Previous Year Questions 2024

Q1: A solid iron pole consists of a solid cylinder of height 200 cm and base diameter 28 cm, which is surmounted by another cylinder of height 50 cm and radius 7 cm. Find the mass of the pole, given that 1 cm^3 of iron has approximately 8 g mass. (CBSE 2024)

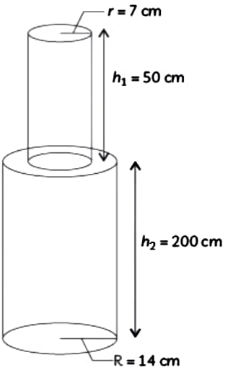
Ans:

Here, the height of small cylinder (h_1) = 50 cm

Radius of small cylinder r = 7 cm

Height of longer cylinder (h_2) = 200 cm

Radius of longer cylinder (R) = 14 cm



Volume of figure = Volume of small cylinder + volume of big cylinder

$= \pi r^2 h_1 + \pi R^2 h_2$

$= \pi[r^2 h_1 + R^2 h_2]$

$= \frac{22}{7}[7\times7\times50+14\times14\times200]$

$= \frac{22}{7}\times49\times50[1+4\times4]$

$= 22 \times 7 \times 50 \times 17$

$= 1,30,900 \text{ cm}^3$

Mass = Volume × Density

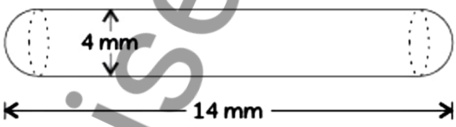
= 10,47,200 g

≈ 1047.2 kg

Q2: A medicine capsule is in the shape of a cylinder with two hemispheres stuck to each of its ends. The length of the entire capsule is 14 mm and the diameter of the capsule is 4 mm, find its surface area. Also, find its volume. (CBSE 2024)

Ans:

Here, two figures are combined, 2 hemisphere and cylinder.



Radius of cylinder = radius of hemisphere

= 4/2 = 2 mm

Height of cylinder (h) = 14 – (2 + 2)

= 14 – 4 = 10 mm.

Surface area of capsule = curved surface area of two hemispheres + curved surface area of cylinder

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

$= 2\pi r[2r + h]$

$= 2\times\frac{22}{7}\times2[4+10]$

$= \frac{88}{7}\times14$

$= 176 \text{ mm}^2$

Volume of capsule = volume of 2 hemisphere + volume of cylinder

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

[∵ Volume of 2 hemisphere = volume of a sphere]

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

$= \frac{22}{7}\times2\times2\left(\frac{4}{3}\times2+10\right)$

$= \frac{22}{7}\times4\times\left[\frac{8}{3}+10\right]$

$= \frac{22}{7}\times4\times\frac{38}{3}$

$= \frac{88\times38}{21} = \frac{3344}{21}$

$= 159.24\ mm^3$.

Previous Year Questions 2023

Q3: The curved surface area of a cone having a height of 24 cm and a radius 7 cm, is (2023)

(a) 528 cm^2

(b) 1056 cm^2

(c) 550 cm^2

(d) 500 cm^2

Ans: (c)

We have, the height of cone. h = 24 cm and radius, r = 7 cm.

We know that,

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

= √625

= 25

Now. curved surface area = πrl

= 22/7 x 7 x 25

= 550 cm^2

Q4: The curved surface area of a cylinder of height 5 cm is 94.2 cm^2. The radius of the cylinder is (Take π = 3.14) (2023)

(a) 2 cm

(b) 3 cm

(c) 2.9 cm

(d) 6 cm

Ans: (b)

Curved surface area of cylinder = 2πrh

⇒ 94.2 = 2 x 3 .14 x r x 5

$\Rightarrow r = \frac{94.2}{2\times3.14\times5}$

⇒ r = 3 cm

Q5: A wooden article was made by scooping out a hemisphere from each end of a solid cylinder, as shown in the figure. If the height of five cylinder is 10 cm and its base is of radius 3.5 cm.

Find the total surface area of the article. (CBSE 2023)

Ans:

Radius of the cylinder (r) = 3.5 cm

Height of the cylinder (h) = 10 cm

Curved surface area = 2πrh

$= \left(2\times\frac{22}{7}\times\frac{35}{10}\times10\right)cm^2$

= 220 cm^2

Curved surface area of a hemisphere = $2\pi r^2$

∴ Curved surface area of both hemispheres

$= 2\times2\pi r^2 = 4\pi r^2 = \left(4\times\frac{22}{7}\times\frac{35}{10}\times\frac{35}{10}\right)cm^2$

= 154 cm^2

Total surface area of the Article

= (220 + 154) cm^2

= 374 cm^2.

