then the box is filled with water. find the volume of the water filled in the box.

→ Given that,

Dimensions of cuboidal box = 16 cm × 8 cm × 8 cm

Then, Volume of cuboidal box = $lbh = 16 \times 8 \times 8 = 1024\ cm^3$

Radius of sphere (r) = 2cm

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

$= 4/3 \times \frac{22}{7} \times 2^3$

$V = (4 \times 22 \times 8)/(3 \times 7)$

$\boxed{V = 704/21}\ cm^3$

Volume of 16 spheres $= 16 \times \frac{704}{21} = \frac{11264}{21}\ cm^3$

$= 536.38\ cm^3$

Now, $\left.\begin{array}{l}\text{Volume of water filled}\\ \text{in the box}\end{array}\right\} = \left(\begin{array}{c}\text{Volume of}\\ \text{the box}\end{array}\right) - \left(\begin{array}{c}\text{Volume of}\\ \text{16 spheres}\end{array}\right)$

$= (1024 - 536.38)$

$\boxed{V = 487.62\ cm^3}$

This is the required volume of water filled in the box.

6.) A cuboidal block of side 7 cm is surmounted by a hemisphere. What is the greatest diameter that the hemisphere can have? Also find the surface area of the solid.

→ Given that, side of cuboidal block $= a = 7\ cm$

diameter of hemisphere $= 7\ cm$

$\Rightarrow$ Radius of hemisphere $(r) = \frac{7}{2} = 3.5\ cm$

Now, Surface area of hemisphere $= 2\pi r^2$

$2\pi r^2 = 2 \times \frac{22}{7} \times 3.5 \times 3.5$

$S = 44 \times 12.25/7$

$= 539/7$

$\boxed{S = 77\ cm^2}$

Surface area of cube $= 6a^2 = 6 \times 7^2 = 294\ cm^2$

Now, surface area of base of hemisphere $= \pi r^2$

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

$= 38.5\ cm^2$

Thus, the $\left(\begin{array}{c}\text{surface area}\\ \text{of solid}\end{array}\right) = \left(\begin{array}{c}\text{surface area}\\ \text{of the cube}\end{array}\right) + \left(\begin{array}{c}\text{surface area}\\ \text{of hemisphere}\end{array}\right) - \left(\begin{array}{c}\text{surface area of}\\ \text{base of hemisphere}\end{array}\right)$

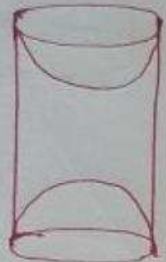
$= 294 + 77 - 38.5$

$= 332.5\ cm^2$

This is the required surface area of solid.

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

→



Given that,

Height of cylinder $(h) = 10$ cm

Radius of the base $(r) = 3.5$ cm

Total surface area is given by,

$$TSA = \begin{pmatrix}\text{curved surface area} \\ \text{of a cylinder}\end{pmatrix} + 2 \times \begin{pmatrix}\text{curved surface area} \\ \text{of hemisphere}\end{pmatrix}$$

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

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

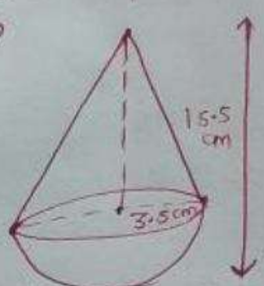
$$= (154/7) \times (10+7)$$

$$= 22 \times 17$$

$\boxed{TSA = 374\, cm^2}$ is the required total surface area of given article.

8.) A toy is in the form of a cone of radius 3.5cm mounted on a hemisphere of same radius. If the total height of the toy is 15.5 cm, find the total surface area of the toy.

