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Topic	Volume and Surface Area	Last updated on	14 October 2024

## CONCEPT 1 – CUBOID RELATED PROBLEMS

1) The dimensions of a cuboid are 16 cm, 18 cm and 24 cm. Find volume, surface area and diagonal.

- a)  $5912 \text{ cm}^3$ ,  $2108 \text{ cm}^2$ , 34 cm
- b)  $6923 \text{ cm}^3$ ,  $2208 \text{ cm}^2$ , 54 cm
- c)  $6912 \text{ cm}^3$ ,  $2208 \text{ cm}^2$ , 34 cm
- d)  $6912 \text{ cm}^3$ ,  $3208 \text{ cm}^2$ , 44 cm

**ANS: c)  $6912 \text{ cm}^3$ ,  $2208 \text{ cm}^2$ , 34 cm**

**Explanation:**

- Volume =  $l \times b \times h$   
 $= 16 \times 18 \times 24$   
 $= 6912 \text{ cm}^3$
- Surface area =  $2(lb + bh + hl)$   
 $= 2(16 \times 18 + 18 \times 24 + 24 \times 16)$   
 $= 2208 \text{ cm}^2$
- Diagonal =  $\sqrt{l^2 + b^2 + h^2}$   
 $= \sqrt{16^2 + 18^2 + 24^2}$   
 $= \sqrt{1156} = 34 \text{ cm}$



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2) Find the length of the longest pole that can be placed in a room 30 m long, 24 m broad and 18 m high.

- a)  $50\sqrt{2}$  m
- b)  $35\sqrt{2}$  m
- c)  $40\sqrt{2}$  m
- d)  $30\sqrt{2}$  m

**ANS: d)  $30\sqrt{2}$  m**

**Explanation:**

$$\begin{aligned}\text{Diagonal} &= \sqrt{l^2 + b^2 + h^2} \\ &= \sqrt{30^2 + 24^2 + 18^2} \\ &= \sqrt{1800} \\ &= 30\sqrt{2} \text{ m.}\end{aligned}$$

3) A brick measures 20 cm × 10 cm × 7.5 cm. How many bricks will be required for a wall whose dimension is 20 m × 2 m × 0.75 m ?

- a) 22,000
- b) 30,000
- c) 25,000
- d) 20,000

**ANS: d) 20,000**

**Explanation:**

$$\begin{aligned}\text{Number of bricks} &= \text{Total Volume of wall} / \text{Volume of one brick} \\ &= (20 \times 2 \times 0.75 \times 100 \times 100 \times 100) / (20 \times 10 \times 7.5) \\ &= 20,000 \text{ bricks.}\end{aligned}$$



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4) The sum of length, breadth and height of a cuboid is 25 cm and its diagonal is 15 cm long. Find the total surface area of the cuboid.

- a) 350 cm<sup>2</sup>
- b) 250 cm<sup>2</sup>
- c) 300 cm<sup>2</sup>
- d) 400 cm<sup>2</sup>

**ANS: d) 400 cm<sup>2</sup>**

**Explanation:**

Total surface area =  $(25)^2 - (15)^2 = 625 - 225 = 400 \text{ cm}^2$ .

## CONCEPT 2 – CUBE RELATED PROBLEMS

5) The Edge of a cube is 5 cm. Find the volume, surface area and diagonal.

- a) 125 cm<sup>3</sup>, 150 cm<sup>2</sup>, 8.66 cm.
- b) 125 cm<sup>3</sup>, 140 cm<sup>2</sup>, 8.66 cm.
- c) 105 cm<sup>3</sup>, 150 cm<sup>2</sup>, 7.66 cm.
- d) 115 cm<sup>3</sup>, 145 cm<sup>2</sup>, 6.66 cm.

**ANS: a) 125 cm<sup>3</sup>, 150 cm<sup>2</sup>, 8.66 cm.**

**Explanation:**

- Volume =  $a^3 = (5)^3 = 125 \text{ cm}^3$
- Surface area =  $6a^2 = 6 \times (5)^2$   
 $= 150 \text{ cm}^2$
- Diagonal =  $a\sqrt{3} = 5\sqrt{3} = 8.66 \text{ cm}$



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6) The surface area of a cube is  $864 \text{ cm}^2$ . Find the volume.

- a)  $1729 \text{ cm}^3$
- b)  $1728 \text{ cm}^3$
- c)  $729 \text{ cm}^3$
- d)  $1331 \text{ cm}^3$

**ANS: b)  $1728 \text{ cm}^3$**

**Explanation:**

$$\text{Surface Area} = 6a^2 = 864 \quad a^2 = 144$$

$$\text{Side} = a = 12 \text{ cm}$$

$$\text{Volume} = a^3 = (12)^3 = 1728 \text{ cm}^3$$

7) Ram has a cube-shaped dice with a total diagonal length of 16 cm. What is the total length of its edges?

