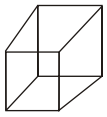
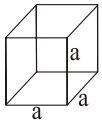
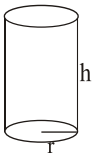
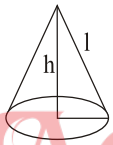
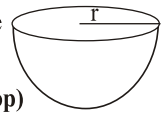
CHAPTER-13

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	[Diagonal of cuboid $=\sqrt{l^2+b^2+h^2}$ Diagonal $=\sqrt{3}$ x side
2.	Cube		$4a^2$	$6a^2$	a^3	a=side	
3.	Right Circular Cylinder		$2\pi rh$	$2\pi r(h+r)$	πr^2h	h=height r=radius of base	
4.	Right Circular Cone		πrl	$\pi r(l+r)$	$\frac{1}{3}\pi r^2h$	h=height r=radius of base	
5.	Sphere		$4\pi r^2$	$4\pi r^2$	$\frac{4}{3}\pi r^3$	r = radius	
6.	Hemisphere Solid		$2\pi r^2$	$3\pi r^2$	$\frac{2}{3}\pi r^3$	r = radius	
7.	Hemisphere hollow **(Without top)**		$2\pi r^2$	$2\pi r^2$	$\frac{2}{3}\pi r^3$	r = radius	

- $1m^3 = 1000$ L
- $1l = 1000\ cm^3$

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Very Very Short Answer questions (1 mark)

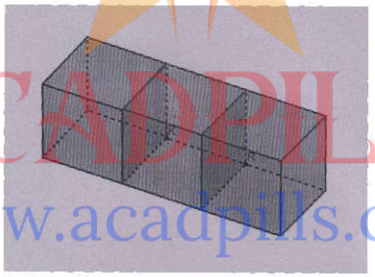
1. If the volume of a sphere is numerically equal to its surface area then find the radius of the sphere.
2. Find the surface area of a solid hemisphere having radius r.
3. In a cylinder, if radius is halved and height is doubled then what will be the change in volume ?
4. Find the height of a cone of diameter 10cm and slant height 13cm.
5. The radius of a hemispherical balloon increase from 6cm to 12cm as air is being pumped into it. Find the ratios of the surface areas of the balloon in the two cases.
6. How many bricks will be required to construct a wall 13.5cm long; 6cm high and 22.5cm thick if each brick measures (27cm x 12.5cm x 9cm)?
7. If the radius of a sphere is 2r, then find its volume.
8. The radius of a sphere is 21cm. What is the surface area of the sphere?
9. What will be the length of the longest pole that can be put in a room of dimensions 10m x 10m x 5m?
10. A copper sphere of diameter 6cm is melted and drawn into a 36cm long wire of uniform circular cross-section. Find the radius of the wire.
11. Find 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 .
12. The radius if a sphere is increased by 10%. Find the percentage increase in its volume.
13. In a cylinder, If radius is doubled and height is halved, then what will be the change in its volume?
14. Two cubes have their volumes in the ratio 1:27. Find the ratio of their surface areas.
15. A cone is 8.4cm high and the radius of its base is 2.1cm. It is melted and recast into a sphere. Find the radius of the sphere.
16. If the length of diagonal of a cube is 873cm then find its surface area.
17. The total surface area of a cube of 96cm. Find the volume of this cube.
18. If each side of a cube is doubled then find the change in its volume.
19. If a sphere is inscribed in a cube then find the ratio of the volume of the cube to the volume of the sphere.
20. If each edge of a cube is increased by 50% then find the percentage increase in its surface area.
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 ?

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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 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 increases 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 ?

Case Study based Questions :-

31. Sana wanted to gift 3 cube puzzles to her friend on her birthday. Three cubes each of side 5cm are joined end to end. She arranged the cubes joining them end to end (as shown in figure).



