BAL BHARATI PUBLIC SCHOOL, PITAMPURA, DELHI – 110034

SUBJECT:- MATHEMATICS

CHAPTER12:- SURFACE AREAS AND VOLUMES(PART-4)

Week : 21st December to 24th December

Number of blocks : 3

Subtopics:

- Volume of a cuboid and cube
- Volume of a cylinder
- Application problems on volumes in day to day life

Link for the chapter : http://ncert.nic.in/textbook/textbook.htm?jemh1=3-15

Learning Outcomes:

Each student will be able to:

- Find Volume of a cube
- Find Volume of a cuboid
- Apply the volume of cube and cuboid in different problems
- Volume of a cylinder and hollow cylinder
- Analyse the case study and solve the related problems.

Teaching Aids Used :

Presentation of E-lesson, PDF of NCERT textbook, YouTube videos by screen sharing, white board and marker or register and pen using laptop/mobile camera, digital board, Google Jamboard etc.

GUIDELINES:

Dear students,
Kindly read the content given below and view the links shared for better understanding.

Solve the given questions in **yellow register** provided in the notebook set.

Link for the chapter: http://ncert.nic.in/textbook/textbook.htm?jemh1=3-15

DAY 1

INTRODUCTION ACTIVITY

Students will recall the following

- Surface areas of cube = 6x side^2
- Lateral surface area of a cube = 4x side^2
- Surface area of a cuboid = 2 (lb+bh+hl)
- Lateral surface area of a cuboid = 2h (l+b)

LESSON DEVELOPMENT

Volume of a Cuboid

A cuboid is a 3-dimensional shape.
To work out the volume we need to know 3 measurements.
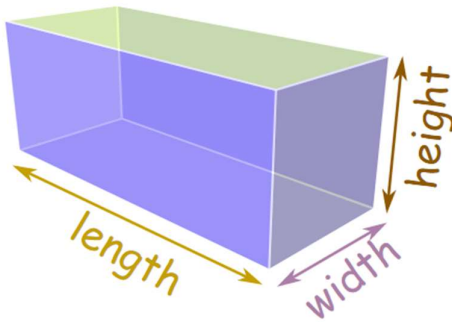
Look at this shape.

There are 3 different measurements:

Length,   Width,   Height

There are 3 different measurements:

Length, Breadth/Width, Height

The volume is found using the formula:

Volume = Length × Breadth × Height

Which is usually shortened to:
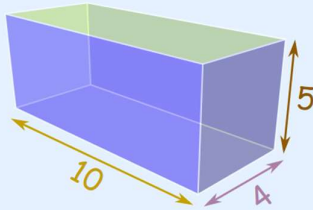
V = l × b × h

Or more simply:

$$V = lbh$$

In Any Order

It doesn't really matter which one is length, breadth or height, so long as you multiply all three together.

Example: Lengths in metres (m):

The volume is:

$10 \text{ m} \times 4 \text{ m} \times 5 \text{ m} = \mathbf{200} \text{ m}^3$

It also works out the same like this:

$4 \text{ m} \times 5 \text{ m} \times 10 \text{ m} = \mathbf{200} \text{ m}^3$

Note: the result is in **m³** (cubic metres) because we have multiplied metres together three times.
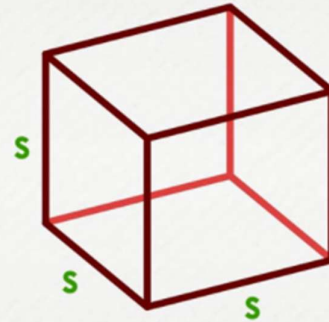
Volume of a Cube

Volume of Cube Formula

Every edge of the cube is the same length.

$V = w \cdot l \cdot h$

width = length = height
simplify this formula to:

$V = s^3 \longrightarrow$ s = the length of any edge

LINK

EX 13.5

Question 5: The capacity of the cuboidal tank is 50000 litres of water. Find the breadth of the tank if its length and depth are 2.5 m and 10 m respectively.

