CHAPTER-13
SURFACE AREAS AND VOLUMES
MIND MAPPING

(i)   Total surface Area (T.S.A) = Curved Surface Area (C.S.A) + Base Area

(ii)   For plane Figure   For Curved figure

        Lateral surface Area (L.S.A)   curved surface area (C.S.A)

(iii)   Volume of cylinder   =   3x volume of cone

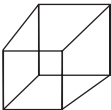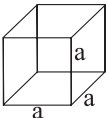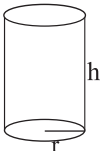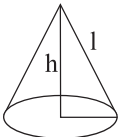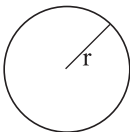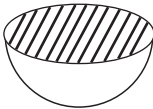   Volume of hemisphere   =   2x volume of cone
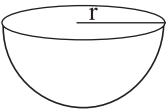
volume of cone : volume of hemisphere : volume of cylinder = 1 : 2: 3

$$= \quad v_1 : v_2 : v_3 = 1 : 2 : 3$$

SURFACE AREAS AND VOLUMES

KEY POINTS

S. No.	Name	Figure	Lateral/ Curved Surface Area	Total surface Area	Volume	Symbols used for
1.	Cuboid		$2(l+b) \times h$	$2(lb+bh+hl)$	lbh	l =Length b=breadth h=height
2.	Cube		$4a^2$	$6a^2$	a^3	a=side
3.	Right Circular Cylinder		$2\pi rh$	$2\pi r(h+r)$	$\pi r^2 h$	h=height r=radius of base
4.	Right Circular Cone		πrl	$\pi r(l+r)$	$\dfrac{1}{3}\pi r^2 h$	h=height r=radius of base
5.	Sphere		$4\pi r^2$	$4\pi r^2$	$\dfrac{4}{3}\pi r^3$	r = radius
6.	Hemisphere Solid		$2\pi r^2$	$3\pi r^2$	$\dfrac{2}{3}\pi r^3$	r = radius
7.	Hemisphere hollow		$2\pi r^2$	$2\pi r^2$	$\dfrac{2}{3}\pi r^3$	r = radius

CHAPTER-13
SURFACE AREAS AND VOLUMES
PART - A

1. If the volume of a sphere is numerically equal to its surface area. Then radius of sphere is.

    (a)   1 unit   (b)   3 unit

    (c)   2 unit   (d)   6 unit

2. Th surface area of a solid hemisphere having radius r.

    (a) $2\pi r^2$ (b) $3\pi r^2$

    (c) $4\pi r^2$ (d) $\frac{2}{3}\pi r^3$

3. In a cylinders, If radius is halved and height is doubled the volume will be.

    (a)   Same   (b)   double

    (c)   halved   (d)   four times

4. Th height of a cone of diameter 10cm and slant height 13cm, is

    (a)   12cm   (b)   13cm

    (c) $\sqrt{69}$ cm   (d) $\sqrt{194}$ cm

5. The radius of a hemispherical balloon increases from 6 cm to 12cm as air is being pumped into it. The ratios of the surface areas of the balloon in the two cases is.

    (a)   1 : 4   (b)   1 : 3

    (c)   2 : 3   (d)   2 : 1

6. How many bricks will be required to construct a wall 13.5m long; 6m high and 22.5cm thick if each brick measures (27cm x 12.5cm x 9cm) ?

    (a)   6000   (b)   7500

    (c)   5000   (d)   3750

7. The radius of a sphere is 2r, then its volume will be.

    (a) $\frac{32}{3}\pi r^3$ (b) $4\pi r^3$

    (c) $\frac{4}{3}\pi r^3$ (d) $\frac{8\pi r^3}{3}$

8. The radius of a sphere is 21cm. What is the surface area of the sphere?

(a) $12932 \, cm^2$ (b) $4312 \, cm^2$

(c) $9702 \, cm^2$ (d) $5544 \, cm^2$

9. The length of the longest pole that can be put in a room of dimensions (10m x 10m x 5m) is

(a) 15m   (b) 16m

(c) 12m   (d) 10m

10. A copper sphere of diameter 6cm is melted and drawn into 36cm long wire of uniform circular cross-section. Then, its radius is

(a) 2cm   (b) 1.5cm

(c) 1.2cm   (d) 1cm

11. The number of planks of dimension (4m x 50cm x 20cm) that can be stored in a pit which is 16m long, 12m wide and 4m deep is.