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(i) The areas of the gift paper required to wrap the resulting shape if there is no overlapping of paper is :
(a) $350cm^2$ (b) $750cm^2$ (c) $530cm^2$ (d) $1000cm^2$

(ii) The space occupied by this resulting shape is :
(a) $573cm^2$ (b) $370cm^2$ (c) $375cm^2$ (d) $570cm^2$

(iii) The ratio of the total surface area of the new cuboid to that of the sum of the surface areas of the three cubes is :
(a) 9 : 7 (b) 1:1 (c) 1:9 (d) 7:9

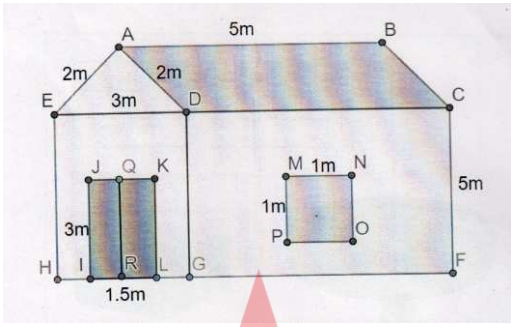
(iv) The ratio of the volume of new cuboid to that of the sum of the volumes of the three cubes is :

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

(v) Find total surface area of four such cubes joined end to end.

(a) $450cm^2$ (b) $350cm^2$ (c) $475cm^2$ (d) $550cm^2$

32. Rashmi wants to construct the hut given in the picture.



(i) She uses a tape on all joints of roof (such as AB, BC, CD, AD, and back side also) as well as the walls (such as DG, CF, EH and the black side). Find the length of the tape required.

(a) 42m (b) 43m (c) 34m (d) 40m

(ii) The door is covered with tiles of measures 10cm by 15cm. How many such tiles are required to cover the door from both its sides ?

(a) 600 tiles (b) 100 tiles (c) 500 tiles (d) 60 tiles

(iii) Find the area of the four walls to be white washed.

(a) $70.5m^2$ (b) $75.4cm^2$ (c) $74.5m^2$ (d) $47.5m^2$

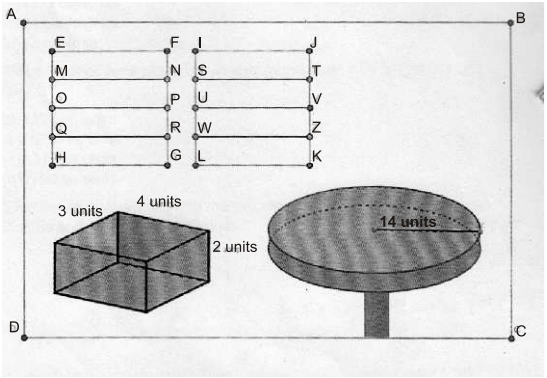
(iv) Find the cost of white washing the four walls at the rate of Rs. 12 per m^2.

(a) Rs 894 (b) Rs 800 (c) Rs 900 (d) Rs. 984

(v) If the roof (ABCD and the back sides) is covered with tiles of size 20cm by 20m the find the number of tiles required.

(a) 100 tiles (b) 500 tiles (c) 400 tiles (d)540 tiles

33.



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In the given picture, there are two windows EFGH and IJKL on the wall. MN, OP, QR, ST, UV, WZ are rods of the windows. A box and a chair with round seat are also shown.

(i) If the length of each rod is 6 units then the total length of the rods in two windows will be-

(a) 60 units (b) 36 units (c) 30 units (d) 18 units

(ii) If the distance between two rods is 0.8 units then the height of each window will be-

(a) 3.2 units (b) 4 units (c) 2.4 units (d) 5 units

(iii) Volume of the cuboidal box will be -

(a) 42 cubic units
(b) 48 cubic units
(c) 24 cubic units
(d) 52 cubic units

(iv) Total Surface area of the top seat of round chair if its height is 1 unit, will be-

(a) 1320 sq units
(b) 1230 sq units
(c) 2310 sq units
(d) 1200 sq units

(v) Find the area of wall leaving the two windows, if the length of the wall is 25 units and its breadth is 20 units.

(a) 500 Sq. Units (b) 961.6 Sq. Units
(c) 960 Sq. Units (d) 38.4 Sq. Units

Very Short answer type questions (2 marks)

34. 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.
35. 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 ?
36. The dimensions of a cuboid are in the ratio of 1 : 2 : 3 and its total surface area is 88m^2. Find its dimensions.
37. 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.
38. The total surface area of a cube is 150sq. cm. Find the perimeter of any one of its faces.
39. Three metal cubes whose edge measures 3cm, 4cm and 5cm respectively are melted to form a single cube. Find the edge of the cube.
40. 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 m^2.

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

42. The curved surface area of a cylinder is 176 cm^2 and its base area is 38.5 cm^2. Find the volume of the cylinder.

43. A cylinder and a cone have the same height and the same radius. The volume of the cylinder is 24cm^3. What will be the volume of the cone ?