Let b be the width of the cuboidal tank.

Volume of the cuboidal tank = 50,000 l

1 m³ = 1000 l

Volume of the cuboidal tank = 50000/1000 m³

= 50 m³

Volume of cuboid = l × b × h

50 = 2.5 × 10 × b

b = 50/(2.5×10)

b = 2 m

Question 6: A village, having a population of 4000, requires 150 litres of water per head per day. It has a tank measuring 20 m x 15 m x 6 m. For how many days will the water of this tank last?

EXTRA QUESTIONS

Q. If a wooden box of dimensions 8 m x 7 m x 6 m is to carry boxes of dimensions 8 cm x 7 cm x 6 cm, then find the maximum number of boxes that can be carried in the wooden box.

Q. A cube with an edge of 7 cm and a cuboid measuring 7 cm × 4 cm × 8 am are kept on a table. Which shape has more volume?

Q. A cuboid is 9 cm long, 5 cm broad and 4 cm high and a cube has an edge of 5 cm. Which one has greater volume?

Q. What is the volume of a brick of ice-cream in litres with length 25 cm, breadth 10 cm and height 8 cm?

Q. A brick measures 15 cm in length, 8 cm in breadth and 5 cm in height. How many bricks will be used to make a wall of length 15 m, breadth 10 m and height 8 metres?

Q. A pond is 50 m long, 30 m wide and 2 m deep. Find the capacity of the pond in litres.

Do the following work from NCERT book in the yellow register
1.Solved example number 11 and 12.
2. Ex 13.5 question number 1 and 2.

Links for the reference:
https://youtu.be/PhLc6B5WXtc

DAY 2

LESSON DEVELOPMENT

EX 13.5

Question 7: A godown measures 40 m × 25 m × 15 m. Find the maximum number of wooden crates each measuring 1.5 m × 1.25 m × 0.5 m that can be stored in the godown.

Question 8: A solid cube of side 12 cm is cut into eight cubes of equal volume. What will be the side of the new cube? Also, find the ratio between their surface areas.

Question 9: A river 3 m deep and 40 m wide is flowing at the rate of 2 km per hour. How much water will fall into the sea in a minute?

EXTRA QUESTIONS

Q. A rectangular tank is 225 m × 162 m at base. With what speed should water flow into it through an aperture 60 cm × 45 cm so that the level of water is raised by 20 cm in 2.5 hours?

Q. Find the length of the longest pole that can be put in a room of dimensions 10 m x 10 m x 5 m. [NCERT Exemplar Problem]

Do the following work from NCERT book in the yellow register

1.Ex-13.5 question number 3 and 4.

2.Revise all the questions and do the practice questions.

Links for the reference:

https://youtu.be/uLiyuS3Z-0g

https://youtu.be/RDk6ED-IITM

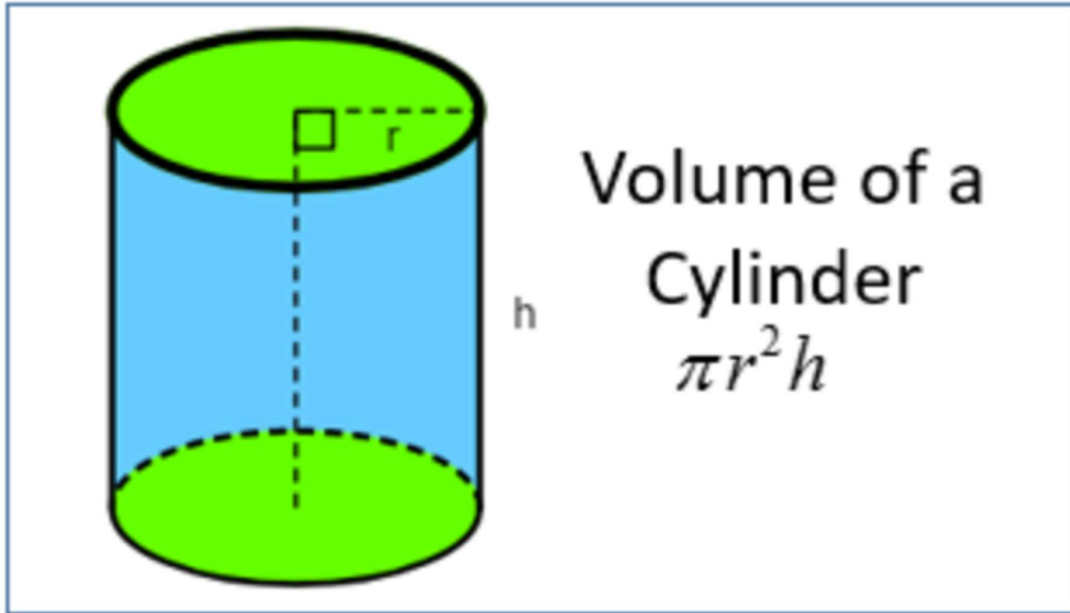**DAY 3**

LESSON DEVELOPMENT

Volume enclosed by a cylinder

Definition: The number of cubic units that will exactly fill a cylinder is its volume.

Volume of a Right Circular Cylinder

The volume of a right circular cylinder is equal to base area × its height.

Area of the base = $\prod r^2$ (base is a circle of radius r)

Volume of a Cylinder

$\pi r^2 h$

Volume and Capacity

The **volume** of an object is the measure of the space it occupies and the **capacity** of an object is the volume of substance its interior can accommodate. The unit of measurement of either volume or capacity is a cubic unit.

Links for the reference:

https://www.mathopenref.com/cylindervolume.html

https://youtu.be/-6DyvXAp0_Y

Example:

Calculate the volume of a cylinder where:

a) the area of the base is 30 cm ^{2} and the height is 6 cm.
b) the radius of the base is 14 cm and the height is 10 cm.

Solution:

a) V = Area of base × height
    = 30 cm^2 × 6 am
    = 180 cm^3

b)

$$V = \text{Area of base} \times \text{height}$$
$$= \pi r^2 h$$
$$= \frac{22}{7} \times 14^2 \times 10 \quad (\text{take } \pi = \frac{22}{7})$$
$$= 6{,}160 \text{ cm}^3$$

Question 2: Calculate the radius of the base of a cylindrical container of volume 440 cm³. Height of the cylindrical container is 35 cm. (Take pi = 22/7)

Solution:

Given: Volume = 440 cm³

Height = 35 cm

We know from the formula of cylinder;

Volume, V = πr²h cubic units

So, 440 = (22/7) × r² × 35

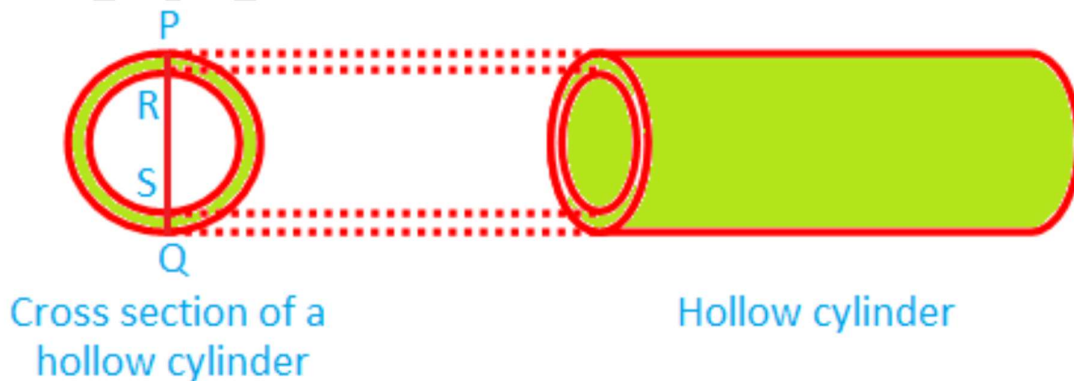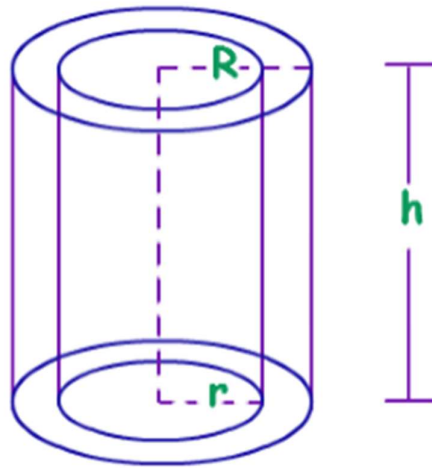r² = (440 × 7)/(22 × 35) = 3080/770 = 4