Q6: A room is in the form of a cylinder surmounted by a hemispherical dome. The base radius of the hemisphere is one-half the height of the cylindrical part. Find the total height of the room if it contains $\left(\frac{1408}{21}\right)m^3$ of air. $\left(\text{Take } \pi=\frac{22}{7}\right)$ (2023)

Ans: Let r be the radius and h be the height of the cylindrical part and R be the radius of hemispherical part

volume of air = volume of cylinder = 1408/21

$\therefore\ R=\frac{1}{2}h=r$

Now, volume of air =

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

$\therefore\ \frac{1408}{21}=\frac{2}{3}\times\frac{22}{7}\times\left(\frac{1}{2}h\right)^3+\frac{22}{7}\left(\frac{1}{2}h\right)^2\times h$

$\Rightarrow\ \frac{1408}{21}=\frac{22}{7}\times\left(\frac{1}{2}\right)^2\times h^3\left(\frac{2}{3}\times\frac{1}{2}+1\right)$

$\Rightarrow\ \frac{1408}{21}\times\frac{7\times4}{22}=\frac{4}{3}h^3$

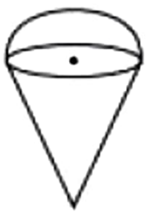
$\Rightarrow\ h^3=\frac{1408\times7\times4\times3}{21\times22\times4}=64$

⇒ h = 4

Now, radius of hemispherical part R = 1/2h = 2m

∴ Total height of the room = R + h = 2 + 4 = 6m

Q7: An empty cone is of radius 3 cm and height 12 cm. Ice-cream is filled in it so that lower part of the cone which is $(1/6)^{th}$ of the volume of the cone is unfilled but hemisphere is formed on the top.



Find volume of the ice-cream. Take (π = 3.14) (2023)

Ans: Radius of cone, r = 3 cm

Height of cone, h = 12 cm

Let x be the volume of unfilled part of cone.

Now, volume of cone, = $\frac{1}{3}\pi r^2 h = \frac{1}{3}\times 3.14\times(3)^2\times 12$

Volume of filled part of cone = Volume of cone - Volume of unfilled part of cone

$=\frac{1}{3}\times 3.14\times(3)^2\times 12-\frac{1}{6}\times\frac{1}{3}\times 3.14\times(3)^2\times 12$

$=\frac{1}{3}\times 3.14\times(3)^2\times 12\left(1-\frac{1}{6}\right)$

$=\frac{5}{6}\times\frac{1}{3}\times 3.14\times(3)^2\times 12=94.2\text{ cm}^3$

Now, volume of ice-cream = volume of filled part of cone + volume of hemisphere

$= 94.2+\frac{2}{3}\times 3.14\times(3)^3$

= 150.72 cm^3

Previous Year Questions 2022

Q8: The radios of the base and the height of a solid right circular cylinder are in the ratio 2:3 and its volume is 1617 cm^3. Find the total surface area of the cylinder. Take [π = 22/7] (2022)

Ans: Given ratio of radium and height of the right circular cylinder = 2:3

Let radius (r) of the base be 2x and height(h) be 3x.

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

$1617=\frac{22}{7}\times(2x)^2\times 3x$ $\quad$ [∵ V = 1617 c

$\Rightarrow 1617=\frac{22}{7}\times 4x^2\times 3x$

$\Rightarrow \frac{1617\times 7}{22\times 4\times 3}=x^3$

$\Rightarrow x^3=\frac{7\times 7\times 7}{2\times 2\times 2}\Rightarrow x=\frac{7}{2}\text{cm.}$

$\therefore$ Radius $r=2x=\frac{2\times 7}{2}=7\text{ cm}$

and height $h=3x=\frac{3\times 7}{2}=\frac{21}{2}\text{ cm}$

Total surface area of cylinder = 2πr (h + r)

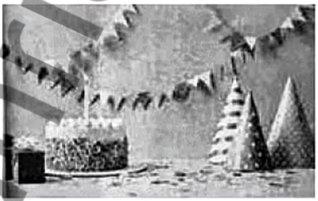
$=\frac{2\times 22\times 7}{7}\left(\frac{21}{2}+7\right)=\frac{44\times 35}{2}\text{cm}^2$

= 770 cm^2

Q9: Case Study : John planned a birthday party for his younger sister with his friends. They decided to make some birthday caps by themselves and to buy a cake from a bakery shop. For these two items they decided the following dimensions:

Cap : Conical shape with base circumference 44 cm and height 24 cm.