(a) 1900   (b) 1920

(c) 1800   (d) 1840

12. If the radius of a sphere is increased by 10% then its volume will be increased by

(a) 11.1 %   (b) 22.1%

(c) 33.1%   (d) 44.1%

13. In a cylinder, radius is double and height is halved, surface area will be.

(a) halved   (b) doubled

(c) Same   (d) four times

14. Two cubes have their volumes in the ratio 1 :27. The ratio of their surface area is.

(a) 1 :3   (b) 1 :8

(c) 1 : 9   (d) 1 : 18

15. A cone is 8.4cm high and the radius of its base is 2.1cm. It is melted and recast into a sphere. The radius of the sphere is :

(a)   4.2 cm   (b)   2.1 cm

(c)   2.4 cm   (d)   1.6 cm

16. If the length of diagonal of a cube is $8\sqrt{3}$ cm, then its surface area is.

(a)   768 cm^2 (b)   512 cm^2

(c)   384 cm^2 (d)   192 cm^2

17. The total surface area of a cube is 96cm^2. The volume of the cube is :

(a)   8cm^3 (b)   512 cm^3

(c)   64 cm^3 (d)   27 cm^3

18. If each side of a cube is doubled, then its volume,

(a)   Becomes Doubled   (b)   Becomes 4 times

(c)   becomes 6 times   (d)   become 8 times

19. If a sphere is inscribed in a cube, then the ratio of the volume of the cube to the volume of the sphere will be :

(a) $6 : \pi$ (b) $3 : \pi$

(c) $2 : \pi$ (d) $3 : 2\pi$

20. If each edge of a cube is increased by 50%, then the percentage increase in its surface area is.

(a)   50 %   (b)   75 %

(c)   100 %   (d)   125 %

21. The lateral surface area of a cube is 256 cm^2. Find its volume.

22. A matchbox measures 4cm x 2.5 cm x 1.5 cm. What will be the volume of a packet containing 12 such boxes ?

23. The ratio of height of two cylinders is 5 :3, as well as the ratio of their radii is 2 : 3. Find the ratio of the volumes of the cylinders.

24. Find the area of canvas required for a conical tent of height 24m and base radius 7m.

25. Find the ratio of total surface area of a sphere and a hemisphere of same radius.

26. The surface area of the cuboid is 1372 sq. cm. If its dimensions are in the ratio of 4:2:1. Then find its length.

27. If the radius and slant height of a cone are a r/2 and 2l. Then find its total surface area.

28. A cone and a hemisphere have equal base and equal volumes. Find the ratio of their heights.

29. The radius of a spherical balloon increase from 6cm to 12 cm as air is being pumped into it. Find the ratio of the surface areas of the balloon in two cases.

30. The largest possible right circular cone is cut out of a cube of edge r cm. What is the volume of cone ?

PART – B

31. A rectangular sheet of dimension 33 cm x 18 cm is rolled along its breadth to form a cylinder. Find the radius of the cylinder.

32. A roller 1.5 m long has a diameter of 70 cm. How many revolutions will it make to level a play ground measuring 50 m x 33 m ?

33. The dimensions of a cuboid are in the ratio of 1 : 2 : 3 and its total surface area is $88m^2$. Find its dimensions.

34. A solid cylinder has a total surface area of 231 cm^2. The curved surface area is 2/3 of the total surface area. Find the volume of cylinder.

35. The total surface area of a cube is 150sq. cm. Find the perimeter of any one of its faces.

36. Three metal cubes whose edge measures 3cm, 4cm and 5cm respectively are melted to form a single cube. Find the edge of the cube.

37. The length, breadth and height of room are 5m, 4m and 3m respectively. Find the cost of white washing the walls of the room and the ceiling at the rate of ₹ 7.50 per m².

38. Three spheres of radii 3cm, 4cm and 5cm are melted together to form a single sphere. Find the radius of new sphere.

39. The curved surface area of a cylinder is 176 cm² and its base area is 38.5 cm². Find the volume of the cylinder.

40. A cylinder and a cone have the same height and the same radius. The volume of the cylinder is 24cm³. What will be the volume of the cone ?