- a)  $18 \sqrt{3} \text{ cm}$
- b)  $16 \sqrt{3} \text{ cm}$
- c)  $16 \sqrt{2} \text{ cm}$
- d)  $15 \sqrt{3} \text{ cm}$

**ANS: b)  $16 \sqrt{3} \text{ cm}$**

**Explanation:**

Let the length of the diagonal be  $x$

$$4x = 16$$

$$x = 4 = \sqrt{3} a, \text{ where } a \text{ is the side length of the cube}$$

$$\text{Total Length of its Edges} = 12a = 16 \sqrt{3} \text{ cm}$$

## CONCEPT 3 – RIGHT CIRCULAR CYLINDER RELATED PROBLEMS

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8) Find the volume of an iron rod which is 7 cm long and whose diameter is 1 cm.

- a) 4.5 cm<sup>3</sup>
- b) 6.5 cm<sup>3</sup>
- c) 5 cm<sup>3</sup>
- d) 5.5 cm<sup>3</sup>

**ANS: d) 5.5 cm<sup>3</sup>**

**Explanation:**

Diameter = 1 cm; Radius = 1/2 cm; Height = 7 cm

Volume of Cylinder =  $\pi r^2 h$

$$= (22/7) * (1/2) * (1/2) * 7$$

$$= 5.5 \text{ cm}^3$$

9) A powder tin has a square base with side 8 cm and height 13 cm. Another is cylindrical with radius of its base 7 cm and height 15 cm. Find the difference in their capacities.

- a) 4096 m<sup>3</sup>
- b) 1331 m<sup>3</sup>
- c) 1478 m<sup>3</sup>
- d) 1728 m<sup>3</sup>

**ANS: c) 1478 m<sup>3</sup>**

**Explanation:**

Difference in capacities =  $((22/7) * 7 * 7 * 15) - (8 * 8 * 13)$

$$= 2310 - 832 = 1478 \text{ m}^3$$

10) The diameter of a cylindrical tank is 24.5 metres and depth 32 metres. How many metric tons of water will it hold ? (One cubic metre of water weighs 1000 kg.)



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- a) 25092 metric tonnes
- b) 15092 metric tonnes
- c) 17280 metric tonnes
- d) 12488 metric tonnes

**ANS: b) 15092 metric tonnes**

**Explanation:**

- Volume of the cylinder =  $\{(22/7) * (24.5 * 24.5 * 32)\} / 2 * 2 = 15092 \text{ m}^3$
- Since 1 cubic metre = 1000 kg.
- 1 cubic metre = 1 metric ton
- Volume of cylinder = 15092 metric tonnes

## CONCEPT 4 – RIGHT CIRCULAR CONE RELATED PROBLEMS



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11) Find the volume of a cone whose diameter of the base is 21 cm and the slant height is 37.5 cm.

- a) 4096 cm<sup>3</sup>
- b) 4158 cm<sup>3</sup>
- c) 4156 cm<sup>3</sup>
- d) 4258 cm<sup>3</sup>

**ANS: b) 4158 cm<sup>3</sup>**

**Explanation:**

- Height =  $\sqrt{(37.5^2 - 10.5^2)} = 36$  cm
- Volume =  $(1/3)\pi r^2 h$

$$= (1/3) * (22/7) * 10.5 * 10.5 * 36 = 4158 \text{ cm}^3$$

12) If a right circular cone of vertical height 24 cm has a volume of 1232 cm<sup>3</sup>, then the area of its curved surface in cm<sup>2</sup> is \_\_\_\_\_.

- a) 450 cm<sup>2</sup>
- b) 400 cm<sup>2</sup>
- c) 350 cm<sup>2</sup>
- d) 550 cm<sup>2</sup>

**ANS: d) 550 cm<sup>2</sup>**

**Explanation:**

- Volume =  $(1/3) * \pi r^2 h = (1/3) * (22/7) * r^2 * 24 = 1232$

$$r^2 = 49 = r = 7$$

- Slant height =  $\sqrt{(24^2 + 7^2)} = 25$  cm
- Curved surface =  $(22/7) * 7 * 25 = 550$  cm<sup>2</sup>



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13) The right cylindrical vessel is full of water. How many right circular cones having the same diameter and height as those of the right circular cylinder will be needed to store that water?