Cake : Cylindrical shape with diameter 24 cm and height 14 cm.



Based on the above information answer the following questions.

(a) How many square cm paper would be used to make 4 such caps?

(b) The bakery shop sells cakes by weight (0.5 kg, 1 kg, 1.5 kg. etc..}. To have the required dimensions how much cake should they order if 650 cm^3 equals 100 g of cake? (2022)

Ans: Paper required to make four caps is 2,200 sq.cm.

Weight of the cake for required dimensions is 1kg.

Step-by-step explanation:

(a) Given the base circumference of the cone, c = 44 cm

Height of a cone, h = 24 cm.

Base circumference of the cone, c = 2πr = 44 cm

Thus, the radius of the cone is

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

The curved surface area of the cone is given by

$$\text{CSA} = \pi r\left(\sqrt{h^2 + r^2}\right)$$

Substituting the values of h and r,

$$\text{CSA} = \frac{22}{7} \times 7 \times \sqrt{(24)^2 + 7^2}$$

$$= 22 \times \sqrt{576 + 49} = 22 \times \sqrt{625}$$

$$= 22 \times 25 = 550 sq.cm$$

Thus, to make one cap, 550 sq.cm of paper is required.

Then to make four caps, the required paper is

500 x 4 = 2000 sq. cm

Therefore, 2,200 sq.cm of paper is required to make four caps.

(b) Given the diameter of cylindrical shape cake, d = 24 cm

Height of cylindrical shape cake, h = 14 cm.

Radius of the cylindrical shape cake,

$$r = \frac{d}{2} = \frac{24}{2} = 12cm$$

Volume of the cylinder is given byV = πr2h

Substituting the values of h and r,

$$V = \frac{22}{7} \times (12)^2 \times 14$$

$$V = \frac{22}{7} \times (12)^2 \times 14$$

$$= 22 \times 144 \times 2 = 6,336 cu.cm$$

The required volume of the cylindrical shape cake is 6,336 cu.cm.

Given 650 cu.cm equals 100 g of cake.

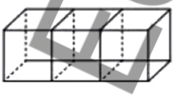
Then the required weight of the cake is

$$\frac{6336}{650} \times 100 \approx 974.76g$$

Given the bakery shop sells cakes by weight of 0.5 kg, 1 kg, 1.5 kg, etc.

Since, $974.76g \approx 1kg$, ,therefore, the cake of 1kg should be ordered for required dimensions.

Q10: Three cubes of side 6 cm each, are joined as shown in given figure. Find the total surface area of the resulting cuboid. (2022)



Ans: The dimension of the cuboids so formed are

length = 18 cm

breath = 6 cm and height = 6 cm.

Surface area of cuboids = 2 (l× b + b × h + l × h)

= 2 × (18 × 6 + 6 × 6+ 18 × 6)

= 504 cm^2

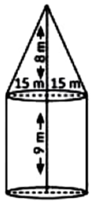
Q11: Case Study : A 'circus' is a company of performers who put on shows of acrobats, downs etc to entertain people started around 250 years back, in open fields, now generally performed in tents. One such 'Circus Tent is shown below.

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

(i) the area of the canvas used in making the tent.

(ii) the cost of the canvas bought for the tent at the rate Rs. 200 per sq. m. if 30 sq. m canvas was wasted during stitching. (CBSE Term-2 2022)

Ans: According to given information, we have the following figure.



Clearly, the radius of conical part = radius of cylindrical part = 30/2 = 15 m = r ...(say)

Let h and H be the height of conical and cylindrical part respectively.

