BAL BHARATI PUBLIC SCHOOL, PITAMPURA, DELHI – 110034

SUBJECT: MATHEMATICS-CLASS: X

WEEK - 5th October, 2020 – 9th October, 2020
SUBJECT - MATHEMATICS
CLASS - X
No. OF BLOCKS - 4
TOPIC – SURFACE AREA AND VOLUME (CHAPTER -13)

Guidelines:-

Dear students, kindly refer to the following link of notes/video links from the chapter "**SURFACE AREA AND VOLUME**" and thereafter do questions in your Math register.
https://ncert.nic.in/textbook.php?jemh1=13-15

SUBTOPICS:-

- Surface area and Volume of 3- D solids
- Recapitulation of formulae of Volume and surface area of cube, cuboid, cone, cylinder, sphere and hemisphere
- Application of above formulae in daily life situations

INSTRUCTIONAL AIDS:-

Presentation by screen sharing, offline whiteboard, online whiteboard, YouTube links, E lesson

LEARNING OUTCOMES:-

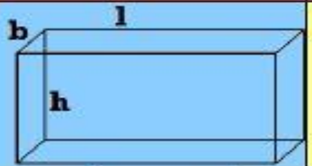
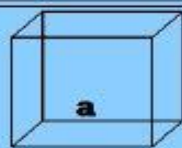
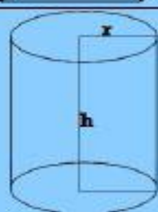
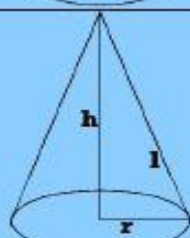
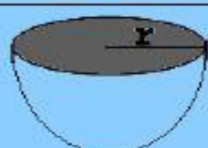
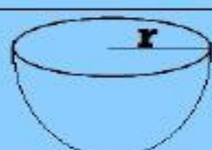
Each student will be able to:

- comprehend the formulae of surface area and volumes of these 3- D objects
- apply these formulae to solve questions related to daily life situations
- identify and apply suitable formula

Block 1

Introduction Activity-

- Recapitulation of concepts related to volume and surface area of cube, cuboid, cone cylinder, sphere and hemisphere.
- Let us recall the formulae.

Name	Figure	Curved Surface Area	Total Surface Area	Volume
Cuboid		$2(l+b)h$	$2(lb+bh+hl)$	lbh
Cube		$4a^2$	$6a^2$	a^2
Right Circular Cylinder		$2\pi rh$	$2\pi r(h+r)$	$\pi r^2 h$
Right Circular Cone		πrl	$\pi r(l+r)$	$\frac{1}{3}\pi r^2 h$
Sphere		$4\pi r^2$	$4\pi r^2$	$\frac{4}{3}\pi r^3$
Solid Hemisphere		$2\pi r^2$	$3\pi r^2$	$\frac{2}{3}\pi r^3$
Hollow Hemisphere		$2\pi r^2$	$2\pi r^2$	$\frac{2}{3}\pi r^3$

Lesson Development:-

Surface area means area of the surface which is to be worked upon. For example, if a hemispherical bowl is to be tin plated inside and outside, then

Area to be painted =inner surface area +outer surface area of the bowl

Although the amount of milk which can be filled in this bowl is same as the Volume of the hemisphere. In daily life, we come across many such situations where we need to calculate surface area and volume of the 3-D objects.

Application of surface area and volume-Refer to the following link to understand few daily life situations-https://www.examfear.com/free-video-lesson/Class-10/Maths/Surface-Areas-Volumes/part-1.htm

https://www.examfear.com/free-video-lesson/Class-10/Maths/Surface-Areas-Volumes/part-2/Surface_Area_and_Volume_Part_2_(Surface_Area).htm

https://www.examfear.com/free-video-lesson/Class-10/Maths/Surface-Areas-Volumes/part-3/Surface_Area_and_Volume_Part_3_(Surface_Area_Examples).htm

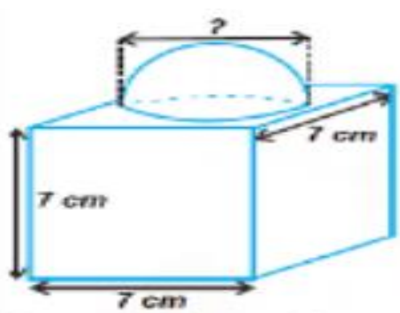
https://www.examfear.com/free-video-lesson/Class-10/Maths/Surface-Areas-Volumes/part-4/Surface_Area_and_Volume_Part_4_(Surface_Area_Examples).htm

https://www.examfear.com/free-video-lesson/Class-10/Maths/Surface-Areas-Volumes/part-5/Surface_Area_and_Volume_Part_5_(Surface_Area_Examples).htm

Q-4. Exercise 13.1

A cubical block of side 7 cm is surmounted by a hemisphere. What is the greatest diameter the hemisphere can have? Find the surface area of the solid. $\left[\text{Use } \pi = \frac{22}{7}\right]$

Solution-



From the figure, it can be observed that the greatest diameter possible for such hemisphere is equal to the cube's edge, i.e., 7cm.