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

45. 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 .

46. 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 = $\pi (R^2 - r^2)$

47. 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 cm^2
    (b) Its outer curved surface area = 871.2 cm^2
    (c) Surface area of each end = 2.64 cm^2
    (d) Its total surface area = 1665.84 cm^2

48. 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

49. 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

50. Write true or false.

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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)

Short Answer Type Questions (3 Marks)

51. A cuboidal vessel is 10m long and 8m wide. How high must it be made to hold 380m^3 of a liquid ?
52. A wall of length 10m was to be built across an 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 ?
53. 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.
54. 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 ?
55. 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?
56. 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)
57. 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%.
58. The diameter of a hemisphere is decreased by 30%. What will be the percentage change in its total surface area ?
59. A sphere and a cube have the same surface area. Find the ratio of their volumes.
60. The volume of a sphere is 4851 cm^3. How much should its radius be reduced so that its volume becomes $\frac{4312}{3}$ cm^3 ?
61. A semicircular sheet of paper of diameter 14 cm is bent to form an open conical cup. Find the capacity of the cup.
62. 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 is radius and h is height.

Long Answer Type Questions (5 Marks)

63. A cuboidal closed tank can store 5040 litres of water. The external dimensions

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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 ?

64. 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 and an open box is made of the remaining sheet. Find the volume of the box.

65. 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.

66. 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.

67. 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 the ball ?

68. 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.

69. 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.

70. 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 do 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 if during rain the height of water level is 5m?

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71. 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?

72. 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 height 2.5 m with base dimensions 4m x 3m. Assuming stiching margin is negligible.

73. Twenty Seven solid iron spheres each of radius r and surface area 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'.

74. 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.

75. 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.

76. 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 ?

77. 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 and 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)

78. A sphere 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 ?

79. 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.

80. 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.

81. A toy is in the form of a cone mounted on 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 $\pi = \frac{22}{7}$)

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

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

83. 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/m^3.

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84. 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.

85. A hemispherical bowl is to be painted from inside at the rate of Rs. 20 per $100m^2$. The total cost of painting is Rs. 30.80. Find

    (i) Inner surface area of the bowl.

    (ii) Volume of air inside the bowl.

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

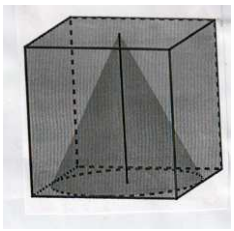
87. A cube of side 4cm contains a sphere touching its sides. Find the volume of the gap in between.

88. 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 ?

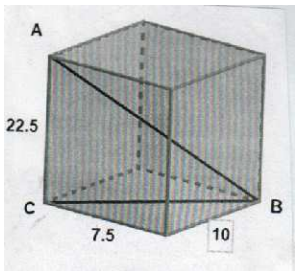
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CHAPTER-13
SURFACE AREAS AND VOLUMES
ANSWERS

1. 3 Units
2. $3\pi r^2$
3. halved
4. 12cm
5. 1:4
6. 6000
7. $\frac{32}{3}\pi r^2$
8. $5544 cm^2$
9. 15m
10. 1 cm
11. 1920
12. 33.1%
13. sam
14. 1:9
15. 2.1cm
16. $384 cm^2$
17. $64 cm^3$
18. becomes 8 times
19. $6:\pi$
20. 125%
21. $512\ cm^2$
22. $180 cm^2$
23. 20:27
24. $550 m^2$
25. 4:3
26. 28cm
27. $\pi r(l+r/4)$
28. 2:1
29. 1:4
30. Radius of cone = R = $\frac{r}{2}$
    Height of cone = h = r
    Ans. $\frac{1}{12}\pi r^3$



31. (i) (a) $350 cm^2$
    (ii) (c) $375 cm^2$
    (iii) (d) 7 : 9
    (iv) (a) 1:1
    (v) (a) $450 cm^2$
32. (i) (b) 43cm
    (ii) (a) 600 tiles
    (iii) (c) $74.5 m^2$
    (iv) (a) Rs 894
    (v) (b) 500 tiles
33. (i) (b) 36 units
    (ii) (a) 3.2 units
    (iii) (c) 24 cubic units
    (iv) (a) 1320 sq. units
    (v) 961.6 sq. units
35. 500
37. $269.5\ cm^2$
39. Vol. of new single cube = Sum of volumes of 3 cubes.
    $v = s^3 = (3)^3 + (4)^3 + (5)^3$
    Ans - 6cm
41. 6cm
43. $8 cm^3$
45. In rt ΔBCD
    $BC^2 = (10)^2 + (7.5)^2$
    In rt ΔABC