→



Given that,

Total height of toy $(h) = 15.5$ cm

Radius of base of conical part $(r) = 3.5$ cm

Now, Height of cone $(h) = 15.5 - 3.5 = 12$ cm

We have, $l^2 = h^2 + r^2$

$$l^2 = 12^2 + 3.5^2$$

$$l^2 = 144 + 12.25 = 156.25$$

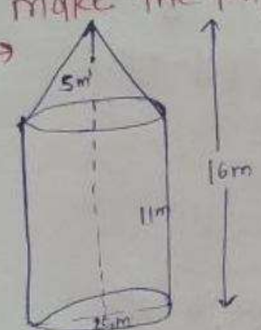
$$\boxed{l = 12.5 \text{ cm}}$$

$$\begin{pmatrix}\text{Total surface area} \\ \text{of the toy}\end{pmatrix} = \begin{pmatrix}\text{curved surface} \\ \text{area of cone}\end{pmatrix} + \begin{pmatrix}\text{curved surface} \\ \text{area of the} \\ \text{hemisphere}\end{pmatrix}$$

$$TSA = \pi r l + 2\pi r^2$$
$$= \pi r(l+2r)$$
$$= \frac{22}{7} \times 3.5 \times (12.5 + 2 \times 3.5)$$
$$= 11 \times 19.5$$
$$\boxed{TSA = 214.5\ cm^2}$$

This is the required surface area of the toy.

10.) A circus tent is in the shape of a cylinder surmounted by a cone. The diameter of the cylindrical portion is 24 m and its height is 11 m. If the vertex of the cone is 16 m above the ground, find the area of the canvas used to make the tent.



Given that,

Radius of base of cylindrical part of the tent $\Big\}\ r = \frac{24}{2} = 12\,m$

Height of cylindrical part $(H) = 11\,m$

As the vertex of a cone is 16m above the ground, height of cone $(h) = 16 - 11 = 5\,m$

Now, we have

$$l^2 = h^2 + r^2$$
$$l^2 = 25 + 144$$
$$l^2 = 169$$
$$\boxed{l = 13\,m}$$

Radius of cone $(r) = 12\,m$

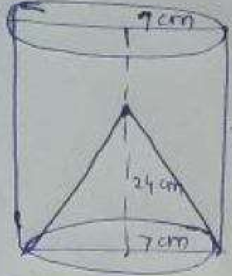
$\begin{pmatrix}\text{Area of canvas} \\ \text{used to make tent}\end{pmatrix} = 2\pi r H + \pi r l$

$$= (2H + l)\pi r$$
$$= \left(\frac{264}{7}\right) \times (22+13)$$
$$= 264 \times 5$$
$$\boxed{A = 1320\,m^2}$$

Thus, the area of the canvas used to make the tent is found to be $1320\,m^2$.

12) From a solid cylinder of height 30 cm and radius 7 cm, a conical cavity of height 24 cm and of base radius 7 cm is drilled out. Find the volume and total surface of the remaining solid.

→ Given that,



Radius of solid cylinder $(r_1) = 7\,cm$

Height of cylinder $(H) = 30\,cm$

Height of cone $(h) = 24\,cm$

Radius of cone $(r) = 7\,cm$

Then, $l^2 = h^2 + r^2$

$l^2 = 24^2 + 7^2$

$l^2 = 576 + 49$

$l^2 = 625$

$\boxed{l = 25\,cm}$

Now, $\begin{pmatrix}\text{Volume} \\ \text{of remaining solid}\end{pmatrix} = \begin{pmatrix}\text{Volume of} \\ \text{cylinder}\end{pmatrix} - \begin{pmatrix}\text{Volume of} \\ \text{the cone}\end{pmatrix}$

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

$V = \pi r^2 (H - h/3)$

$V = \pi r^2 (H - h/3)$

$= \frac{22}{7} \times 7^2 \times (30 - 24/3)$

$= 22 \times 7 \times (30 - 8)$

$\boxed{V = 3388\,cm^3}$ is the required volume of remaining solid

Now,

$\begin{pmatrix}\text{Total surface area of} \\ \text{remaining solid}\end{pmatrix} = \begin{pmatrix}\text{Curved surface} \\ \text{area of cylinder}\end{pmatrix} + \begin{pmatrix}\text{surface area} \\ \text{of top of cylinder}\end{pmatrix} + \begin{pmatrix}\text{Curved surface} \\ \text{area of the cone}\end{pmatrix}$

$= 2\pi r H + \pi r^2 + \pi r l$

$= \pi r (2H + r + l)$

$= \frac{22}{7} \times 7 (2 \times 30 + 7 + 25)$

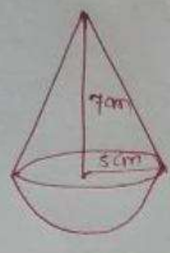
$= 22 \times (60 + 32)$

$= 22 \times 92$

$\boxed{TSA = 2024\,cm^2}$

This is the required total surface area of the remaining solid.