- a) 1
- b) 2
- c) 3
- d) 4

**ANS: c) 3**

**Explanation:**

Volume of 1 cylinder =  $\pi r^2 h$

Volume of 1 cone =  $(1/3) \pi r^2 h$

Number of cones =  $(\pi r^2 h) / ((1/3) \pi r^2 h) = 3$ .

14) A cylindrical piece of metal of radius 2 cm and height 6 cm is shaped into a cone of same radius. The height of the cone is \_\_\_\_\_.

- a) 18 cm
- b) 36 cm
- c) 27 cm
- d) 9 cm

**ANS: a) 18 cm**

**Explanation:**

Volume of Cone =  $(1/3)\pi r^2 h = (1/3)\pi(2)^2 h$

Volume of cylinder =  $\pi (2)^2 6$

Volume of cone = Volume of cylinder

$(1/3)\pi(2)^2 h = \pi (2)^2 6$

**h = 18 cm.**



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15) If the heights of two cones are in the ratio 1 : 4 and their diameters in the ratio 4 : 5. What is the ratio of their volumes?

- a) 4:25
- b) 9:25
- c) 16:25
- d) 1:25

**ANS: a) 4:25**

**Explanation:**

$$\text{Ratio of Volumes} = (4 : 5)^2 \times (1 : 4)$$

$$= (16/25) * (1/4)$$

$$= 4 : 25$$

[ratio of diameters = ratio of radii]

16) If the volumes of the two cones are in the ratio 4 : 1 and their heights in the ratio 4 : 9, what is the ratio of their radii ?

- a) 1:3
- b) 1:2
- c) 2:1
- d) 3:1

**ANS: d) 3:1**

**Explanation:**

$$\text{Ratio of radii} = \sqrt{(4 : 1) * (1/4 : 1/9)}$$

$$= \sqrt{(4 : 1) * (9 : 4)}$$

$$= 3:1.$$



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17) If the heights and the curved surface areas of two circular cylinders are in the ratio 1 : 3 and 4 : 5 respectively. Find the ratio of their radii.

- a) 15:12.
- b) 12:8.
- c) 6:5.
- d) 12:5.

**ANS: d) 12:5.**

**Explanation:**

$$\begin{aligned}\text{Required ratio} &= (4 : 1) * (1 : 1/3) \\ &= (4 : 1) * (3 : 1) \\ &= 12:5.\end{aligned}$$

18) If a cone's height and base radius are both increased by 100%, the cone's volume will change by what percentage?

- a) 800%
- b) 700%
- c) 500%
- d) 400%

**ANS: b) 700%**

**Explanation:**

$$\text{Volume of the cone, } v = \frac{1}{3} \pi r^2 h$$

$$\text{New Radius} = R = r + r = 2r$$

$$\text{New Height} = H = h + h = 2h$$

$$\text{New Volume, } V = \frac{1}{3} \pi R^2 H = \frac{1}{3} \pi (2r)^2 (2h) = (8v - v) = 7v$$

Therefore, the volume of the cone is increased by 700%



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## CONCEPT 5 – SPHERE, HEMISPHERE RELATED PROBLEMS

19) If the curved surface area of a sphere is the same as the curved surface area of a hemisphere, then find the radius of the hemisphere.

- a) Same as that of the sphere
- b)  $\sqrt{2}$  times that of the sphere
- c)  $\sqrt{3}$  times that of the sphere
- d) 2 times that of the sphere

**ANS: b) $\sqrt{2}$  times that of the sphere**

**Explanation:**

Curved surface area of a sphere = Curved surface area of a hemisphere

$$4 \pi R^2 = 2 \pi r^2$$

$$2 R^2 = r^2$$

Radius of hemisphere i.e. 'r' =  $\sqrt{(2R^2)} = (\sqrt{2}) R$ .



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20) If the radius of a sphere is increased by 2 cm, its surface area increases by 352 cm<sup>2</sup>. The radius of the sphere before change is \_\_\_\_\_.

- a) 3 cm
- b) 4 cm
- c) 5 cm
- d) 6 cm

**ANS: d) 6 cm**

**Explanation:**

According to question, Let the radius of sphere = r cm

$$4\pi (r + 2)^2 - 4\pi r^2 = 352$$

$$4\pi \{(r + 2)^2 - r^2\} = 352$$

$$4\pi \{r^2 + 4 + 4r - r^2\} = 352$$

$$\pi (1 + r) = 352/16 = 22$$

$$(22/7) (1 + r) = 22$$

$$1 + r = 7$$

$$r = 6 \text{ cm.}$$