41. What is the volume of the largest cone that can be inscribed completely in a hollow hemisphere of radius 7 cm?

42. Find the maximum length of the rod that can be placed in a cuboid of dimesions 22.5 cm x 7.5 cm x 10 cm .

43. Which is false in case of a hollow cylinder. Write the correct answer.

    (a)   curved surface area of a hollow cylinder = $2\pi h (R + r)$

    (b)   Total surface area of a hollow cylinder = $2\pi (R +r) (h+R-r)$

    (c)   Inner curved surface area of a hollow cylinder = $2\pi h (R -r)$

    (d)   Area of each end of a hollow cylinder = $\pi (R^2 -r^2)$

44. Which is false ? Write the correct answer.

    A metal pipe is 63cm long. Its inner diameter is 4 cm and the outer diameter is 4.4 cm. Then

    (a)   Its inner curved surface area = 792 cm²

    (b)   Its outer curved surface area = 871.2 cm²

    (c)   Surface area of each end = 2.64 cm²

    (d)   Its total surface area = 1665.84 cm²

45. Which is false ? Write the correct answer.

(a) Volume of the hollow sphere = $\frac{4}{3}\pi(R^3 - r^3)$

(b) Volume of a hemisphere = $\frac{2}{3}\pi r^3$

(c) Total surface area of a hemisphere = $3\pi r^2$

(d) Curved surface area of a hemisphere = πr^2

46. Which is false ? write the correct answer.

For a right circular cylinder of base radius = 7cm and height = 14 cm.

(a) curved surface area = 616cm^2

(b) Total surface area = 924 cm^2

(c) Volume = 2156cm^3

(d) Total area of the end face = 154 cm^2

47. Write true or false.

The largest possible right crcular cone is cut out of a cube of edge r cm. The volume of the cone is $\frac{1}{12}\pi r^3$. (T/F)

PART – C

48. A cuboidal vessel is 10m long and 8m wide. How high must it be made to hold 380m^3 of a liquid ?

49. A wall of length 10m was to be built across and open ground. The height of the wall is 4m and thickness of the wall is 24cm. If this wall is to be built up with bricks whose dimensions are 24cm x10cm x 8cm, how many bricks would be required ?

50. 1.1 cm^3 of gold is drawn into a wire of 0.1 mm in diameter. Find the length of the wire in metre.

51. A hemispherical bowl of internal diameter 36cm contain a liquid. This liquid is to be filled in cylindrical bottles of radius 3cm and height 6cm. How many bottles are required to empty the bowl ?

52. Find the lateral curved surface area of a cylindrical petrol storage tank that is 4.2m in diameter and 4.5m high. How much steel was actually used if 1/12 of steel actually used was wasted in making the closed tank?

53. Water in a canal, 30 dm wide and 12 dm deep is flowing with a speed of 20 km per hour. How much area will it irrigate in 30 min if 9 cm of standing water is desired ? (10dm=1m)

54. The radius of a sphere is 10 cm. If the radius is increased by 1cm, then prove that volume of the sphere is increased by 33.1%.

55. The diameter of a hemisphere is decreased by 30%. What will be the percentage change in its total surface area ?

56. A sphere and a cube have the same surface area. Find the ratio of their volumes.

57. The volume of a sphere is 4851 cm³. How much should its radius be reduced so that its volume becomes $\frac{4312}{3}$ cm³ ?

58. A semicircular sheet of paper of diameter 14 cm is bent to form an open conical cup. Find the capacity of the cup.

59. Ifc, t and v are curved surface area, total surface area and volume of a cylinder then show that

$$th^2 = ch^2 + 4v^2 + 8v^2rh$$

where r and h are radius and height.

PART-D

60. A cuboidal tank can store 5040 litres of water. The external dimensions of the tank are 2.2m x 1.7m x1.7m. If the wall of the tank are 5 cm thick, then what is the thickness of the bottom of the tank ?

61. A metallic sheet is of the rectangular shape with dimensions 48cm x 36cm. From each one of its corners, a square of 8cm is cut off An open box is made of the remaining sheet. Find the volume of the box.

62. A right triangle having side 6cm, 8cm and 10cm is revolved about the side of length 8cm. Find the volume of the solid so formed.

63. A right circular cone is 5.4 cm high and radius of its base is 2cm. It is melted and recast into another right circular one with radius of base as 1.5 cm. Find the height of new cone formed.

