Class 10 Mathematics · Chapter 12: Surface Areas and Volumes

Answer key and marking scheme · 20 marks · about 40 minutes · based on NCERT

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1. A solid is a cylinder of radius r and height h with a hemisphere of radius r fixed at each end. Its total surface area is [1]

(a) $\pi r(2h + 6r)$ (b) $\pi r(2h + 4r)$
(c) $\pi r(2h + 2r)$ (d) $\pi r(h + 4r)$

Answer: (b) TSA = CSA of cylinder + CSA of two hemispheres = $2\pi rh + 2(2\pi r^2) = \pi r(2h + 4r)$. The flat ends are covered, so they are not counted.

2. A toy is made by fixing a cone on a hemisphere so that the join is smooth. The base radius of the cone must be [1]

(a) twice the radius of the hemisphere (b) equal to the height of the cone
(c) half the radius of the hemisphere (d) equal to the radius of the hemisphere

Answer: (d) For a smooth join the cone's base must exactly cover the hemisphere's flat face, so the two radii are equal.

3. Asha works out the paint needed to cover a toy and writes her answer as 550 cm^3. What does the unit tell you? [1]

(a) Her answer is correct, since paint fills the toy. (b) cm^3 is the unit of curved surface area.
(c) She has found a volume, but paint covers a surface, so the answer must be in cm^2. (d) cm^3 and cm^2 mean the same for a combined solid.

Answer: (c) cm^3 belongs to volume and cm^2 to surface area. Paint covers a surface, so the unit shows a volume formula was used by mistake.

4. The volume of a solid hemisphere of radius 21 cm is (Take $\pi = 22/7$) [1]

(a) 38808 cm^3 (b) 9702 cm^3
(c) 2772 cm^3 (d) 19404 cm^3

Answer: (d) $V = (2/3)\pi r^3 = (2/3) \times (22/7) \times 9261 = 19404\ cm^3$. 38808 cm^3 is the full sphere; 2772 cm^2 is the curved surface, not a volume.

5. The curved surface area of a hemisphere of radius 14 cm is (Take $\pi = 22/7$) [1]

(a) 616 cm^2 (b) 2464 cm^2
(c) 1232 cm^2 (d) 1848 cm^2

Answer: (c) CSA of a hemisphere = $2\pi r^2 = 2 \times (22/7) \times 196 = 1232\ cm^2$. 2464 cm^2 is the whole sphere; 1848 cm^2 adds the flat face.

6. On one face of a cube of edge 21 cm is fixed a hemisphere of diameter 14 cm. Take $\pi = 22/7$. Find the total surface area of the solid. [2]

$r = 7$ cm. Surface = $6a^2 - \pi r^2 + 2\pi r^2 = 6a^2 + \pi r^2 = 2646 + 154 = 2800\ cm^2$.

- subtracts the covered circle and adds the hemisphere's curved surface (1)
- gets 2800 cm^2 (1)

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7. A solid made of a cone of radius 3 cm and height 4 cm on a hemisphere of radius 3 cm is lowered fully into a cylindrical vessel of radius 5 cm containing water. By how much does the water level rise? [2]

Volume of solid = $12\pi + 18\pi = 30\pi$ cm^3. Rise x: $\pi(25)x = 30\pi$, so x = 1.2 cm.

- finds the solid's volume as 30π cm^3 (1)
- equates it to $\pi(5^2)x$ and gets 1.2 cm (1)

8. A solid toy is a cone of radius 7 cm and height 7 cm fixed on a hemisphere of the same radius. Take $\pi = 22/7$. Find the volume of the toy. [2]

Volume = $(1/3)\pi r^2 h + (2/3)\pi r^3 = (1/3)(22/7)(49)(7) + (2/3)(22/7)(343) = 1078/3 + 2156/3 = 1078$ cm^3.

- writes volume of toy = volume of cone + volume of hemisphere with both formulas (1)
- computes 1078 cm^3 (1)

9. A lane-marker float for a swimming pool is a hemisphere of radius 9 cm with a cone on its flat face. The float is 21 cm tall. The cone is painted red and the hemisphere white. Take $\pi = 3.14$. Which colour covers the larger area, and by how much? [3]

Cone height = 21 − 9 = 12 cm, l = $\sqrt{(81 + 144)} = 15$ cm. Red (cone) = $\pi rl = 3.14 \times 9 \times 15 = 423.9$ cm^2. White (hemisphere) = $2\pi r^2 = 2 \times 3.14 \times 81 = 508.68$ cm^2. The joined circle is inside and is painted neither colour. White covers more, by 508.68 − 423.9 = 84.78 cm^2.

- cone height 12 cm and l = 15 cm (1)
- red 423.9 cm^2 and white 508.68 cm^2, the join not counted (1)
- white, larger by 84.78 cm^2 (1)

10. From a solid cube of edge 14 cm, a cone of radius 7 cm and depth 6 cm is hollowed out of the top face. Take $\pi = 22/7$. Find the volume of wood left. [3]

Cube = $14^3 = 2744$ cm^3. Cone = $(1/3)(22/7)(49)(6) = 308$ cm^3. Left = 2744 − 308 = 2436 cm^3.

- cube volume 2744 cm^3 (1)
- cone volume 308 cm^3 (1)
- subtracts: 2436 cm^3 (1)

11. A paperweight is a cuboid 10 cm × 8 cm × 6 cm with a hemisphere of radius 3.5 cm fixed on its top face. Take $\pi = 22/7$. Find the total surface area of the paperweight. [3]

Cuboid TSA = $2(80 + 48 + 60) = 376$ cm^2. Covered circle $\pi r^2 = 38.5$ cm^2; hemisphere CSA $2\pi r^2 = 77$ cm^2. Total = 376 − 38.5 + 77 = 414.5 cm^2.

- cuboid TSA 376 cm^2 (1)
- subtracts πr^2 and adds $2\pi r^2$ (1)
- 414.5 cm^2 (1)