PM SHRI KENDRIYA VIDYALAYA GACHIBOWLI,GPRA CAMPUS,HYD-32

PRACTICE PAPER 13 (2024-25)

CHAPTER-11 SURFACE AREAS AND VOLUMES

(ANSWERS)

SUBJECT: MATHEMATICS **MAX. MARKS : 40**

CLASS : IX **DURATION : 1½ hrs**

General Instructions:

(i). **All** questions are compulsory.

(ii). This question paper contains 2**0** questions divided into five Sections A, B, C, D and E.

(iii). **Section A** comprises of **10 MCQs** of **1 mark** each. **Section B** comprises of 4 questions of **2 marks** each. **Section C** comprises of 3 questions of **3 marks** each. **Section D** comprises of 1 question of **5 marks** each and **Section E** comprises of 2 Case Study Based Questions of **4 marks** each.

(iv). There is no overall choice.

(v). Use of Calculators is not permitted

SECTION – A

Questions 1 to 10 carry 1 mark each.

1. If volume and surface area of a sphere is numerically equal, then its radius is

(a) 2 units (b) 3 units (c) 4 units (d) 5 units

Ans: (b) 3 units

Let radius of sphere be r units.

Surface area of sphere = Volume of sphere

$$4\pi r^2 = \frac{4}{3}\pi r^3 \Rightarrow 1 = \frac{1}{3} \times r \Rightarrow r = 3 \text{ units}$$

2. Ratio of the volume of a cone and a cylinder of same radius of base and same height is

(a) 1 : 1 (b) 1 : 2 (c) 1 : 3 (d) 1 : 4

Ans: (c) 1 : 3

Radius and height of cone and cylinder are same.

Let radius of cone = radius of cylinder = r

∴ Height of cone = Height of cylinder = h

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

3. A conical tent is to accommodate 11 persons. Each person requires 4 square metres of the space on the ground and 20 cubic metres of air to breath, then the height of the cone is

(a) 10 m (b) 12 m (c) 15 m (d) 18 m

Ans: (c) 15 m

Each person requires 4 sq. m of the space on the ground

∴ Area of base = 11 × 4 = 44 sq. m

$\Rightarrow \pi r^2 = 44$ sq.m ...(i)

Each person requires 20 cubic metres of air.

∴ Volume of conical tent = 11 × 20

= 220 cubic metres.

$$\Rightarrow \quad \frac{1}{3}\pi r^2 h = 220 \text{ cubic metres}$$

From (i) and (ii), we get

$$\frac{1}{3} \times 44 \times h = 220 \quad \Rightarrow \quad h = 15 \text{ m.}$$

4. If surface area of a sphere is 676 π cm^2, then its radius is equal to

(a) 12 cm (b) 13 cm (c) 9 cm (d) 8 cm

Ans: (b) 13 cm

Let radius of sphere be r cm

Surface area of sphere = 676p cm^2

$\therefore 4pr^2 = 676p$

$r^2 = \frac{676}{4} \Rightarrow r = 13$ cm

5. The diameter of a sphere is decreased by 25%, by what percentage its volume decreases?

(a) 25% (b) 57.81% (c) 53.50% (d) 50%

Ans: (b) 57.81%

Diameter of sphere $= 2r$ units

New diameter $= 2r - 25\%$ of $2r$

$= 2r\left(1-\frac{25}{100}\right) = 2r \times \frac{3}{4} = \frac{3r}{2}$ units

New radius $= \frac{3r}{4}$ units

New volume $= \frac{4}{3}\pi\left(\frac{3r}{4}\right)^3 = \frac{27}{64}\left(\frac{4}{3}\pi r^3\right)$

Decrease in volume

$$= \frac{4}{3}\pi r^3 - \frac{27}{64}\left(\frac{4}{3}\pi r^3\right) = \left[1-\frac{27}{64}\right]\frac{4}{3}\pi r^3 = \frac{37}{64}\left[\frac{4}{3}\pi r^3\right]$$

$$\%\text{ decrease in volume} = \frac{\frac{37}{64}\left(\frac{4}{3}\pi r^3\right)}{\frac{4}{3}\pi r^3} \times 100 = \frac{37}{64} \times 100 = 57.81\%$$

