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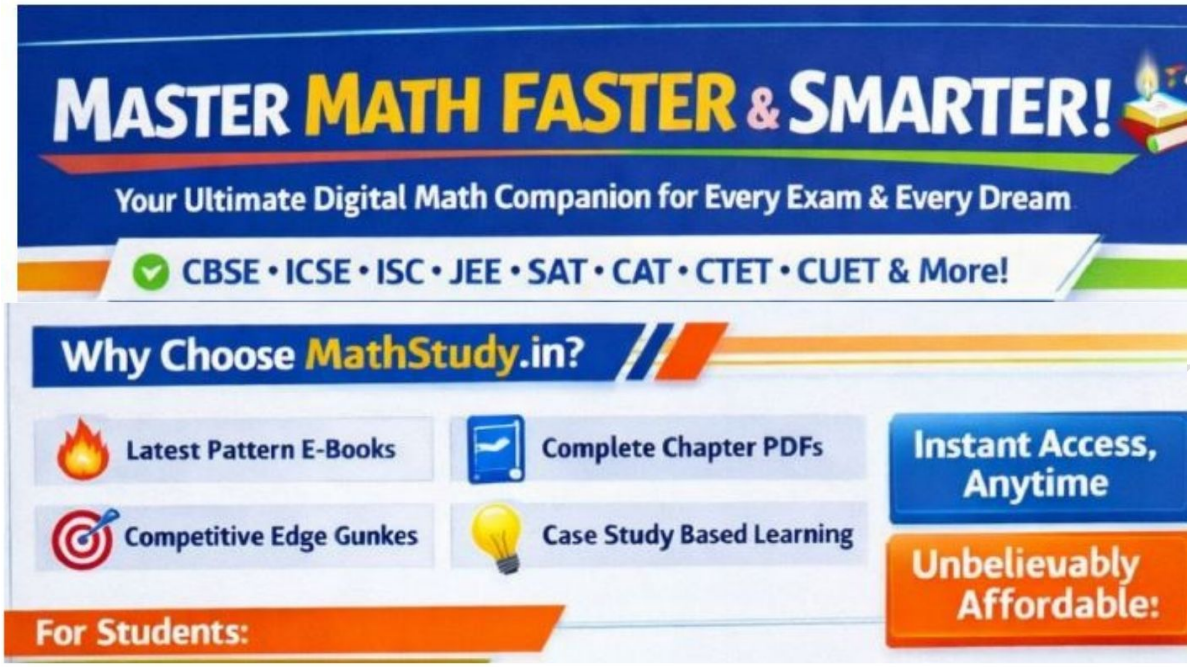

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SOLUTIONS: SURFACE AREAS AND VOLUMES

Mathematics | Class IX (2026/SURVOL/09/002)

Section A (Multiple Choice Questions)

1. **(c)** 8 : 1
   Original volume $V = \frac{4}{3}\pi r^3$. New radius $R = 2r$.
   New volume $V' = \frac{4}{3}\pi(2r)^3 = 8 \times \frac{4}{3}\pi r^3 = 8V$. Ratio = 8 : 1.

2. **(b)** 64 $\mathbf{cm^3}$
   $TSA = 6a^2 = 96 \implies a^2 = 16 \implies a = 4$ cm.
   Volume $V = a^3 = 4^3 = 64$ cm^3.

3. **(b)** 3 : 1
   $V_{cyl} = \pi r^2 h$ and $V_{cone} = \frac{1}{3}\pi r^2 h$. Ratio $= 1 : \frac{1}{3} = 3 : 1$.

4. **(b)** $2\pi r^2$
   Standard formula for the Curved Surface Area of a hemisphere.

5. **(b)** 5 **cm**
   Slant height $l = \sqrt{h^2 + r^2} = \sqrt{4^2 + 3^2} = \sqrt{16 + 9} = \sqrt{25} = 5$ cm.

6. **(b)** 1728
   $n = \frac{V_{big}}{V_{small}} = \frac{\frac{4}{3}\pi(6)^3}{\frac{4}{3}\pi(0.5)^3} = \frac{216}{0.125} = 1728$.