13.) The following fig. shows a hemisphere of radius 5 cm surmounted by a right circular cone of base radius 5cm. Find the volume of the solid if the height of the cone is 7cm. Give your answer correct to two places of decimal.



→ Given that,

Height of conical portion $(h) = 7$ cm

Radius of base of cone $(r) = 5$ cm

Now,

$$\text{Volume of solid} = \begin{pmatrix}\text{Volume of}\\ \text{hemisphere}\end{pmatrix} + \begin{pmatrix}\text{Volume of}\\ \text{the cone}\end{pmatrix}$$

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

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

$$= \frac{1}{3} \times \frac{22}{7} \times 5^2 \times (10+7)$$

$$= \frac{22}{21} \times 25 \times 17$$

$$= 445.238$$

$$\boxed{V = 445.24 \text{ cm}^3}$$

This is the required volume of solid.

15.) A building is in the form of a cylinder surmounted by a hemisphere valted dome and contains $41 (19/21)$ m³ of air. If the internal diameter of the dome is equal to its total height above the floor, find the height of the building.

→ Let us consider, r be the radius of dome.

Then, internal diameter $= 2r$

Given that, internal diameter = total height

Then, total height of building $= 2r$

And height of hemispherical area $= r$

Then, height of cylindrical area $= h = 2r - r = r$

$$\text{Now, } \begin{pmatrix}\text{Volume of the}\\ \text{building}\end{pmatrix} = \begin{pmatrix}\text{Volume of}\\ \text{cylindrical area}\end{pmatrix} + \begin{pmatrix}\text{volume of}\\ \text{hemispherical}\\ \text{area}\end{pmatrix}$$

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

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

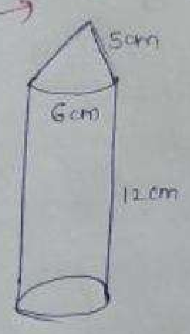
$$V = \pi r^3 (1 + 2/3)$$
$$= \pi r^3 (3+2)/3$$
$$\boxed{V = (5/3)\pi r^3}$$

Given that, Volume of building $= 41\ (19/21) = 880/21$

$$(5/3)\pi r^3 = 880/21$$
$$5/3 \times \frac{22}{7} \times r^3 = 880/21$$
$$r^3 = \frac{880 \times 3 \times 7}{(5 \times 22 \times 11)}$$
$$r^3 = 880/110$$
$$r^3 = 8$$
$\boxed{r = 2m}$ is the required radius

Now, height of the building $= 2r = 2 \times 2 = 4m$

16.) A rocket is in the form of a right circular cylinder closed at the lower end and submitted by a cone with the same radius as that of the cylinder. The diameter and the height of the cylinder are 6cm and 12cm respectively. If the slant height of the conical portion is 5cm, find the total surface area and the volume of the rocket.



Given that,
Height of cylindrical portion $= 12cm\ (H)$
diameter $= 6\ cm \Rightarrow$ Radius $= r = 3\ cm$
Slant height of conical portion $(l) = 5cm$

Now, $l^2 = h^2 + r^2$
$$h^2 = l^2 - r^2$$
$$h = \sqrt{25-9} = \sqrt{16} \Rightarrow \boxed{h = 4cm}$$

Now,
$$\begin{pmatrix}\text{Total surface area} \\ \text{of the rocket}\end{pmatrix} = \begin{pmatrix}\text{curved surface} \\ \text{area of cylinder}\end{pmatrix} + \begin{pmatrix}\text{base area} \\ \text{of cylinder}\end{pmatrix} + \begin{pmatrix}\text{curved} \\ \text{surface area} \\ \text{of cone}\end{pmatrix}$$
$$= 2\pi r H + \pi r^2 + \pi r l$$
$$= \pi r (2H + r + l)$$
$$= 3.14 \times 3 \times (24 + 3 + 5)$$
$$= 3.14 \times 3 \times 32$$
$$= 301.44\ cm^2$$

