CBSE Test Paper 02

Chapter 13 Surface Area and Volume

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1. The surface area of a cube whose volume is $64 cu.cm$ is **(1)**

   a. 96 sq. cm
   b. 72 sq. cm
   c. 64 sq. cm
   d. 108 sq. cm

2. Three cubes of metal whose edges are 3cm, 4cm and 5cm are melted and a single cube is formed. The edge of the single cube so formed is **(1)**

   a. 4cm
   b. 8cm
   c. 5cm
   d. 6cm

3. The inner dimensions of a closed box are 12cm, 10cm and 8cm. If the thickness of the wood is 1cm, then the capacity of the box is **(1)**

   a. 1200 cu.cm
   b. 1920 cu.cm
   c. 480 cu.cm
   d. 960 cu.cm

4. A cone of radius 20 cm is divided into two parts by drawing a plane through the mid-point of its axis parallel to the base. The ratio of the volumes of the two parts is **(1)**

   a. 1 : 4
   b. 1 : 2
   c. 1 : 7
   d. 1 : 3

5. The surface areas of two spheres are in the ratio 16: 9. The ratio of their volumes is **(1)**

a. 64 : 27
b. 16 : 9
c. 27 : 64
d. 16 : 27

6. If the volumes of two spheres are in the ratio 64 : 27,then find the ratio of their surface areas. **(1)**

7. The surface area of a sphere is 616 cm^2. Find its radius. **(1)**

8. The radii of the circular ends of a bucket of height 40 cm are 24 cm and 15 cm. Find the slant height of the bucket. **(1)**

9. Find the area of the triangle whose base measures 24 cm and the corresponding height measures 14.5 cm. **(1)**

10. A cone of height 24 cm and radius of base 6 cm is made up of modeling clay. Find the volume of the cone. **(1)**

11. A cylindrical bucket, 32 cm high and with a radius of base 18 cm, is filled with sand. This bucket is emptied on the ground and a conical heap of sand is formed. If the height of the conical heap is 24 cm, find the radius and slant height of the heap. **(2)**

12. A circus tent is in the shape of a cylinder surmounted by a conical top of same diameter If there common diameter is 56 m, the height of cylindrical part is 6 m and the total height of the tent above the ground is 27 m, find the area of canvas used in the tent. **(2)**

13. Find the length of the diagonal of a square whose area is 128 cm^2. Also, find its perimeter. **(2)**

14. A right triangle whose sides are 15 cm and 20 cm is made to revolve about its hypotenuse. Find the volume and the surface area of the double cone so formed. (Use π = 3.14) **(3)**

15. A solid metallic sphere of diameter 8 cm is melted and drawn into a cylindrical wire of uniform width. If the length of the wire is 12 m, find its width. **(3)**

16. A reservoir in the form of the frustum of a right circular cone contains44×10^7 litres of water which fills it completely. The radii of the bottom and top of the reservoir are 50 metres and 100 metres respectively. Find the depth of water and the lateral surface area of the reservoir. (Take: π = 22/7) **(3)**

17. The rain water from a roof of 44 m $\times$ 20 m drains into a cylindrical tank having diameter of base 4 m and height 3.5 m. If the tank is just full, find the rainfall in cm. **(3)**

18. A toy is in the form of a cone mounted on a hemisphere. The diameter of the base of the cone is 7 cm and its height is 15.5 cm. Find the volume of the toy. (Use π = 3.14). **(4)**

19. A metallic right circular cone 20 cm high and whose vertical angel is 60° is cut into two parts at the middle of its height by a plane parallel to its base if the frustum so obtained be drawn into a wire of uniform diameter $\frac{1}{16}$ cm, find the length of the wire. **(4)**

20. Water in a canal, 30 dm wide and 12 dm deep is flowing with velocity of 10km/hr. How much area will it irrigate in 30 minutes, if 8 cm of standing water is required for irrigation? **(4)**