Therefore, r = 2 cm

Therefore, the radius of a cylinder = 2 cm.

Volume of a Hollow Right Circular Cylinder

If a right circular cylinder is hollow from inside then it has different

 curved surface and volume.

We will discuss here about the volume and surface area of Hollow Cylinder.

Cross section of a
hollow cylinder

Hollow cylinder

0

Cross section of hollow cylinder ,perpendicular to the length (or height) is the portion bounded by two concentric circles.

Here, AB is the outer diameter and CD is the inner diameter of the circular cross section. AC (or BD) is the thickness of the material of which the hollow cylinder is made.

If R, r are the outer and inner radii respectively and t is the thickness then R = r + t, r = R - t, t = R - r.

The volume of the material = п(R² - r²) × Height.

Example on Hollow Cylinder:

A hollow copper pipe of inner radius 3 cm and outer radius 4 cm is melted and changed into a solid right circular cylinder of the same length as that of the pipe. Find the area of the cross section of the solid cylinder.

Solution:

Cross section of the
copper pipe

Hollow copper pipe
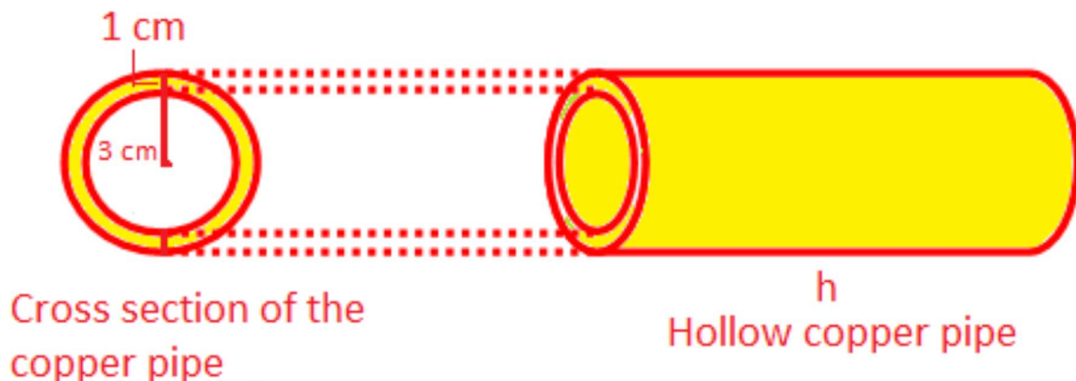
The area of the cross of the pipe = $(\pi \cdot 4^2 - \pi \cdot 3^2)$ cm^2 = 7π cm^2

Therefore, the volume of the pipe = (Area of the cross section) × length

$$= 7\pi \times h \text{ cm}^3;$$

(Taking length of the pipe = h cm)

$$= 7\pi h \text{ cm}^3.$$

The volume of the right circular cylinder = $\pi r^2 h$ cm^3.

(Taking the radius of the cross section of the cylinder = r cm)

According to the question, these two volumes are equal.