Then h = 8 m and H = 9 m

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

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

= $\sqrt{225 + 64}$

= $\sqrt{289}$

= 17 m

(i) The area of the canvas used in making the tent

= Curved surface area of cone + Curved surface area of cylinder

= $\pi rl + 2\pi rH$

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

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

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

= 1650 m^2

(ii) Area of canvas bought for the tent

= (1650 + 30) m^2

= 1680 m^2

Now, this cost of the canvas height for the tent

= ₹ (1680 × 200)

= ₹ 3,36,000

Previous Year Questions 2021

Q12: Water is being pumped out through a circular pipe whose internal diameter is 8 cm. If the rate of flow of water is 80 cm/s. then how many litres of water is being pumped out through this pipe in one hour? (2021)

Ans: Given diameter of circular pipe = 8 cm

So, radius of circular pipe = 4cm

Length of flow of water in one sec = 80 cm

length of flow of water in one hour = 80 x 60 x 60 cm=288000 cm=h

Volume of cylinderical pipe in one hour = $\pi r^2 h$

$= \frac{22}{7} \times 4 \times 4 \times 288000\ cm^3$

$= \frac{101376000}{7} cm^3 = \frac{10137}{7}$ litre [$\because$ 1000 cm^3 = 1 litre]

= 14482.28 litre [approx.]

14482.28 litres of water being pumped out through this pipe in 1 hr.

Previous Year Questions 2020

Q13: A solid spherical ball fits exactly inside the cubical box of side 2a. The volume of the ball is (2020)

(a) $\frac{16}{3}\pi a^3$

(b) $\frac{1}{6}\pi a^3$

(c) $\frac{32}{3}\pi a^3$

(d) $\frac{4}{3}\pi a^3$

Ans: (d)

Diameter of sphere = Distance between opposite faces of cube = 2a

radius of sphere = a

So, volume of spherical ball = $\frac{4}{3}\pi r^3$

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

Q14: The radius of a sphere (in cm) whose volume is 12 πcm^3, is (2020)

(a) 3

(b) 3√3

(c) $3^{2/3}$

(d) $3^{1/3}$

Ans: (c)

Let radius of the sphere be r.

According to the question, $\frac{4}{3}\pi r^3 = 12\pi$

$\Rightarrow r^3 = \frac{3\times 12}{4} = 9 = 3^2 \Rightarrow r = (3^2)^{1/3} = (3)^{2/3}$ cm

Q15: Two cones have their heights in the ratio 1: 3 and radii in the ratio 3 : 1. What is the ratio of their volumes? (2020)

Ans: Let height of one cone be h and height of another cone be 3h. Radius, of one cone is 3r and radius of another cone is r.

∴ Ratio o f their volumes = $\frac{\frac{1}{3}\pi(3r)^2 \times h}{\frac{1}{3}\pi r^2 \times (3h)} = \frac{9r^2h}{3r^2h} = \frac{9}{3}$:

= 3 : 1

Q16: How many cubes of side 2 cm can be made from a solid cube of side 10 cm? (2020)

Ans: Let n be the number of solid cubes of 2cm made from a solid cube of side 10 cm.

∴ n x Volume of one small cube = Volume of big cube

⇒ n x $(2)^3$ = $(10)^3$

⇒ 8n = 1000

⇒ n = 1000/8

= 125

Thus, the number of solid cubes formed of side 2 cm each is 125.

Q17: A cone and a cylinder have the same radii but the height of the cone is 3 times that of the cylinder. Find the ratio of their volumes. (CBSE 2020)

Ans: Let the radius and the height of the cylinder are r and h respectively.

So, radios of t he cone is r and height of the cone is 3h.

∴ Volume of the cylinder = πr2h

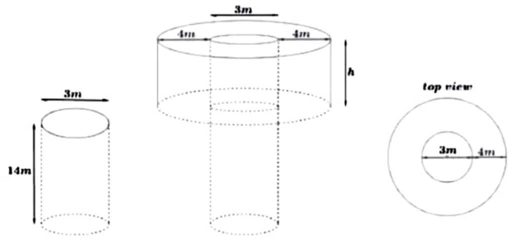
So Volume of cone = $\frac{1}{3}\pi r^2 3h = \pi r^2 h$

So, require ratio = $\frac{\pi r^2 h}{\pi r^2 h}$

= 1 : 1

Q18: A well of diameter 3 m is dug 14 m deep. The earth taken out of it has been spread evenly all around it in the shape of a circular ring of width 4 m to form a platform. Find the height of the platform. (Take π = 22/7) (2020)

Ans: Given that, the depth of the well is 14 m and the diameter is 3 m.
The width of the circular ring of the embankment is 4 m.
A figure is drawn below to visualize the shapes.