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Solution

1. a. $96 sq. cm$

   Explanation: Given: Volume of cube = 64 cu. cm

   $\Rightarrow a^3 = 64 \Rightarrow a^3 = (4)^3 \Rightarrow a = 4$ cm

   $\therefore$ Surface Area of cube = $6a^2$ = $6(4)^2$ = 96 sq. cm

2. d. 6cm

   Explanation: Let a_1, a_2, a_3 be the edges of 3 smaller cubes

   and A be the edge of the bigger cube

   According to the question,

   Sum of volumes of three cubes = Volume of one bigger cube

   $\Rightarrow a_1{}^3 + a_2{}^3 + a_3{}^3 = A^3$

   $3^3 + 4^3 + 5^3 = A^3$

   $27 + 64 + 125 = A^3$

   $A^3 = 216$

   $A = 6$ cm

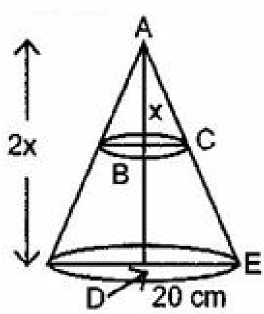
3. d. 960 cu.cm

   Explanation: Given: $l = 12$ cm, $b = 10$ cm and $h = 8$ cm

   $\therefore$ Capacity of a closed box = $lbh = 12 \times 10 \times 8$ = 960 cu. cm

   Capacity of box of thickness 1 cm = $\frac{960}{1}$ = 960 cu. cm

4. c. 1 : 7

   Explanation: 

   Radius of the cone = 20 cm

   Let the height of the cone be = $2x$ cm

$\Rightarrow$ The height of the smaller cone = x cm

$\because \Delta\mathrm{ABC} \sim \Delta\mathrm{ADE}$

$\therefore \frac{\mathrm{AB}}{\mathrm{AD}} = \frac{\mathrm{BC}}{\mathrm{DE}}$

$\Rightarrow \frac{x}{2x} = \frac{\mathrm{BC}}{20}$

$\Rightarrow \mathrm{BC} = 10$ cm = Radius of smaller cone

$\therefore$ Required ratio = $\frac{\frac{1}{3}\pi\mathrm{R}^2 h}{\frac{1}{3}\pi h_1\left(r_1^2+r_2^2+r_1r_2\right)}$

= $\frac{100\times x}{700x} = \frac{1}{7}$

= 1 : 7

5. a. 64 : 27

Explanation: Let r_1 and r_2 be the radius of the two spheres respectively.

Therefore, the ratio of their surface Areas,

$\frac{4\pi r_1^2}{4\pi r_2^2} = \frac{16}{9} \Rightarrow \frac{r_1^2}{r_2^2} = \frac{(4)^2}{(3)^2}\ \frac{r_1}{r_2} = \frac{4}{3}$

Now, ratio of their volumes,

$\frac{\frac{4}{3}\pi r_1^3}{\frac{4}{3}\pi r_2^3} = \frac{r_1^3}{r_2^3}$ = $\left(\frac{r_1}{r_2}\right)^3 = \left(\frac{4}{3}\right)^3$ = $\frac{64}{27}$ = 64 : 27

6. Let the radius of 1^{st} sphere be 'r_1'

Let the radius of 2^{nd} sphere be 'r_2'

According to question,

Ratio of the volume of the given spheres is,

$\frac{\text{Volume of } 1^{\text{st}} \text{ sphere}}{\text{Volume of } \Pi^{\text{nd}} \text{ sphere}} = \frac{\frac{4}{3}\pi r_1^3}{\frac{4}{3}\pi r_2^3} = \frac{64}{27}$

$\therefore \quad \frac{r_1^3}{r_2^3} = \frac{64}{27}$

$\frac{r_1}{r_2} = \frac{4}{3}$

The ratio of the radius of the given spheres, $r_1 : r_2$ = 4:3

Now, Ratio of the surface areas of the spheres $= \frac{\text{Surface area of } 1^{\text{st}} \text{ sphere}}{\text{Surface area of } \Pi^{\text{nd}} \text{ sphere}}$