64. A cylindrical tub of radius 12cm contains water to the depth of 20cm. A spherical ball is dropped into the tub raising the level of water by 6.75cm. What is radius of ball ?

65. A cylinder is within the cube touching all the vertical faces. A cone is inside the cylinder. If their height are the same with the same base find the ratio of their volumes.

66. A plot of land is in the form of rectangle with dimension 240m x 180m. A drainlet 10m wide is dug around it (on the outside). And the earth dug out is evenly spread out over the plot increasing its surface level by 25cm. Find the depth of the drainlet.

67. A residential colony has a population of 5400 and 60 litres of water is required per person per day. For the effective utilization of rain water, a group of people decided to the WATER HARVESTING. They constructed a water reservoir measuring 48m x 27m x 25m to collect the rain water.

    For how many days the water of this tank is sufficient-fi during rain the height of water level is 5m.

68. 50 students of class IX planned a visit to an old age home and to spend the whole day with its inmates. Each one prepared a cylindrical flower vase using card board to gift the inmates. The radius of cylinder is 4.2cm and the height is 11.2 cm.

    What is the amount spent for purchasing the card board at the rate of 20 per 100 m^2.

69. Rahul wanted to make a temporary shelter for street dogs, by making a box like structure with tarpaulin that covers all the four sides and the

top of the house. How much tarpaulin would be required to make the shelter of heigh 2.5 m with base dimensions 4m x 3m. Assuming stiching margin is negligible.

70. Twenty Seven solid iron spheres each of radius r and surface are S are melted to form sphere with surface area S'. Find the

    (i)   radius R of the new sphere.

    (ii)   Ratio of S and S'.

71. The diameter of a metallic ball is 4.2cm. What is the mass of the ball, if the density of the metal is 8.9g per cm^3.

72. A lead pencil consists of a cylinder of wood with a solid cylinder of graphite filled in the interior.

    The diameter of the pencil is 7mm and the diameter of the graphite is 1mm. If the length of the pencil is 14cm. Find the volume of the wood and that of the graphite.

73. A soft drink is available in two packs. (i) a tin can with a rectangular base of length 5cm and width 4cm, having a height of 15cm and (ii) a plastic cylinder with circular base of diameter 7cm and height 10cm. Which container has greater capacity and by how much ?

74. A bus stop is barricaded from the remaining part of the road, by using 50 hollow cones made of recycled cardboard. Each cone has a base diameter of 40cm and height 1m. If the outer side of each of the cone is to be painted ans the cost of painting is ₹ 12per m^2, What will be the cost of painting all these cones ? (Use π=3.14 and $\sqrt{1.04}$ = 1.02)

75. A spere of diameter 6cm is dropped in a right circular cylinder vessel partly filled with water. The diameter of the cylindrical vessel is 12cm. If the sphere is completely submerged in water, by how much will the level of water rise in the cylindrical vessel ?

76. Marbles of diameter, 1.4cm are dropped into a cylindrical beaker, of diameter 7cm. Containing some water. Find the number of marbles

that should be dropped into the beaker, so that the water level rises by 5.6cm.

77. Right circular cylinder having diameter 12cm and height 15 cm is full of ice-cream. The Ice-Cream is to be filled in cones of height 12cm and diameter 6cm having a hemispherical shaped on the top. Find the number of such cones which can be filled with Ice-Cream.

78. A toy is in the form of a cone mounted a hemisphere of diameter 7cm. The total height of the toy is 14.5 cm. Find the volume and the total surface area of the toy. (Take $\pi = \frac{22}{7}$)

79. If h, c and v respectively, are the height, the curved surface and volume of the cone, prove that

$3\pi vh^3 - c^2h^2 + 9v^2 = 0$

80. A wooden box with dimensions 36 cm x 24 cm x 12 cm is 2cm thick. Find the weight of the wood if density of the wood is 100 gm/m³.

81. A rectangular reservoir is 210m long and 75m wide. Water is flowing into it through a square pipe of side 25 cm such that water rises to 3.5 m in 15 hours. Find the speed of the water.

82. A hemispherical bowl is to be painted from inside at the rate of Rs. 20 per 100m². The total cost of painting is Rs. 30.80. Find

   (i)   Inner surface area of the bowl.

   (ii)   Volume of air inside the bowl.