Therefore, $7\pi h$ cm^3 = $\pi r^2 h$ cm^3

$$\Rightarrow r^2 = 7.$$

Therefore, the area of the cross section of the sold cylinder

$$= \pi r^2 \text{ cm}^2$$

$$= 22/7 \cdot 7 \text{ cm}^2$$

$$= 22 \text{ cm}^2.$$

EX 13.6

Question2. The inner diameter of a cylindrical wooden pipe is 24cm and its outer diameter is 28 cm. The length of the pipe is 35 cm. Find the mass of the pipe, if 1 cm^3 of wood has a mass of 0.6 g.
Solution:

Inner diameter of cylindrical wooden pipe , d = 24 cm $\Rightarrow$ r = 12cm

Outer diameter of cylindrical wooden pipe, D = 28 cm $\Rightarrow$ r = 14cm

l = 35 cm

Volume of the wood used in the pipe = $\pi(R^2 - r^2)h$
= $22/7$ x $(14^2 - 12^2)$ x 35
= 5720 cm^3
Mass of the pipe for 1 cm^3 of wood = 0.6 g
Then, the mass of the pipe for 22880cm^3 of wood = 5720 x 0.6 = 3432g = 3.432kg

Question3. A soft drink is available in two packs – (i) a tin can with a rectangular base of length 5 cm and width 4 cm, having a height of 15 cm and (ii) a plastic cylinder with circular base of diameter 7 cm and height 10 cm. Which container has greater capacity and by how much?

Question5. It costs Rs 2200 to paint the inner curved surface of a cylindrical vessel 10 m deep. If the cost of painting is at the rate of Rs 20 per m², find
(i) inner curved surface area of the vessel,
(ii) radius of the base,
(iii) capacity of the vessel.

Question7. 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 7 mm and the diameter of the graphite is 1 mm. If the length of the pencil is 14 cm, find the volume of the wood and that of the graphite.

Extra Questions

Q. The radii of two cylinders of the same height are in the ratio 4 :5, then find the ratio of their volumes.
Q. In a cylinder, if radius is halved and height is doubled, then find the volume with respect to original volume. [NCERT Exemplar Problem]
Q. A school provides milk to the students daily in cylindrical glasses of diameter 7 cm. If the glass is filled with milk up to a height of 12 cm, find how many litres of milk is needed to serve 1600 students.
Q. The volume of cylindrical pipe is 748 cm. Its length is 0.14m and its internal radius is 0.09 m. Find thickness of pipe.
Q. A rectangular piece of paper is 22 cm long and 10 cm wide. A cylinder is formed by rolling the paper along its length. Find the volume of the cylinder.

Q. A cylindrical vessel can hold 154 g of water. If the radius of its base is 3.5 cm, and 1 cm³ of water weighs lg, find the depth of water.

ASSIGNMENT:

Do the following work from NCERT book in the yellow register
1.Solved example number 13 and 14.
2. Ex 13.6 question number 1,4,6 and 8.

Links for the reference:

QUESTIONS FROM EXEMPLAR

Q. The total surface area of a cube is 96 cm^2. The volume of the cube is
(a) 8cm^3
(b) 512cm^3
(c) 64cm^3
(d) 27cm^3

Q. In a cylinder, radius is doubled and height is halved, then curved surface area will   be
(a) halved
(b) doubled
(c) same
(d) four times

Q. The radii of two cylinders are in the ratio of 2 : 3 and their heights are in the ratio of 5 : 3. The ratio of their volumes is
(a) 10:17
(b) 20:27
(c) 17:27
(d) 20:37

Q. The lateral surface area of a cube is 256 m^2. The volume of the cube is
(a) 512m^3
(b) 64m^3
(c) 216m^3
(d) 256m^3

Q. The number of planks of dimensions (4 m x 50cm x 20cm) that can be stored in a pit which is 16 m long, 12 m wide and 40 m deep is
(a) 1900
(b) 1920
(c) 1800
(d) 1840

Q. The length of the longest pole that can be put in a room of dimensions
 (10mx10mx5m)is
(a) 15m
(b) 16m
(c) 10m
(d) 12m

Q. If the radius of a cylinder is doubled and its curved surface area is not changed, the height must be halved. (T/F)

Q. If the radius of a cylinder is doubled and height is halved, the volume will be doubled. (T/F)

Q. A storage tank is in the form of a cube. When it is full of water, the volume of water is 15.625 m^3. If the present depth of water is 1.3 m, then find the volume of water already used from the tank.