From the above figure, we can observe that the shape of the well will be cylindrical, and earth evenly spread out to form an embankment around the well in a circular ring will be cylindrical in shape (Hollow cylinder) having outer and inner radius.

Volume of the earth taken out from well = Volume of the earth used to form the embankment

Hence, Volume of the cylindrical well = Volume of the hollow cylindrical embankment

Let us find the volume of the hollow cylindrical embankment by subtracting volume of inner cylinder from volume of the outer cylinder.

Volume of the cylinder = $\pi r^2 h$ where r and h are the radius and height of the cylinder respectively.

Depth of the cylindrical well, = h_1 = 14 m

Radius of the cylindrical well, = r = 3/2 m = 1.5 m

Width of embankment = 4 m

Inner radius of the embankment, r = 3/2 m = 1.5 m

Outer radius of the embankment, R = Inner radius + Width

R = 1.5 m + 4 m

= 5.5 m

Let the height of embankment be h

Volume of the cylindrical well = Volume of the hollow cylindrical embankment

$\pi r^2 h_1 = \pi R^2 h - \pi r^2 h$

$\pi r^2 h_1 = \pi h (R^2 - r^2)$

$r^2 h_1 = h (R - r)(R + r)$

$h = [(r^2 h_1)/(R - r)(R + r)]$

$h = [((1.5\ m)^2 \times 14\ m)/(5.5\ m - 1.5\ m)(5.5\ m + 1.5\ m)]$

$= (2.25\ m^2 \times 14\ m)/(4m \times 7\ m)$

= 1.125 m

Therefore, the height of the embankment will be 1.125 m.

Q19: In Figure-4, a solid toy is in the form of a hemisphere surmounted by a right circular cone. The height of the cone is 2 cm and the diameter of the base is 4 cm. Deter mine the volume of the toy. [Take π = 3.14] (2020)

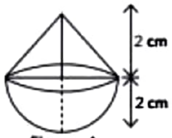


Figure - 4

Ans: Given diameter of conical part = Diameter of hemispherical part = 4cm
∴ Radios of conical part (r) = Radius of hemispherical part (r) = 4/2 = 2 cm

Height of conical part (h) = 2 cm

∴ Volume of toy = Volume of hemisphere + volume of cone

$$= \frac{2}{3}\pi r^3 + \frac{1}{3}\pi r^2 h = \pi r^2\left[\frac{2}{3}r + \frac{1}{3}h\right] = 3.14\times2\times2\left[\frac{2}{3}\times2+\frac{1}{3}\times2\right]$$

= 3 .14 x 4(1.33 + 0.66)= 3.14 x 4 x 1.99 cm^3

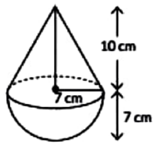
Volume of the toy = 24.99 cm^3

Q20: A solid toy is in the form of a hemisphere surmounted by a right circular cone of same radius. The height of the cone is 10 cm and the radius of the base is 7 cm. Determine the volume of the toy. Also find the area of the coloured sheet required to cover the toy. (Use π = 22/7 and √149 = 12.2) (2020)

Ans: Radius of the cone = Radius of the hemisphere = r = 7cm

Height of the cone, h = 10 cm

Now, volume of the toy = volume of hemisphere + volume of cone



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

$$= \frac{1}{3}\times\frac{22}{7}\times7\times7(2\times7+10) = \frac{22\times7\times24}{3}$$

= 1232 cm^3

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

= πrl + $2\pi r^2$

$$= \pi r\sqrt{h^2+r^2} + 2\pi r^2 = \pi r\left(\sqrt{h^2+r^2}+2r\right)$$

$$= \frac{22}{7}\times7\left(\sqrt{10^2+7^2}+14\right) = 22(\sqrt{149}+14)$$

= 22(12.2 + 14)

= 22 x 26.2

= 576.4 cm^3

Q21: From a solid right circular cylinder of height 14 cm and base radius 6 cm, a right circular cone of same height and same base radius is removed. Find the volume of the remaining solid. (CBSE 2020)

Ans: Radius of cylinder = Radius of cone = r = 6 cm.

Height of cylinder = Height of cone = h = 14 cm

Volume of remaining solid = $\pi r^2 h$ – $1/3\pi r^2 h$

= $2/3\pi r^2 h$

= 2/3 x 22/7 x 6 x 6 x 14

= 2 x 22 x 2 x 6 x 2

= 1056cm^2

Hence, the volume of the remaining solid is 1056 cm^2.