Thus, the total surface area of the rocket is found to be $301.44 cm^2$

Now, Volume of rocket = $\begin{pmatrix}\text{Volume of the} \\ \text{cone}\end{pmatrix} + \begin{pmatrix}\text{volume of the} \\ \text{cylinder}\end{pmatrix}$

$$= \frac{1}{3}\pi r^2 h + \pi r^2 H$$
$$= \pi r^2 (h/3 + H)$$
$$= 3.14 \times 3^2 \times (4/3 + 12)$$
$$= 3.14 \times 9 \times (4+36)/3$$
$$= 3.14 \times 3 \times 40$$

$\boxed{\text{Volume of rocket} = 376.8 \text{ cm}^3}$

This is the required volume of the rocket

17.) The following fig. represents a solid consisting of a right circular cylinder with a hemisphere at one end and a cone at the other. Their common radius is 7 cm. The height of the cylinder and the cone are each of 4 cm. find the volume of the solid.

→ Given that, Common radius RCC & hemisphere $r = 7$ cm
Height of the cone $(h) = 4$ cm
Height of the cylinder $(H) = 4$ cm

Then,
Volume of solid = $\begin{pmatrix}\text{Volume of} \\ \text{the cone}\end{pmatrix} + \begin{pmatrix}\text{Volume of} \\ \text{the cylinder}\end{pmatrix} + \begin{pmatrix}\text{Volume of the} \\ \text{hemisphere}\end{pmatrix}$

$$= \frac{1}{3}\pi r^2 h + \pi r^2 H + \frac{2}{3}\pi r^3$$
$$= \pi r^2 [h/3 + H + 2r/3]$$
$$= \frac{22}{7} \times 7^2 [4/3 + 4 + 14/3]$$
$$= 22 \times 7 \times (4+12+14)/3$$

$\boxed{\text{Volume of solid} = 1540 \text{cm}^3}$

This is the required volume of the given solid.

18.) A solid is in the form of a right circular cylinder with a hemisphere at one end and a cone at the other end. Their common diameter is 3.5 cm and the height of the cylindrical and conical portions are 10 cm and 6 cm respectively. Find the volume of the solid.

→ Given that, common diameter $(d) = 3.5$ cm

Then, Radius $(r) = 1.75$ cm

Height of cylindrical portion $(h_1) = 10$ cm

Height of conical portion $(h_2) = 6$ cm

Now, Volume of the solid is given by,

$$(\text{Vol. of solid}) = \begin{pmatrix}\text{Volume of}\\ \text{the cone}\end{pmatrix} + \begin{pmatrix}\text{Volume of}\\ \text{the cylinder}\end{pmatrix} + \begin{pmatrix}\text{Volume of}\\ \text{hemisphere}\end{pmatrix}$$

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

$$= \pi r^2 [h/3 + H + 2r/3]$$

$$= 3.14 \times 1.75 \times 1.75 \times [6/3 + 10 + (2\times 1.75)/3]$$

$$= 3.14 \times 3.0625 \times 13.167$$

$$= 9.61625 \times 13.167$$

$$= 126.617 \text{ cm}^3$$

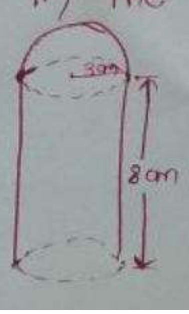
$$\boxed{\text{Volume of Solid} = 126.62 \text{ cm}^3}$$

This is the required volume of the solid.

20.) The following fig. shows a model of solid consisting of a cylinder surmounted by a hemisphere at one end. If the model is drawn to a scale of 1:200, find

i) the total surface area of the solid in πm^2.

ii) the volume of the solid in π litres.



i) Given that,

Height of cylindrical portion $(h) = 8$ cm

Radius $(r) = 3$ cm

Scale $= 1:200$

Then, total surface are of solid is given by,

$$\text{Total surface area} = 2\pi r^2 + 2\pi r h$$
$$= 2\pi r (r+h)$$
$$= 2 \times \pi \times 3 (3+8)$$
$$= 6\pi \times 11$$

$\boxed{\text{Total surface area} = 66\pi \text{ cm}^2}$ is the required total surface area.