6. 100 jugs full of water are emptied in a conical flask. The height of the water level is 75 cm, the diameter of the water level, when each jug contains 3850 cm^3 of water is

(a) 70 cm (b) 35 cm (c) 140 cm (d) 210 cm

Ans: (c) 140 cm

7. The radius of a hemispherical balloon increases from 6 cm to 12 cm as air is being pumped into it. The ratios of the surface areas of the balloon in the two cases is

(a) 1 : 4 (b) 1 : 3 (c) 2 : 3 (d) 2 : 1

Ans: (a) 1 : 4

Here $r_1 = 6$ cm and $r_2 = 12$ cm

Ratios of surface area

$$= \frac{3\pi r_1^2}{3\pi r_2^2} = \left(\frac{r_1}{r_2}\right)^2 = \left(\frac{6}{12}\right)^2 = \frac{1}{4}$$

The surface areas of balloon is in the ratio 1 : 4.

8. A cone is 8.4 cm high and the radius of its base is 2.1 cm. It is melted and recast into a sphere. The diameter of sphere is

(a) 4.2 cm (b) 2.1 cm (c) 2.4 cm (d) 1.6 cm

Ans: (a) 4.2 cm

Let radius of sphere be r cm.

Volume of sphere = Volume of cone

$$\Rightarrow \quad \frac{4}{3}\pi r^3 = \frac{1}{3}\pi(2.1)^2 \times 8.4$$

$$\Rightarrow \quad r^3 = \frac{2.1 \times 2.1 \times 8.4}{4}$$

$$\Rightarrow \quad r^3 = 2.1 \times 2.1 \times 2.1$$

$\Rightarrow r = 2.1$ cm $\Rightarrow$ Diameter $= 4.2$ cm

In the following questions 9 and 10, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

9. **Assertion (A):** The total surface area of a cone whose radius is r/2 and slant height 2*l* is $\pi r\left(l+\frac{r}{4}\right)$.

Reason (R): Total surface area of cone is πr(*l* + r) where r is radius and *l* is the slant height of the cone.
Ans: (a) Both A and R are true and R is the correct explanation of A

10. **Assertion (A):** An edge of a cube measures r cm. If the largest possible right circular cone is cut out of this cube, then the volume of the cone is $\frac{1}{6}\pi r^3$.

Reason (R): Volume of the cone is given by $\frac{1}{3}\pi r^2 h$, where r is the radius of the base and h is the height of the cone.
Ans: (d) A is false but R is true.

SECTION – B

Questions 11 to 14 carry 2 marks each.

11. A solid sphere of radius 3 cm is melted and then recast into small spherical balls each of diameter 0.6 cm. Find the number of small balls thus obtained.
Ans: Radius of solid sphere = 3 cm
Volume of solid sphere = $\frac{4}{3}\pi(3)^3$
Diameter of small spherical ball = 0.6 cm
Radius of small spherical ball = $\frac{0.6}{2}$ = 0.3 cm
Volume of small spherical ball = $\frac{4}{3}\pi(0.3)^3$ cm³
Number of small spherical balls =

$$\frac{\frac{4}{3}\pi(3)^3}{\frac{4}{3}\pi(0.3)} = \frac{3\times3\times3}{0.3\times0.3\times0.3} = 1000$$

12. Curved surface area of a cone is 308 cm^2 and its slant height is 14 cm. Find its total surface area.
Ans: Let radius of cone be *r* cm
Slant height of cone = *l* = 14 cm
curved surface area of cone = 308 cm^2
$\Rightarrow \pi rl = 308 \Rightarrow \frac{22}{7} \times r \times 14 = 308$
$\Rightarrow r = \frac{308\times7}{22\times14} = 7cm$
$\therefore$ Total surface area of cone = $\pi r(r + l)$
$= \frac{22}{7} \times 7 \times (7 + 14) = \frac{22}{7} \times 7 \times 21 = 462$ cm^2

13. How many square metres of canvas is required for a conical tent whose height is 3.5 m and the radius of whose base is 12 m?

