

Exercise 20(D)

A solid sphere of radius 15 cm is melted and recast into solid right circular cones of radius 2.5 cm and height 8 cm. Calculate the number of cones recast.

Solution:

Given,

Radius of the sphere = $R = 15$ cm

So, the volume of sphere melted = $\frac{4}{3} \pi R^3 = \frac{4}{3} \times \pi \times 15 \times 15 \times 15$

Radius of each cone recasted = $r = 2.5$ cm

And, height of each cone recasted = $h = 8$ cm

So, volume of each cone recasted = $\frac{1}{3} \pi r^2 h = \frac{1}{3} \times \pi \times 2.5 \times 2.5 \times 8$

Thus,

Number of cones recasted = Volume of sphere melted / Volume of each cone formed

$$\begin{aligned} & \frac{\frac{4}{3} \times \pi \times 15 \times 15 \times 15}{\frac{1}{3} \times \pi \times 2.5 \times 2.5 \times 8} \\ &= 270 \end{aligned}$$

1. A hollow sphere of internal and external diameters 4 cm and 8 cm respectively is melted into a cone of base diameter 8 cm. Find the height of the cone.

Solution:

Given,

External diameter of the hollow sphere = 8 cm

So, radius (R) = 4 cm

Internal diameter of the hollow sphere = 4 cm

So, radius (r) = 2 cm

Then, the volume of metal used in hollow sphere

$$= \frac{4}{3} \pi (R^3 - r^3) = \frac{4}{3} \times \frac{22}{7} \times (4^3 - 2^3) = \frac{88}{21} (64 - 8) = \frac{88}{21} \times 56 \text{ cm}^3 \dots (i)$$

Also given,

Diameter of cone = 8 cm

Therefore, radius = 4 cm

Let height of the cone = h

$$\text{Volume} = \frac{1}{3} \pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times 4 \times 4 \times h = \frac{352}{21} h \dots (ii)$$

So, according to the question

From (i) and (ii), we have

$$\frac{352}{21} h = \frac{88}{21} \times 56$$

$$h = (88 \times 56 \times 21) / (21 \times 352) = 14 \text{ cm}$$

Thus, the height of the cone = 14 cm

2. The radii of the internal and external surfaces of a metallic spherical shell are 3 cm and 5 cm respectively. It is melted and recast into a solid right circular cone of height 32 cm. find the

diameter of the base of the cone.

Solution:

Given,

Height of the solid right circular cone = 32 cm

Internal radius metallic spherical shell = 3 cm

External radius spherical shell = 5 cm

$$\begin{aligned}\text{Then, the volume of the spherical shell} &= \frac{4}{3} \pi (5^3 - 3^3) \\ &= \frac{4}{3} \times \frac{22}{7} \times (125 - 27) \\ &= \frac{4}{3} \times \frac{22}{7} \times 98\end{aligned}$$

$$\begin{aligned}\text{Volume of solid right circular cone} &= \frac{1}{3} \pi r^2 h \\ &= \frac{1}{3} \times \frac{22}{7} \times r^2 \times 32\end{aligned}$$

According to the question,

$$\frac{1}{3} \times \frac{22}{7} \times r^2 \times 32 = \frac{4}{3} \times \frac{22}{7} \times 98$$

$$r^2 = (4 \times 98) / 32$$

$$r = 7/2 = 3.5 \text{ cm}$$

Therefore, diameter = $2r = 7$ cm

3. Total volume of three identical cones is the same as that of a bigger cone whose height is 9 cm and diameter 40 cm. Find the radius of the base of each smaller cone, if height of each is 108 cm.

Solution:

Let the radius of the smaller cone be r cm

Given,

Diameter of bigger cone = 40 cm

So, the radius = 20 cm and height = 9 cm

Volume of larger cone = $\frac{1}{3} \pi \times (20)^2 \times 9$

And,

The volume of the smaller cone = $\frac{1}{3} \pi \times r^2 \times 108$

From the question, we have

Volume of larger cone = 3 x Volume of smaller cone

$$\frac{1}{3} \pi \times (20)^2 \times 9 = 3 \times (\frac{1}{3} \pi \times r^2 \times 108)$$

$$r^2 = (20)^2 \times 9 / (108 \times 3)$$

$$r = 20/6 = 10/3 \text{ cm}$$

4. A solid rectangular block of metal 49 cm by 44 cm by 18 cm is melted and formed into a solid sphere. Calculate the radius of the sphere.

Solution:

$$\text{Volume of rectangular block} = 49 \times 44 \times 18 \text{ cm}^3 = 38808 \text{ cm}^3 \dots\dots (i)$$

Let r be the radius of sphere.

$$\text{So, the volume} = \frac{4}{3} \pi r^3 = \frac{4}{3} \times \frac{22}{7} \times r^3 = \frac{88}{21} r^3 \dots\dots (ii)$$

Then, according to the question

$$\frac{88}{21} r^3 = 38808$$

$$r^3 = (38808 \times 21) / 88 = 441 \times 21$$

$$= 9261$$

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$$r = 21 \text{ cm}$$

Therefore, the radius of sphere = 21 cm

5. A hemi-spherical bowl of internal radius 9 cm is full of liquid. This liquid is to be filled into conical shaped small containers each of diameter 3 cm and height 4 cm. How many containers are necessary to empty the bowl?

Solution:

Given,

Radius of hemispherical bowl = 9 cm

$$\text{Volume} = \frac{2}{3} \pi r^3 = \frac{2}{3} \pi 9^3 = \frac{2}{3} \pi \times 729 = 486 \pi \text{ cm}^3$$

Diameter of each cylindrical bottle = 3 cm

So, the radius = 1.5 cm and height = 4 cm

$$\text{Volume of bottle} = \frac{1}{3} \pi r^2 h = \frac{1}{3} \pi (3/2)^2 \times 4 = 3 \pi$$

Thus,

$$\begin{aligned} \text{The number of bottles} &= \frac{486 \pi}{3 \pi} \\ &= 162 \end{aligned}$$



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