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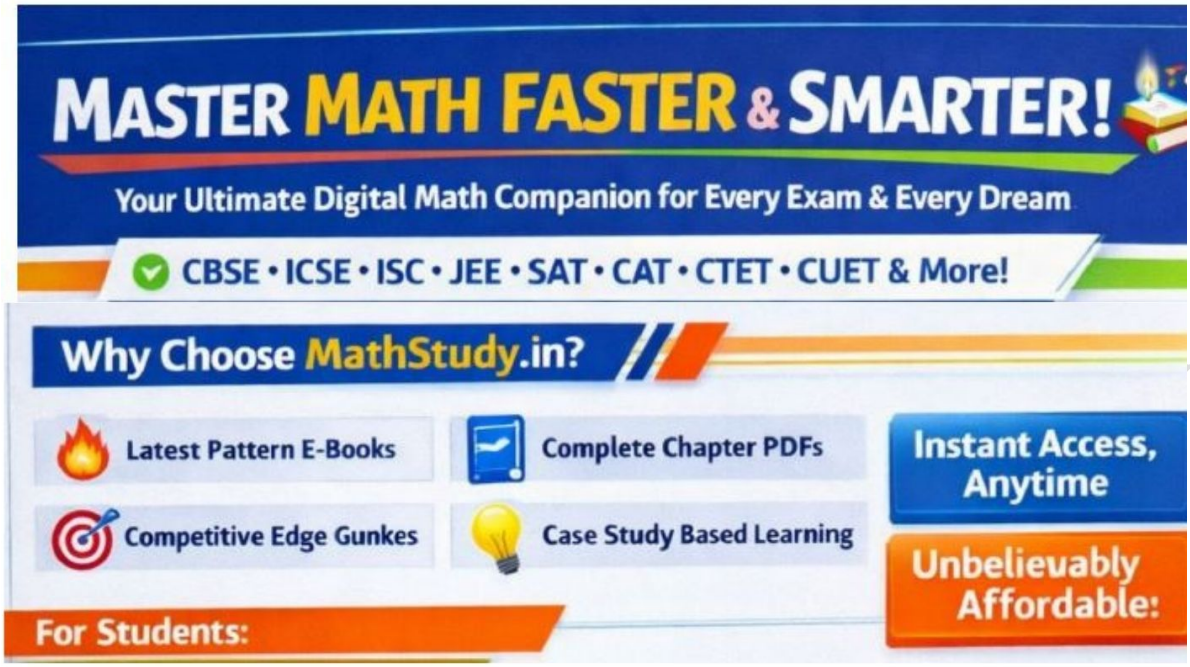

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SOLUTIONS: SURFACE AREAS AND VOLUMES

Mathematics | Class IX (2026/SURVOL/09/003)

Section A: Multiple Choice Questions (8 Marks)

1. **(a) 7 cm**
   $4\pi r^2 = 616 \implies 4 \times \frac{22}{7} \times r^2 = 616 \implies r^2 = \frac{616 \times 7}{88} = 49 \implies r = 7$ cm.

2. **(a) 15 m**
   Diagonal of cuboid $= \sqrt{l^2 + b^2 + h^2} = \sqrt{10^2 + 10^2 + 5^2} = \sqrt{225} = 15$ m.

3. **(b) 2 : 1**
   $V_{cone} = V_{hemi} \implies \frac{1}{3}\pi r^2 h = \frac{2}{3}\pi r^3 \implies h = 2r$. Since height of hemisphere is its radius r, ratio $= 2r : r = 2 : 1$.

4. **(b) 1920**
   $n = \frac{16 \times 12 \times 4}{4 \times 0.5 \times 0.2} = \frac{768}{0.4} = 1920$.

5. **(a) 220 cm^2**
   $CSA = \pi r l = \frac{22}{7} \times 7 \times 10 = 220$ cm^2.

6. **(a) 3 units**
   $\frac{4}{3}\pi r^3 = 4\pi r^2 \implies \frac{r}{3} = 1 \implies r = 3$ units.