PART-D

83. The volumes of the two spheres are in the ratio 64 : 27 find the ratio of their surface areas.

84. A cube of side 4cm contains a sphere touching its sides. Find the volume of the gap in between.

85. A sphere and a right circular cylinder of the same radius have equal volumes. By what percentage does the diameter of the cylinder exceeds its heights ?

CHAPTER-13
SURFACE AREAS AND VOLUMES
ANSWERS

1.	(b)	3 Units	2.	(b)	$3\pi r^2$
3.	(c)	halved	4.	(a)	12 cm
5.	(a)	1 : 4	6.	(a)	6000
7.	(a)	$\frac{32}{3}\pi r^3$	8.	(d)	5544cm^2
9.	(a)	15m	10.	(d)	1cm
11.	(b)	1920	12.	(c)	33.1%
13.	(c)	same	14.	(c)	1 : 9
15.	(b)	2 . 1 cm	16.	(c)	384cm^2
17.	(c)	64cm^3	18.	(d)	becomes 8 times
19.	(a)	6 : π	20.	(d)	125%
21.	512 cm^2		22.	180 cm^2	
23.	20 : 27		24.	550 m^2	
25.	4 : 3		26.	28 cm	
27.	$\pi r (l + r/4)$		28.	2 : 1	
29.	1 : 4		30.	$v = \frac{1}{12}\pi r^3$	
31.	2.8 cm		32.	500	
33.	2m, 4m, 6m		34.	269.5 cm^2	
35.	20cm		36.	6cm	
37.	₹ 555		38.	6cm	
39.	308 cm^3		40.	8cm^3	
41.	359.33cm^3		42.	25.7cm	
43.	(c)	$2\pi h(R-r) = 2\pi rh$	44.	(d) 1665.84 cm^2 = 1668.48cm^2	
45.	(d)	$\pi R^2 = 2\pi R^2$	46.	(d) 154 cm^2 = 308 cm^2	
47.	True		48.	4.75 cm	
49.	5000		50.	140m	
51.	72		52.	59.4m^2, 95.04m^2	
53.	4,00,000m^2		55.	51%	
56.	$\sqrt{6} : \sqrt{\pi}$		57.	6.5cm	

58. 79.2 cm^3

60. 10cm

61. 5120cm^3

62. $96\,\pi\,\text{cm}^3$ 63.   9.6 cm

64. 9cm

65. $v_1 : v_2 : v_3 = 42:33:11$

66. 1.227m

67. 20 days

68. ₹ 3511.20

69. 47m^2

70. (i) R=3r (ii) $s:s^1=1:9$

71. 345.39 g

72. 5.28 cm^3, 0.11 cm^3

73. Plastic Cylinders 85 cm^3

74. 384.34

75. 1cm

76. 150

77. 10

78. 231 cm^3, 204.05 cm^2

80. 3968 g

81. 58.8 km

82. (i) 154m^2 (ii) $251.5\,\text{m}^3$

83. 16:9

84. 30.48 cm^3

85. 50%

PRACTICE TEST

Time : 50 Min.   **Surface Areas and Volumes**   M.M. 20

1. If l, b and h are the length, breadth and height of a room then what will be the total area of the four walls?   (1)

2. The volume of a sphere is 310.4 cm^3. Find its radius.   (1)

3. The circumference of the base of a cylinder is 30.8 cm. Its curved surface area is 289.52 cm^2. Find the height of the cylinder   (2)

4. The side of a cube is double the length of the cuboid. The breadth and height of the cuboid are half of its length. Find the ratio of the curved surface area of cube to cuboid.   (2)

5. The seed of a corn has dimensions 1.8 cm × 0.8 cm × 0.2 cm. The height of the corn-tube is 13.7 cm and its radius is 4.2 cm. Assuming that the corn-seeds have negligible distance between them and all seeds are of same size, find the number of seeds on the corn-tube.   (3)

6. The length, breadth and height of a cuboid are increased by 30%. Find the percent increase in the total surface area.   (3)

7. Ajay prepared a dish and kept it in a hemispherical bowl of 30 cm diameter. He distributed the dish in cylinder cups of diameter 15 cm and height 4 cm among his friends and himself. How many friends were with Ajay?   (4)

8. A river 15 m deep 50 m wide is flowing at the rate of 2 cm per second. How many litres of water will fall from the river into the sea in 9 hours?   (4)