Q. A cylindrical tube opened at both the ends is made of iron sheet which is 2 cm thick. If the outer diameter is 16 cm and its length is 100 cm, find how many cubic centimetres of iron has been used in making the tube?

Critical thinking and case study questions

Q. The curved surface area of a cylinder is 154 cm². The total surface area of the cylinder is three times its curved surface area. Find the volume of the cylinder.

Q. Curved surface area of cylindrical reservoir 12 m deep is plastered from inside with concrete mixture at the rate of Rs 15 per m². If the total payment made is of Rs 5652, then find the capacity of this reservoir in litres.
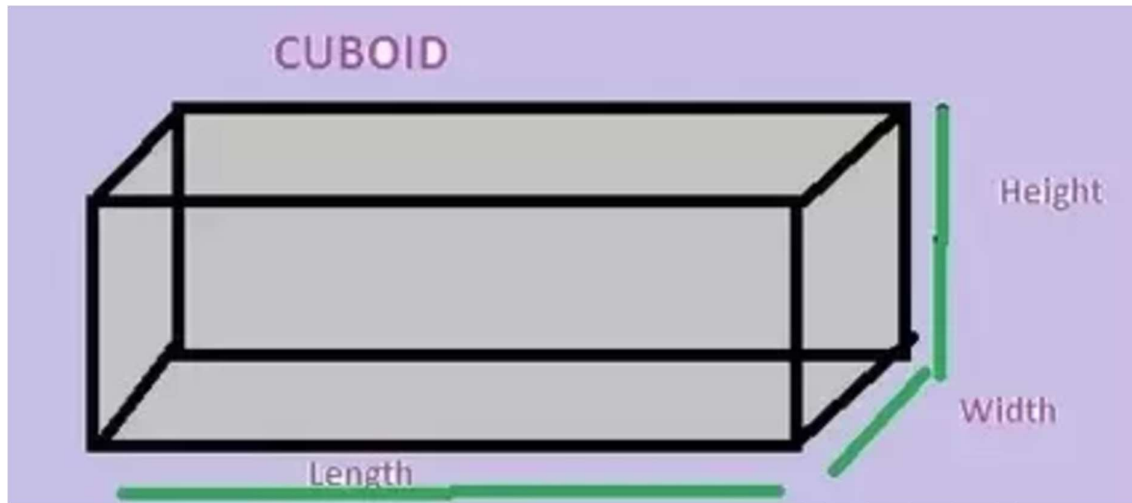
Q.

Which rectangular cake gives you more to eat—a vanilla cake measuring 8 in. x 11 in. x 3 in., or a chocolate cake measuring 9 in. x 12 in. x 2 in.?

Q.

Which can of mixed nuts give you the most—a blue can with a radius of 5 cm and a height of 10 cm, or a red can with a radius of 4 cm and a height of 12 cm?

CUBOID — Height, Width, Length

Q. A room has floor size of 15*6sq.m. What is the height of the room, if the sum of the areas of the base and roof is equal to the sum of the areas of the four walls?

 A.1.12m   B. 3.24m   C. 4.29m   D. 2.5m

Q. The surface area of a cuboid is 22 cm and sum of the lengths of all its edges is

 24cm. Find the length of the diagonal of the cuboid.

 A. 2.74cm   B. 3CM   C. 3.74cm   D. 4cm

Q. The breadth of a cuboid is twice its height and half its length. If the volume of the cuboid is 512 m³, then find the length of the cuboid.

 A. 8m   B. 12m   C. 16m   D. 20m

Q. A company that manufactures gift boxes wants to know how many different-sized boxes having a volume of 50 cubic centimetres it can make if the dimensions must be whole centimetres.
a. List all the possible whole number dimensions for the box.
b. Which possibility requires the least amount of material to make?

c. In which type of the box. the material used will be minimum?