Hence, total surface area of the solid is given by

$$\text{Surface area of solid} = 66\pi \times (200)2/1$$
$$= (66 \times 40{,}000) / (100 \times 100)\pi$$

$\boxed{\text{Surface area of solid} = 264\pi \text{ m}^2}$

This is the required surface area of solid.

ii) $\text{The volume of solid} = \frac{2}{3}\pi r^3 + \pi r^2 h$
$$= \pi r^2 [2/3 r + h]$$
$$= \pi \times 3^2 \times [2/3 \times 3 + 8]$$
$$= 9\pi (2+8)$$

$\boxed{\text{Volume of solid} = 90\pi}$

Given that, scale $= 1:200$

Thus, $\text{Capacity of solid} = 90\pi \times (200)^3$
$$= 90\pi \times 8000000$$
$$= 720000000 \text{ cm}^3$$
$$= (720000000 / (100 \times 100 \times 100)$$
$$= 720\pi \text{ m}^3$$
$$= 720\pi \times 1000 \text{ litres}$$

$\boxed{\text{Capacity of solid} = 720000\pi \text{ litres}}$

This is the required volume of the solid.

Exercise 17.5

1.) The diameter of a metallic sphere is 6 cm. The sphere is melted and drawn into a wire of uniform cross-section. If the length of the wire is 36 m, find its radius.

→ Given that, diameter of metallic sphere = 6 cm

Radius of sphere (r) = 3 cm

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

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

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

$\boxed{V = 36\pi \text{ cm}^3}$

This is the required volume of sphere.

Length of wire (h) = 36 m

Let 'r' be the radius of the wire,

$\pi r^2 h = 36\pi$

$r^2 \times 36 \times 100 = 36$

$r^2 = \frac{1}{100} = \left(\frac{1}{10}\right)^2 \Rightarrow \frac{1}{10} \text{ cm} = r$

$\boxed{r = 1 \text{ mm}}$

2.) A solid metallic sphere of radius 6 cm is melted and made into a solid cylinder of height 32 cm. Find the

i) radius of the cylinder

ii) curved surface area of the cylinder.

→ Given that, Radius of metallic sphere (R) = 6 cm

Height of cylinder (h) = 32 cm

Then, Volume of metallic cylinder is given by,

i) Volume of Cylinder = Volume of metallic sphere

$\pi r^2 h = \frac{4}{3}\pi R^3$

$r^2(32) = \frac{4}{3} 6^3$

$r^2 = \frac{4}{3} \times \frac{6 \times 6 \times 6}{32} = 9$

$\boxed{r = 3 \text{ cm}}$ is the required radius of the cylinder

ii) Curved surface area of the cylinder is given by,

$\left(\text{Curved surface area of Cylinder}\right) = 2\pi r h = 2 \times 3.1 \times 3 \times 32$

Curved surface area of cylinder = 595.2 cm^2.

3.) A solid metallic hemisphere of radius 8cm is melted and recasted into right circular cone of base radius 6 cm. Determine the height of the cone.

→ Given that, Radius of hemisphere $(r) = 8cm$

Volume of hemisphere $= \frac{2}{3}\pi r^3$

$V = \frac{2}{3}\pi r^3$

$= \frac{2}{3} \times 8^3 \times \pi$

$\boxed{V = (1024/3)\pi \ cm^3}$

is the required volume of hemisphere.

Radius of cone $(R) = 6$ cm

Given that, hemisphere is melted and converted into a cone then volume remains same.

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

$(1024)/3\pi = \frac{1}{3} \times \pi \times 6^2 \times h$

$36h = 1024$

$h = 1024/36$

$\boxed{h = 28.44 \ cm}$ is the required height of the cone.

4.) A rectangular water tank of base 11m × 6m contains water upto a height of 5m. If the water in the tank is transferred to a cylindrical tank of radius 3.5m, find the height of the water level in the tank.