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

$= \left(\frac{4}{3}\right)^2 = \frac{16}{9}$

= 16 : 9

7. Surface area of a sphere = 616 cm^2.

$\Rightarrow \quad 4\pi r^2 = 616$

$r^2 = \frac{616}{4\pi} = \frac{616\times7}{4\times22}$

$\Rightarrow \quad r^2 = 7 \times 7$

$\Rightarrow \quad r = \sqrt{7 \times 7}$ = 7 cm

8. Given, r_1 = 24 cm, r_2 = 15 cm, h = 40 cm

We know that, slant height of bucket is given by:-

$l = \sqrt{h^2 + (r_1 - r_2)^2}$

$= \sqrt{40^2 + 9^2}$

$= \sqrt{1681}$

= 41 cm.

9. Area of given triangle = $\frac{1}{2} \times$ Base $\times$ height

$= \left(\frac{1}{2} \times 24 \times 14.5\right) \mathrm{cm}^2 = 174\mathrm{cm}^2$

10. h = 24cm, r = 6cm

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

$= \frac{1}{3}\pi(6)^2(24)$

$= \frac{1}{3} \times 36 \times 24\pi = 288\pi cm^3$

11. For cylindrical bucket

Radius of base (r) = 18 cm

Height (h) = 32cm

$\therefore$ Volume = $\pi r^2 h = \pi(18)^2(32)$

$= 10368\pi \mathrm{cm}^3$

For conical heap Height (H) = 24 cm

Let the radius be R on

Then, volume = $\frac{1}{3}\pi R^2 H = \frac{1}{3}\pi R^2(24)$

$= 8\pi \mathrm{R}^2 \mathrm{cm}^3$

According to the question,

$8\pi R^2 = 10368\pi$

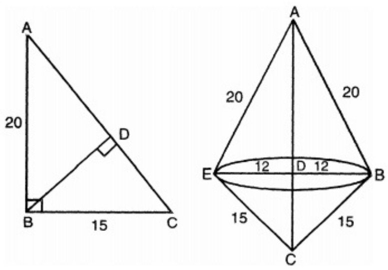
$\Rightarrow 8R^2 = 10368 \Rightarrow R^2 = \frac{10368}{8}$

$\Rightarrow R^2 = 1296 R = \sqrt{1296} \Rightarrow R = 36$

Hence, the radius of the heap is 36 cm
Again, slant height (L) = $\sqrt{R^2+H^2}$
= $\sqrt{(36)^2+(24)^2}=\sqrt{1296+576}$
$=\sqrt{1872}=\sqrt{12\times 12\times 13}=12\sqrt{13}$
Hence, the slant height of the heap is $12\sqrt{13}$ cm

12. Total height of tent = 27 m
Height of cylindrical part = 6 m
$\therefore$ Height of conical part = 27 - 6 = 21 m
radius of cone $=\frac{56}{2}=28\mathrm{m}$
Slant height of cone $=\sqrt{r^2+h^2}$
$=\sqrt{28^2+21^2}$
$=\sqrt{784+441}=\sqrt{1225}$
= 35 m
Area of canvas used $=2\pi rh+\pi rl$
$=\pi r(2h+l)$
$=\frac{22}{7}\times 28(2\times 6+35)$
$=22\times 4\times 47$
$=4136\mathrm{m}^2$

13. Area of the square = $\frac{1}{2}\times(\text{ diagonal })^2$ sq.unit
Let diagonal of square be x
$\frac{1}{2}x\left(x^2\right)=128\Rightarrow x^2=256\Rightarrow x=16$ cm
Length of diagonal = 16 cm
Side of square = $\sqrt{128}\mathrm{cm}=11.31$ cm
Perimeter of square = [4 side] sq. units
= [4 11.31] cm = 45.24 cm

14. 