Ans: Given radius (r) of the base of the cone = 12 m and height (h) of the cone = 3.5 m

$\therefore$ Slant height (l) of the cone = $\sqrt{r^2+h^2} = \sqrt{(12)^2+(3.5)^2}$

$= \sqrt{144+12.25} = \sqrt{156.25} = 12.5m$ g

$\therefore$ Curved surface area of conical tent = πrl

$= \frac{22}{7} \times 12 \times 12.5 = 471.42$ m^2

14. The diameters of two cones are equal. If their slant heights are in the ratio 7:4, find the ratio of their curved surface area.

Ans: Let diameter of both cones be d.

Let radius = $\frac{d}{2} = r$ (say)

$\therefore$ Let slant height of first cone be $7x$ and slant height of second cone be $4x$.

Let C_1 and C_2 be curved surface area of first and second cone respectively.

$\therefore \quad \frac{C_1}{C_2} = \frac{\pi r(7x)}{\pi r(4x)} = \frac{7}{4}$

$\Rightarrow C_1 : C_2 = 7 : 4$

$\therefore$ Ratio of their curved surface area = 7 : 4

SECTION – C

Questions 15 to 17 carry 3 marks each.

15. The radius and height of a cone are in the ratio 4 : 3. The area of the base is 154 cm^2. Find the area of the curved surface. (Use $\pi = \frac{22}{7}$)

Ans: Let Radius of the cone = r cm

Height of the cone = h cm

Area of base = 154 cm^2

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

$\Rightarrow r = 7$ cm. Also,

$\frac{\text{Radius of cone}}{\text{Height of cone}} = \frac{r}{h} = \frac{4}{3}$

$\Rightarrow h = \frac{3r}{4} = \frac{3 \times 7}{4} = \frac{21}{4}$ cm

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

$= \sqrt{(7)^2+\left(\frac{21}{4}\right)^2} = \sqrt{49+\frac{441}{16}}$

$= \sqrt{\frac{784+441}{16}} = \sqrt{\frac{1225}{16}}$

$\Rightarrow l = \frac{35}{4}$ m

$\therefore$ Curved surface area of cone = $\pi rl = \frac{22}{7} \times 7 \times \frac{35}{4} = 192.5$ cm^2

16. How many metres of cloth, 2.5 m wide, will be required to make a conical tent whose base radius is 7 m and height 24 m?

Ans: Radius of the conical tent, r = 7 m
Height of the conical tent, h = 24 m

$Now, l = \sqrt{r^2 + h^2} = \sqrt{49 + 576} = \sqrt{625} = 25\,\text{m}$

Curved surface area of the cone = πrl

$= 22/7 \times 7 \times 25$

$= 550\ \text{m}^2$

Here, area of the cloth = curved surface area of the cone = $550\ \text{m}^2$

Width of the cloth = 2.5 m

$\therefore$ Length of the cloth = $\dfrac{area\ of\ the\ cloth}{width\ of\ the\ cloth} = \dfrac{550}{2.5} = 220\,\text{m}$

17. The circumference of the base of 10 m high conical tent is 44 m. Calculate the length of canvas used in making the tent, if width of canvas is 2 m.

Ans: Let r m be the radius of the base of conical tent.

Circumference of base of conical tent = 44 m

$\Rightarrow 2\pi r = 44$

$\Rightarrow 2 \times \dfrac{22}{7} \times r = 44$

$\Rightarrow r = 7$ m

Height of conical tent = $h = 10$ m

$\therefore$ Slant height of conical tent = $l = \sqrt{r^2 + h^2}$

$\Rightarrow l = \sqrt{7^2 + 10^2} = \sqrt{49 + 100} = \sqrt{149} = 12.21$ m

Let x be the length of canvas used in making the tent.

$\therefore$ Area of canvas used = $x \times 2\ \text{m}^2$

Also, $x \times 2 = \pi rl$

$\Rightarrow 2x = \dfrac{22}{7} \times 7 \times 12.21$

$\Rightarrow x = 11 \times 12.21 = 134.31$ m

$\therefore$ Required length of canvas = 134.2 m.