→ Given that, Base of water tank = 11 m × 6m

Height of water level in tank $(h) = 5m$

And volume of water $= 11 \times 6 \times 5 = 330 \ m^3$

Now, volume of cylindrical tank is given by,

(Volume of cylindrical tank) $= \pi r^2 h$

$330 = \frac{22}{7} \times 3.5 \times 3.5 \times h$

$h = 330 \times \frac{7}{22} \times 12.25$

$\boxed{h = 8.57m}$

This is the required height of water level in the tank.

6) The volume of a cone is the same as that of the cylinder whose height is 9 cm and diameter 40 cm. Find the radius of the base of the cone if its height is 108 cm.

→ Given that, diameter of cylinder = 40 cm

Then, radius of cylinder = (r) = 20 cm

Height of cylinder (h) = 9 cm

Now, Volume of cylinder is given by

$V = \pi r^2 h$

Height of cone = 108 cm

$V = \pi \times 20 \times 20 \times 9$

$\boxed{V = 3600\pi \text{ cm}^3}$

And volume of cone $= 1/3 \pi r^2 h$

$$3600\pi = \frac{1}{3} \times \pi \times r^2 \times 108$$

$$r^2 = \frac{3 \times 3600\pi}{\pi \times 108} = \frac{3 \times 3600}{108}$$

$$r = \sqrt{100} = 10 \text{ cm}$$

$\boxed{r = 10 \text{ cm}}$ This is the required radius of the cone.

7) A hemispherical bowl of diameter 7.2 cm is filled completely with chocolate sauce. This source is poured into an inverted cone of radius 4.8 cm. Find the height of the cone.

→ Given that, diameter of hemispherical bowl = 7.2 cm

Radius of hemispherical bowl (r) = 3.6 cm

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

$$= \frac{2}{3} \times \frac{22}{7} \times 3.6 \times 3.6 \times 3.6$$

$\boxed{V = 97.76 \text{ cm}^3}$

And, Volume of cone $= \frac{1}{3}\pi R^2 h = \frac{1}{3} \times \frac{22}{7} \times 4.8 \times 4.8 \times h$

$\boxed{V = 24.14 \times h}$

But, Volume of cone = Volume of hemispherical bowl

$$24.14 \times h = 97.76$$

$$h = 97.76 / 24.14 = 4.05 \text{ cm}$$

This is the required height of the cone.

9.) A hollow copper pipe of inner diameter 6 cm and outer diameter 10 cm is melted and changed into a solid circular cylinder of the same height as that of the pipe. Find the diameter of the solid cylinder.

→ Given that, $\begin{pmatrix}\text{Inner diameter} \\ \text{of hollow pipe}\end{pmatrix} = 6$ cm

Outer diameter of hollow pipe = 10 cm

Then, Inner radius (r) = 3 cm & outer radius (R) = 5 cm

Let us consider, 'h' be the height of the hollow pipe.

$$\text{Volume of pipe} = \pi R^2 h - \pi r^2 h$$
$$= \pi (5^2 - 3^2) h$$
$$= \pi h (25 - 9)$$
$$= \pi R^2 h$$
$$16 = R^2$$
$$\boxed{\therefore R = 4\text{ cm}}$$

Then, diameter of solid cylinder is found to be 8 cm.

10.) A hollow sphere of internal & external diameter 4 cm & 8 cm respectively, is melted into a cone of base diameter 8 cm. Find the height of the cone.

→ Given that,

Internal diameter of hollow sphere = 4 cm

Then, inner radius of hollow sphere = 2 cm

And outer diameter of hollow sphere = 8 cm

Then, outer radius of hollow sphere = 4 cm

Thus, Volume of the hollow sphere is given by

$$V = \frac{4}{3}\pi (4^3 - 2^3) \text{ —— ①}$$

Again, diameter of a cone = 8 cm

Then, Radius of a cone (r) = 4 cm

Then, volume of a cone $= \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi \times 4^2 \times h$ —— ②

But, given that the volume of hollow sphere & cone are equal. from ① & ② ⇒

$$\frac{4}{3}\pi(4^3-2^3) = \frac{1}{3}\pi \times 4^2 \times h$$

$$4 \times (64-8) = 16 \times h$$

$$\Rightarrow \boxed{h = 14 cm}$$

This is the required height of the cone.