According to the question,we have the following information.
$AC^2=20^2+15^2=625$ ...(i)

or, AC = 25 cm

$\text{ar}(\triangle ABC) = \text{ar}(\triangle ABC)$ ....(ii)

$\frac{1}{2} \times BC \times AB = \frac{1}{2} \times AC \times BD$

or, $15 \times 20 = 25 \times BD$

or, BD = 12 cm

Volume of double cone = Volume of upper cone + Volume of lower cone

$= \frac{1}{3}\pi(BD)^2 \times AD + \frac{1}{3}\pi(BD)^2 \times CD$

$= \frac{1}{3}\pi(BD)^2\{AD + CD\} = \frac{1}{3}\pi(BD)^2(AC)$

$= \frac{1}{3} \times 3.14 \times 144 \times 25 = 3768\text{cm}^2$

Surface area = curved surface area of upper cone + curved surface area of lower cone

$= \pi(12)(20) + \pi(12)(15)$

$= 12\pi\{20 + 15\}$

$= 12 \times \frac{22}{7} \times 35$

$= 1320 \text{ cm}^2$

15. The diameter of the sphere = 8 cm

Radius of the sphere = 4 cm

Length of the wire = 12 m = 1200 cm

Volume of the sphere = Volume of the cylindrical wire

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

$\Rightarrow \frac{4}{3}(4)^3 = R^2(1200)$

$\Rightarrow R^2 = \frac{4\times4\times4\times4}{3\times1200}$

$\Rightarrow R^2 = \frac{4\times4\times4\times4}{3\times3\times400}$

$\Rightarrow R = \frac{16}{3\times20}$

$\Rightarrow R = \frac{4}{15}\text{cm}$

The width of the wire = the diameter of the base of the wire

$= 2\left(\frac{4}{15}\right) = \frac{8}{15}\text{cm}$

16. Volume of water in frustum = 44 $\times$ 10^7 litres

= 44 $\times$ 10^4 litres

= 440000 m^3

Radius of bottom of frustum = 50 m(r)

Radius of top of frustum = 100 m (R).

Let the depth of water = h (m) = height of frustum

Let slant height = 1 cm

$\therefore$ Volume of frustum = $\frac{1}{3}\pi h(R^2 + r^2 + Rr)$

$\Rightarrow 440000 = \frac{1}{3} \times \frac{22}{7} \times h(100^2 + 100 \times 50 + 50^2)$

$\Rightarrow 440000 = \frac{1}{3} \times \frac{22}{7} \times h \times 17500$

$\Rightarrow h = \frac{440000 \times 3 \times 7}{22 \times 17500} = 24$ m

Slant height of frustum l = $\sqrt{h^2 + (R-r)^2}$

$= \sqrt{24^2 + (100-50)^2}$

$= \sqrt{576 + 2500}$

$= \sqrt{3076} = 55.46$ m

Lateral surface area of frustum = $\pi l(R + r)$

$= \frac{22}{7} \times 55.46(100 + 50)$

$= \frac{22}{7} \times 55.46 \times 150$

$= 26145.4\ m^2$

17. Length of the roof (l) = 44 m,

Breadth of the roof (b) = 20 m

Let the height of the water on the roof be h m.

Volume of water falling on the roof = $l \times b \times h$

$= 44 \times 20 \times h$

= 880h

Radius of the cylindrical vessel $(R) = \frac{4}{2} = 2m$

Height of the water in the cylindrical vessel (H) = 3.5 m

Volume of the water in the cylindrical vessel = $\pi R^2 H$

$= \frac{22}{7} \times 2 \times 2 \times 3.5$

$= \frac{308}{7}$

= 44

Volume of water falling on the roof = Volume of the water in the cylindrical vessel

$\Rightarrow$ 880 h = 44

$\Rightarrow h = \frac{44}{880}$

$\Rightarrow h = \frac{44}{880} \times 100$

$\Rightarrow$ h = 5 cm

$\Rightarrow$ Height of the water on the roof is 5 cm.