7. **(b) 2 : 1**
   $V_{old} = \pi r^2 h$. $V_{new} = \pi(2r)^2(\frac{h}{2}) = \pi(4r^2)\frac{h}{2} = 2\pi r^2 h$. Ratio $= 2 : 1$.

8. **(a) $\frac{4}{3}\pi(R^3 - r^3)\rho$**
   Mass = Volume $\times$ Density = (Outer Vol $-$ Inner Vol) $\times \rho$.

Section B: Very Short Answer Questions (8 Marks)

1. $TSA = 3\pi r^2 = 3 \times 3.14 \times 10^2 = 3 \times 314 = \mathbf{942}$ cm$^\mathbf{2}$.

2. Volume $= 6 \times 5 \times 4.5 = 135$ m^3. Capacity $= 135 \times 1000 = \mathbf{1,35,000}$ litres.

3. $V = \frac{1}{3}\pi r^2 h \implies 1570 = \frac{1}{3} \times 3.14 \times r^2 \times 15$.
   $1570 = 15.7 \times r^2 \implies r^2 = 100 \implies \mathbf{r = 10}$ cm.

4. Sphere $SA = 4\pi r^2$. Cylinder $CSA = 2\pi r(2r) = 4\pi r^2$. Ratio $= 4\pi r^2 : 4\pi r^2 = \mathbf{1 : 1}$.

Section C: Short Answer Questions (9 Marks)

1. Inner radius $r = 2$, Outer $R = 2.2$, $h = 77$.
   Inner $CSA = 2\pi r h = 968$. Outer $CSA = 2\pi R h = 1064.8$. Area of 2 rings $= 2\pi(R^2 - r^2) = 5.28$.
   Total Area $= 968 + 1064.8 + 5.28 = \mathbf{2038.08}$ cm$^\mathbf{2}$.

2. $l = \sqrt{10^2 + 24^2} = \sqrt{676} = \mathbf{26}$ m.
   $CSA = \pi r l = \frac{22}{7} \times 24 \times 26 \approx 1961.14$ m^2.
   Cost $= 1961.14 \times 70 = \mathbf{Rs.\ 1,37,280}$.

3. $\frac{V_1}{V_2} = \frac{r_1^3}{r_2^3} = \frac{64}{27} \implies \frac{r_1}{r_2} = \frac{4}{3}$.
   Ratio of $SA = \frac{r_1^2}{r_2^2} = \frac{4^2}{3^2} = \mathbf{16 : 9}$.

Section D: Long Answer Questions (10 Marks)

1. $r = 100$ cm, $R = 101$ cm.
   $V_{iron} = \frac{2}{3}\pi(R^3 - r^3) = \frac{2}{3} \times \frac{22}{7} \times (101^3 - 100^3) = \frac{44}{21} \times 30301 \approx \mathbf{63487.8}$ cm$^\mathbf{3}$.

2. $r = 1.75$ mm. $V = \frac{4}{3} \times \frac{22}{7} \times (1.75)^3 \approx \mathbf{22.46}$ mm$^\mathbf{3}$.
   Side of box $a = 3.5$ mm. $V_{box} = 3.5^3 = 42.875$ mm^3.
   Empty Space $= 42.875 - 22.458 = \mathbf{20.417}$ mm$^\mathbf{3}$.

Section E: Case Study Solutions

1. **(a) 1,176** π ($V = \pi \times 7^2 \times 24$).

2. **(b) 25 meters** ($l = \sqrt{24^2 + 7^2} = 25$).

3. **(b) 392** π ($V = \frac{1}{3}\pi \times 7^2 \times 24$).

4. **(a) 1,568** π ($1176\pi + 392\pi$).

5. **(a) Rs. 99,000**
   $CSA = \pi rl = \frac{22}{7} \times 7 \times 25 = 550$ m^2.
   Liters required $= 550/10 = 55$ L. Cost $= 55 \times 1800 = \mathbf{Rs.\ 99,000}$.