12.) A cylindrical can of internal diameter 21 cm contains water. A solid sphere whose diameter is 10.5 cm is lowered into the cylindrical can. The sphere is completely immersed in water. Calculate the rise in water level, assuming that no water overflows.

→ Given that, inner diameter of cylindrical can = 21 cm

Then, inner radius (R) = 21/2 cm

diameter of sphere = 10.5 cm

Then, Radius of sphere (r) = 10.5/2 = 21/4 cm

Let us consider, h be the height of water level raised.

Rise in (water level) volume = Volume of sphere immersed

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

$$\left(\frac{21}{2}\right)^2 \pi h = \frac{4}{3} \times \pi \times \left(\frac{21}{4}\right)^3$$

$$\frac{21}{2} \times \frac{21}{2} \times h = \frac{4}{3} \times \frac{21}{4} \times \frac{21}{4} \times \frac{21}{4}$$

$$\Rightarrow h = 21/12 = 7/4$$

$\boxed{h = 1.75 cm}$ This is the required rise in water level.

13.) There is water to a height of 14 cm in a cylindrical glass jar of radius 8 cm. Inside the water there is a sphere of diameter 12 cm completely immersed. By what height will the water go down when the sphere is removed?

→ Given that, Radius of glass jar (R) = 8 cm

diameter of sphere = 12 cm

Then, Radius of sphere (r) = 6 cm

When, the sphere immersed in the water is removed from the jar then water level decreases

Let us consider, h is the height of water level decreased.

Volume of water decreased = Volume of the sphere

$$\pi R^2 h = \frac{4}{3}\pi r^3$$

$$8^2 \pi h = \frac{4}{3}\pi 6^3$$

$$h = \frac{\frac{4}{3} \times 6 \times 6 \times 6}{8 \times 8}$$

$$\boxed{h = 4.5 cm}$$

This is the required height by which the water level decreased.

15) A solid metallic circular cylinder of radius 14 cm and height 12 cm is melted and recast into small cubes of edge 2 cm. How many such cubes can be made from the solid cylinder.

→ Given that, Radius of solid metallic cylinder $(r) = 14$ cm

Height of solid cylinder $(h) = 12$ cm

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

$$= 14^2 \times 12 \times \pi$$

$$= 196 \times 12 \times \pi$$

$$= 2352 \times \pi$$

$\boxed{V = 7392 cm^3}$ is the required volume of a cylinder.

Then, Volume of a cube $= a^3 = 2^3 = 8 cm^3$

$\boxed{V = 8 cm^3}$ is the required volume of a cube.

Then, no. of cubes made from solid cylinder $= \frac{7392}{8} = 924$

16) How many shots each having diameter 3 cm can be made from a cuboidal lead solid of dimensions 9 cm × 11 cm × 12 cm?

→ Given that, diameter of shot = 3 cm

dimensions of cuboidal solid = 9 cm × 11 cm × 12 cm

Then, volume of cuboidal solid $= 9 \times 11 \times 12 = 1188 cm^3$

Radius of shot $(r) = 3/2$ cm

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

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

$= \frac{4}{3} \times \pi \times 1.5^3 = \frac{4}{3} \times \frac{22}{7} \times 1.5^3$

$\boxed{V = 297/21 \text{ cm}^3}$ is the required volume of one shot.

Then, no. of shots made from cuboidal lead of solid are

$1188 \times \frac{21}{297} = 84$

Thus, the no. of shots made from cuboidal lead of solid is found to be 84.

17) A solid metal cylinder of radius 4cm and height 21 cm is melted down and recast into sphere of radius 3.5 cm. Calculate the no. of spheres that can be made.