Radius (r) of hemispherical part $= \frac{7}{2} = 3.5\text{cm}$

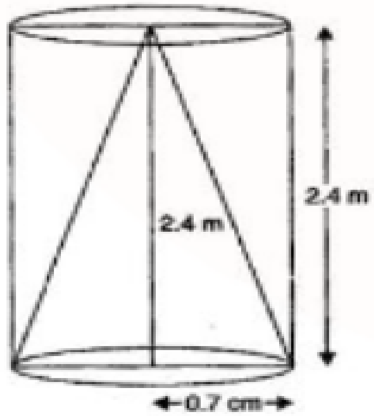
Total surface area of solid = Surface area of cubical part + CSA of hemispherical part
− Area of base of hemispherical part
$= 6\,(\text{Edge})^2 + 2\pi r^2 - \pi r^2 = 6\,(\text{Edge})^2 + \pi r^2$

Total surface area of solid $= 6(7)^2 + \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2}$
$= 294 + 38.5 = 332.5 \text{ cm}^2$

Q-8

From a solid cylinder whose height is 2.4 cm and diameter 1.4 cm, a conical cavity of the same height and same diameter is hollowed out. Find the total surface area of the remaining solid to the nearest cm^2. $\left[\text{Use } \pi = \frac{22}{7}\right]$

Solution-



Given that,

Height (h) of the conical part = Height (h) of the cylindrical part = 2.4 cm

Diameter of the cylindrical part = 1.4 cm
Therefore, radius (r) of the cylindrical part = 0.7 cm
Slant height (l) of conical part = $\sqrt{r^2 + h^2}$

$= \sqrt{(0.7)^2 + (2.4)^2} = \sqrt{0.49 + 5.76}$

$= \sqrt{6.25} = 2.5$

Total surface area of the remaining solid will be
= CSA of cylindrical part + CSA of conical part + Area of cylindrical base

$= 2\pi rh + \pi rl + \pi r^2$

$= 2 \times \frac{22}{7} \times 0.7 \times 2.4 + \frac{22}{7} \times 0.7 \times 2.5 + \frac{22}{7} \times 0.7 \times 0.7$

$= 4.4 \times 2.4 \times + 2.2 \times 2.5 + 2.2 \times 0.7$

$= 10.56 + 5.50 + 1.54 = 17.60\ cm^2$

The total surface area of the remaining solid to the nearest cm^2 is 18 cm^2

ASSIGNMENT- Questions to be discussed in class:

Q-1

2 cubes each of volume 64 cm^3 are joined end to end. Find the surface area of the resulting cuboids.

Q-2

A vessel is in the form of a hollow hemisphere mounted by a hollow cylinder. The diameter of the hemisphere is 14 cm and the total height of the vessel is 13 cm. Find the inner surface area of the vessel. $\left[\text{Use } \pi = \frac{22}{7}\right]$

Q-5

A hemispherical depression is cut out from one face of a cubical wooden block such that the diameter l of the hemisphere is equal to the edge of the cube. Determine the surface area of the remaining solid.

Q-7

A tent is in the shape of a cylinder surmounted by a conical top. If the height and diameter of the cylindrical part are 2.1 m and 4 m respectively, and the slant height of the top is 2.8 m, find the area of the canvas used for making the tent. Also, find the cost of the canvas of the tent at the rate of Rs 500 per m^2. (Note that the base of the tent will not be covered with canvas.)

$\left[\text{Use } \pi = \frac{22}{7}\right]$

Q-9.

A wooden article was made by scooping out a hemisphere from each end of a solid cylinder, as shown in given figure. If the height of the cylinder is 10 cm, and its base is of radius 3.5 cm, find the total surface area of the article.

$\left[\text{Use } \pi = \frac{22}{7}\right]$

HW- Q-3, 6

Block 2

Activity - Students will create mindmaps on surface area and Volume of 3-D objects.