18. According to question it is given that Diameter of the base of the cone is = 7cm

Therefore radius = $\frac{7}{2}$ = 3.5cm

Total height of the toy = 14.5 cm

Height of the cone = 15.5 - 3.5 = 12 cm

Height of the hemisphere = 3.5 cm

According to question it is also given that

Volume of the toy = Volume of cone + Volume of hemisphere

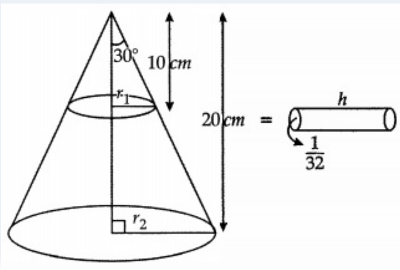
= $\frac{1}{3}\pi r^2 h + \frac{2}{3}\pi r^2$

=$\frac{1}{3}\pi r^2(2r + h)$

=$\frac{1}{3} \times \frac{22}{7} \times (3.5)^2[2 \times 3.5 + 12]$

=$\frac{1}{3} \times 22 \times 1.75 \times 19$

= 243.83 cm^3

19. 

According to the question,A metallic right circular cone 20 cm high and whose vertical angel is 60° is cut into two parts at the middle of its height by a plane parallel to its base if the frustum so obtained be drawn into a wire of uniform diameter $\frac{1}{16}$ cm.

Total height of cone = 20 cm and Vertex angle = 30°

Let the radius of cone be r_2 .

$\therefore \frac{r_2}{20} = \tan 30^\circ \Rightarrow \frac{1}{\sqrt{3}}$

$r_2 = \frac{20}{\sqrt{3}} \text{cm}$

The height of the cone cut off = 10 cm Let its radius be r_1

$\Rightarrow \frac{r_1}{10} = \tan 30^\circ \Rightarrow r_1 = \frac{10}{\sqrt{30}} \text{cm}$

Let the length of wire be l

Its radius $= \frac{1}{32} \text{cm}$

$\therefore$ Volume of frustum = Volume of wire

$\Rightarrow \frac{1}{3}\pi \times h\left[(r_1)^2 + (r_2)^2 + (r_1 r_2)\right] = \pi r^2 l$

$\Rightarrow \frac{1}{3} \times 10 \times \pi\left[\left(\frac{10}{3}\right)^2 + \left(\frac{20}{3}\right)^2 + \frac{10}{3} \times \frac{20}{3}\right]$

$= \pi\left(\frac{1}{32}\right)^2 \times l$

$\Rightarrow \frac{1}{3} \times 10\left[\frac{100}{9} + \frac{400}{9} + \frac{200}{9}\right] = \frac{1}{32\times32} \times l$

$\Rightarrow \frac{1}{3} \times 10 \times \frac{700}{9} = \frac{1}{32} \times \frac{1}{32} \times l$

$\Rightarrow l = \frac{32\times32\times700\times10}{3\times9}$

= 796444.4 cm.

Hence, the length of wire = 7964.44 m

20. Width of the canal = 30 dm = 300 cm = 3 m

Depth of the canal 12 dm = 120 cm = 1.2 m

It is given that the water is flowing with velocity 10 km/hr

Therefore Length of the water column formed in 1/2 hour = 5 km = 5000 m

Therefore, volume of the water flowing in 1 hour

= Volume of the cuboid of length 5000 m, width 3 m and depth 1.2 m

$10 \times \frac{30}{60}$ km = 5km = 5000m

$\Rightarrow$ Volume of the flowing water in half hour= $5000 \times 1.2 \times 3$ m^3

Suppose x m^2 area is irrigated in 1/2 hour

x × 8 /100 = 18000

x = 1800000/8

x = 225000