→ Given that, Radius of a solid metallic cylinder $(r) = 14$ cm

Height of cylinder $(h) = 21$ cm

Then, Volume of Cylinder $= \pi r^2 h$

$V = \frac{22}{7} \times 14 \times 14 \times 21$

$\boxed{V = 12936 \text{ cm}^3}$

· Given that, Radius of sphere $(R) = 3.5$ cm

Then, Volume of sphere $= \frac{4}{3}\pi R^3$

$= \frac{4}{3} \times \frac{22}{7} \times 3.5 \times 3.5 \times 3.5$

$= 11 \times 49/3$

$\boxed{V = 539/3 \text{ cm}^3}$ is the required volume of sphere.

Then, no. of spheres made $= \frac{\text{Volume of metal cylinder}}{\text{Volume of sphere}}$

$= 12936 \times \frac{3}{539}$

$\boxed{\text{no. of spheres made} = 72}$

18) A metallic sphere of radius 10.5 cm is melted and then recast into small cones, each of radius 3.5 cm and height 3 cm. Find the no. of cones thus obtained.

→ Given that, Radius of metallic sphere $(r) = 10.5$ cm

Radius of cone $(r) = 3.5$ cm

Height of cone $(h) = 3$ cm

Then, Volume of sphere is given by

$V = \frac{4}{3}\pi R^3$

$= \frac{4}{3} \times \pi \times 10.5^3$

$\boxed{V = 1543.5\pi \ cm^3}$

is the required volume of sphere.

And volume of cone is given by

$V = \frac{1}{3}\pi r^2 h = \frac{1}{3} \times \pi \times 3.5^2 \times h$

$\boxed{V = 12.25\pi \ cm^3}$

is the required volume of cone.

Now, $\left(\text{no. of cones made from sphere}\right) = \frac{\text{Volume of sphere}}{\text{Volume of cone}}$

$= \frac{1543.5\pi}{12.25\pi}$

$\left(\text{no. of cones made from sphere}\right) = 126$

19) A certain no. of metallic cones each of radius 2 cm and height 3 cm are melted and recast in a solid sphere of radius 6 cm. Find the no. of cones.

→ Given that, radius of cone $(r) = 2$ cm

Height of cone $(h) = 3$ cm

Radius of sphere $(R) = 6$ cm

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

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

$\boxed{V = 4\pi \ cm^3}$

is the required volume of cone

and volume of sphere $= \frac{4}{3}\pi R^3$

$V = \frac{4}{3} \times \pi \times 6^3$

$\boxed{V = 288\pi \ cm^3}$

is the required volume of sphere.

Then, no. of cones made from sphere $= \frac{\text{volume of sphere}}{\text{Volume of cone}}$

$= 288\pi / 4\pi$

$\boxed{\text{no. of cones made from sphere} = 72}$

) A cylindrical can whose base is horizontal and of radius 3.5cm contains sufficient water so that when a sphere is placed in the can, the water just covers the sphere. Given that, the sphere just fits into the can. Calculate i) the total surface area of the can in contact with water when sphere is in it.

ii) the depth of water in the can before the sphere was put into the can. Give your answer as proper fractions.

→ Given that, Radius of cylindrical can = 3.5cm

Radius of the sphere = 3.5cm

Water level height in the can = $3.5 \times 2 = 7$cm

i) Height of cylinder (h) = 7 cm

Then,

$$\begin{pmatrix}\text{Total surface area of can} \\ \text{in contact with water}\end{pmatrix} = \begin{pmatrix}\text{curved surface} \\ \text{area of cylinder}\end{pmatrix} + \begin{pmatrix}\text{base area} \\ \text{of cylinder}\end{pmatrix}$$

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

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

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

$$= 11 \times 17.5$$

$$\boxed{TSA = 192.5\ cm^2}$$

This is the required surface area of can in contact with water.

ii) Let 'd' be the depth of the water before putting sphere in it.

Then, Volume of cylindrical can = $\begin{pmatrix}\text{Volume of} \\ \text{sphere}\end{pmatrix} + \begin{pmatrix}\text{Volume of} \\ \text{water}\end{pmatrix}$

$$\pi r^2 h = \frac{4}{3}\pi r^3 + \pi r^2 d$$

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

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

$$d = h - 4/3 r = 7 - \frac{4}{3} \times 3.5$$

$$d = (21 - 14)/3$$

$\boxed{d = 7/3}$ is the required depth of water