SECTION – D

Questions 18 carry 5 marks.

18. The volumes of two spheres are in the ratio 64 : 27. Find their radii, if the sum of their radii is 21 cm.

Ans: Let r_1 cm be the radius of 1st sphere and r_2 cm be the radius of 2nd sphere.

Also, $r_1 + r_2 = 21$ cm ...(i)

$$\frac{\text{Volume of 1st sphere}}{\text{Volume of 2nd sphere}} = \frac{\frac{4}{3}\pi r_1^3}{\frac{4}{3}\pi r_2^3}$$

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

Putting $r_1 = \dfrac{4}{3} r_2$ in (i), we get

$\dfrac{4}{3} r_2 + r_2 = 21 \Rightarrow \dfrac{7r_2}{3} = 21$

$\Rightarrow r_2 = \dfrac{21 \times 3}{7} = 9$ cm $\Rightarrow r_1 = 21 - 9 = 12$ cm

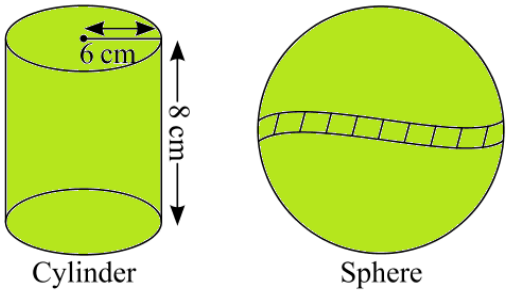
$\therefore$ Radius of 1st sphere = 12 cm

Radius of 2nd sphere = 9 cm

SECTION – E (Case Study Based Questions)

Questions 19 to 20 carry 4 marks each.

19. Mr. Kumar, a Mathematics teacher brings some green coloured clay in the classroom to teach the topic 'mensuration'. First, he forms a cylinder of radius 6 cm and height 8 cm with the clay. Then, he moulds that cylinder into a sphere similarly, he moulds the sphere in other different shapes. Answer the following questions: (use $\pi = 3.14$)



(i) What is the volume of the cylindrical shape? (2)
(ii) Find the radius of the sphere. (2)
Ans: (i) Volume of cylindrical shape = $\pi r^2 h$
$= \pi (6)^2 \times 8 = 288\pi \text{ cm}^3 = 3.14 \times 288 = 904.32 \text{ cm}^3$
(ii) *Volume of Sphere = Volume of cylindrical shape*

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

$$\Rightarrow R^3 = \frac{3}{4}(6)^2 \times 8 \Rightarrow R^3 = 216 \Rightarrow R = 6 \text{ cm}$$

20. Mathematics teacher of a school took his 10th standard students to show Taj Mahal. It was a part of their Educational trip. The teacher had interest in history as well. He narrated the facts of Taj Mahal to the students. Then the teacher said in this monument one can find combination of solid figures. There are 4 pillars which are cylindrical in shape. Also, 2 domes at the back side which are hemispherical. 1 big domes at the centre. It is the finest example of the symmetry. (Use $\pi = 22/7$)

(i) How much cloth material will be required to cover 2 small domes each of radius 4.2 metres?
(ii) Write the formula to find the volume of one pillar (including hemispherical dome)
(iii) Find the volume of the hemispherical dome at the centre if base radius is 7 m
(iv) What is the lateral surface area of all 4 pillars if height of the each pillar is 14 m and base radius is 1.4 m (without dome)?
Ans: (i) CSA of 2 hemispheres = $2 \times 2\pi r^2$

$$= 4 \times \frac{22}{7} \times \frac{42}{10} \times \frac{42}{10} = \frac{88 \times 252}{100} = 221.76 m^2$$

(ii) Volume of pillar = Volume of cylinder + Volume of hemisphere

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

(iii) Volume of hemispherical dome = $\frac{2}{3}\pi r^3$

$\frac{2}{3}\times\frac{22}{7}\times 7\times 7\times 7 = 718.66m^3$

(iv) Lateral surface area of 4 pillars = 4 x $2\pi rh$ = $4\times 2\times\frac{22}{7}\times 14\times 14 = 591.36m^2$