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$AB^2 = AC^2 + BC^2$

$AB^2 = (22.5)^2 + (10)^2 + (7.5)^2$

$AB = 25.7cm$

47. (d) $1665.84cm^2$, $1668.48cm^2$

49. (d) $154cm^2$, $308cm^2$

51. 4.75cm $\quad \frac{1}{2} \quad \frac{30}{100}$

53. 140m $\quad \frac{7}{10}$

55. $59.4m^2$, $95.04m^2$

58. Decreased Radius $= \frac{3\pi r^2 - 3\pi \left(\frac{7}{10}r\right)^2}{[2r\,3\pi r^2 \times 2r]} \times 100$

$= r$

% change in TSA $=$

Ans. 51%

60. 3.5cm

61. Circumference of the base of the conical cup = Length of the arc of the semi-circle

Ans. $79.2\ cm^3$

63. Let x be thickness of bottom & top

vd - $5040 \times 1000cm^3 = (220\text{-}5\text{-}5)(170\text{-}5\text{-}5)(170\text{-}x\text{-}x)$

Ans. 10cm

64. $5120cm^3$

65. $96\pi cm^3$

66. 9.6cm

67. 9cm

68. $V_1 : V_2 : V_3 = 42 : 33 : 11$

69. 1.227 m

70. 20 days

71. ₹3511.20

72. $47m^2$

73. (i) $R = 3r$ (ii) $s:s' = 1:9$

74. 345.39g

75. $5.28cm^3$, $0.11cm^3$

Solution : Here the pencil is in the form of a cylinder which is made up of an outer cylinder of wood (radius "R") and an inner cylinder of graphite (radius "r") Height of the pencil is 14cm.

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Therefore h = 14cm,

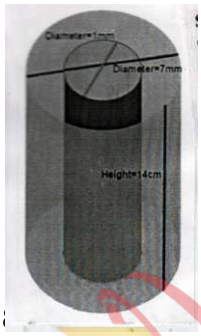
$R = \frac{7}{2} = 3.5$ mm = 0.35cm and $r = \frac{1}{2}$ mm = 0.5mm = 0.05cm

Volume of graphite = $V_G = \pi r^2 h = \frac{22}{7} \times 0.05 \times 0.05 \times 14 = 0.11 cm^3$

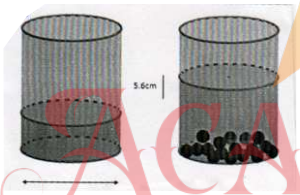
Volume of wood = Total volume of the pencil - volume of graphite

$V_w = \pi R^2 h - \pi r^2 h = h(R^2 - r^2) = \frac{22}{7} \times 14 \times [(0.35)^2) - (0.05)^2]$

$= 22 \times 2 \times 0.4 \times 0.3 = 5.28 cm^3$



76. Plastic Cylinder
77. 384.34
78. 1cm
79. Hint



No. of marbles

$= \frac{\text{Vol. of water raised}}{\text{Vol. of 1 marble}}$

Ans :- 150

80. 10
81. $231 cm^3$, $204.05 cm^2$
83. Volume of wood = External Vol.- Internal Vol.

    Ans. 0.5248g
84. Vol of water in reservoir collected in 15 hours

    $= 210 \times 75 \times 3.5 m^3$

    ATQ $210 \times 75 \times 3.5 =$

    Where x km/h be the speed of water or $1000x$ m/h

    Ans. 58.8 km/hour $\frac{1}{4} \times \frac{1}{4} \times 15000x$
85. (i) $154 m^2$

    (ii) $251.5 m^3$
86. 16:9
87. $30.48 cm^3$
88. 50% Hint : $\frac{4}{3}\pi r^3 = \pi r^2 h$

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PRACTICE TEST

Time : 1hr. **Surface Areas and Volumes** M.M. 25

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. Thee sphere of radii 3cm, 4cm and 5cm are metted together to form a single sphere. Find the radius of new sphere. (1)

4. 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)

5. 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)

6. A semcircular sheet of paper of diameter 14cm is bent to form a conical cup. Find the capacity of the cup. (2)

7. 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)

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

9. 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? (5)

10. 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? (5)

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