7. **(a)** 10 **cm**
   $CSA = 2\pi rh = 176 \implies 2 \times \frac{22}{7} \times 2.8 \times h = 176 \implies 17.6 \times h = 176 \implies h = 10$ cm.

8. **(a)** 160 $\mathbf{cm^2}$
   Resulting cuboid: $l = 8, b = 4, h = 4$.
   $SA = 2(lb + bh + hl) = 2(32 + 16 + 32) = 2(80) = 160$ cm^2.

Section B (Very Short Answer Questions)

1. $r = 0.21$ m, $h = 4$ m. $CSA = 2 \times \frac{22}{7} \times 0.21 \times 4 = 5.28$ m^2.
   Cost $= 5.28 \times 25 =$ **Rs. 132**.

2. $4\pi r^2 = 154 \implies r^2 = \frac{154 \times 7}{4 \times 22} = 12.25 \implies r = 3.5$ cm.
   Volume $= \frac{4}{3} \times \frac{22}{7} \times (3.5)^3 =$ **179.67** cm$^{\mathbf{3}}$.

3. $r = 7, l = 25 \implies h = \sqrt{25^2 - 7^2} = 24$ cm.
   Volume $= \frac{1}{3} \times \frac{22}{7} \times 7^2 \times 24 =$ **1232** cm$^{\mathbf{3}}$.

4. Let sides be $x, 2x, 3x$. $TSA = 2(2x^2 + 6x^2 + 3x^2) = 88 \implies 22x^2 = 88 \implies x = 2$.
   Dimensions: **2** cm, **4** cm, **6** cm.

Section C (Short Answer Questions)

1. $V = \frac{2}{3}\pi r^3 = \frac{2}{3} \times \frac{22}{7} \times (3.5)^3 = \mathbf{89.83}$ cm$^\mathbf{3}$.
   $TSA = 3\pi r^2 = 3 \times \frac{22}{7} \times (3.5)^2 = \mathbf{115.5}$ cm$^\mathbf{2}$.

2. $R = 3.5$ mm, $r = 0.5$ mm, $h = 140$ mm.
   $V_{wood} = \pi(R^2 - r^2)h = \frac{22}{7} \times (12.25 - 0.25) \times 140 = 22 \times 12 \times 20 = \mathbf{5280}$ mm$^\mathbf{3}$ $= \mathbf{5.28}$ cm$^\mathbf{3}$.

3. $r = 12, h = 3.5 \implies l = \sqrt{12^2 + 3.5^2} = \sqrt{144 + 12.25} = 12.5$ m.
   Canvas Area $= \pi rl = \frac{22}{7} \times 12 \times 12.5 = \mathbf{471.43}$ m$^\mathbf{2}$.

Section D (Long Answer Questions)

1. $V_{solid} = V_{cone} + V_{hemi} = \frac{1}{3}\pi r^2 h + \frac{2}{3}\pi r^3$. Since $r = h = 1$:
   $V_{solid} = \frac{1}{3}\pi + \frac{2}{3}\pi = \pi$ cm$^\mathbf{3}$.
   $V_{cyl} = \pi(1)^2(2) = 2\pi$ cm^3.
   Water left $= V_{cyl} - V_{solid} = 2\pi - \pi = \pi$ cm$^\mathbf{3}$.

2. Total water/day $= 4000 \times 150 = 600,000$ L $= 600$ m^3.
   Tank volume $= 20 \times 15 \times 6 = 1800$ m^3.
   Days $= \frac{1800}{600} = \mathbf{3}$ days.

Section E (Case Study Solutions)

1. **(a)** 630π **sq. m** $(2\pi \times 21 \times 15)$.

2. **(b)** 882π **sq. m** $(2\pi \times 21^2)$.

3. **(c)** $12,789\pi$ **m**^{3} $(V_{cyl} + V_{hemi} = \pi \cdot 21^2 \cdot 15 + \frac{2}{3}\pi \cdot 21^3 = 6615\pi + 6174\pi)$.

4. **(a)** $1,512\pi$ **sq. m** $(CSA_{cyl} + CSA_{hemi} = 630\pi + 882\pi = 1512\pi)$.

5. **(b) Rs. 5,702,400**
   Area $= 1512 \times \frac{22}{7} = 4752$ m^2. Cost $= 4752 \times 1200 = 5,702,400$.