Refer to the following link:

https://www.examfear.com/free-video-lesson/Class-10/Maths/Surface-Areas-Volumes/part-6/Surface_Area_and_Volume_Part_6_(Volume_Examples).htm

https://www.examfear.com/free-video-lesson/Class-10/Maths/Surface-Areas-Volumes/part-7/Surface_Area_and_Volume_Part_7_(Volume_Examples).htm

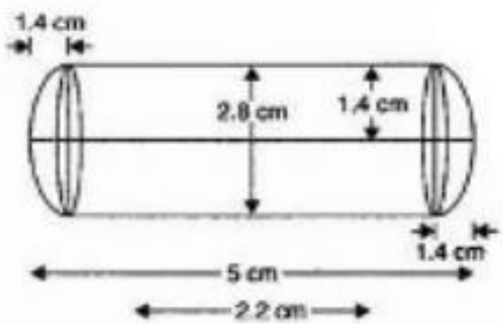
Lesson Development:-

Exercise 13.2 (Volume Application Questions)

Q-3

A gulab jamun, contains sugar syrup up to about 30% of its volume. Find approximately how much syrup would be found in 45 gulab jamuns, each shaped like a cylinder with two hemispherical ends with length 5 cm and diameter 2.8 cm (see the given figure). $\left[\text{Use } \pi = \frac{22}{7}\right]$

Solution-



It can be observed that

Radius (r) of cylindrical part = Radius (r) of hemispherical part

$$= \frac{2.8}{2} = 1.4 \text{ cm}$$

Length of each hemispherical part = Radius of hemispherical part = 1.4 cm

Length (h) of cylindrical part = 5 − 2 × Length of hemispherical part

$$= 5 - 2 \times 1.4 = 2.2 \text{ cm}$$

-

Volume of one gulab jamun = Vol. of cylindrical part

$$+ 2 \times \text{Vol. of hemispherical part}$$

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

$$= \pi \times (1.4)^2 \times (2.2) + \frac{4}{3}\pi (1.4)^3$$

$$= \frac{22}{7} \times 1.4 \times 1.4 \times 2.2 + \frac{4}{3} \times \frac{22}{7} \times 1.4 \times 1.4 \times 1.4$$

$$= 13.552 + 11.498 = 25.05 \text{ cm}^3$$

Volume of 45 gulab jamuns = $45 \times 25.05 = 1{,}127.25 \text{ cm}^3$

Volume of sugar syrup = 30% of volume

$$= \frac{30}{100} \times 1{,}127.25$$

$$= 338.17 \text{ cm}^3$$

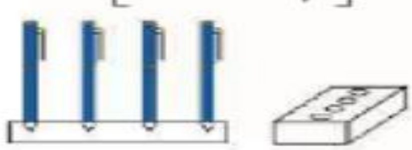
ASSIGNMENT-

Q-1

A solid is in the shape of a cone standing on a hemisphere with both their radii being equal to 1 cm and the height of the cone is equal to its radius. Find the volume of the solid in terms of π.

Q-4

A pen stand made of wood is in the shape of a cuboid with four conical depressions to hold pens. The dimensions of the cuboids are 15 cm by 10 cm by 3.5 cm. The radius of each of the depressions is 0.5 cm and the depth is 1.4 cm. Find the volume of wood in the entire stand (see the following figure). $\left[\text{Use } \pi = \frac{22}{7}\right]$



HW-Exercise-13.2, Q-2

Block 3

Activity- Refer to the following link:

https://www.examfear.com/free-video-lesson/Class-10/Maths/Surface-Areas-Volumes/part-8/Surface_Area_and_Volume_Part_8_(Volume_Examples).htm

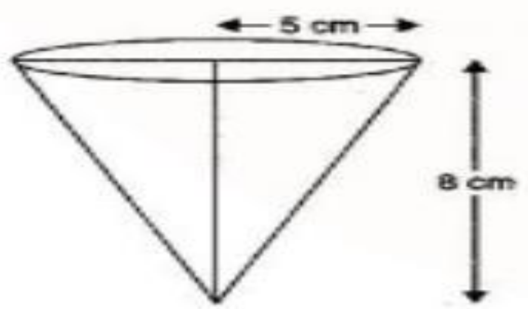
https://www.examfear.com/free-video-lesson/Class-10/Maths/Surface-Areas-Volumes/part-9/Surface_Area_and_Volume_Part_9_(Volume_Examples).htm

Lesson Development:

Q-5

A vessel is in the form of an inverted cone. Its height is 8 cm and the radius of its top, which is open, is 5 cm. It is filled with water up to the brim. When lead shots, each of which is a sphere of radius 0.5 cm are dropped into the vessel, one-fourth of the water flows out. Find the number of lead shots dropped in the vessel.

Solution-



Height (h) of conical vessel = 8 cm
Radius (r_1) of conical vessel = 5 cm
Radius (r_2) of lead shots = 0.5 cm

Let n number of lead shots were dropped in the vessel.

Volume of water spilled = Volume of dropped lead shots

$$\frac{1}{4} \times \text{volume of cone} = n \times \frac{4}{3} r_2^3$$

$$\frac{1}{4} \times \frac{1}{3} \pi r_1^2 h = n \times \frac{4}{3} \pi r_2^3$$

$$r_1^2 h = n \times 16 r_2^3$$

$$5^2 \times 8 = n \times 16 \times (0.5)^3$$

$$n = \frac{25 \times 8}{16 \times \left(\frac{1}{2}\right)^3} = 100$$

Hence, the number of lead shots dropped in the vessel is 100.

ASSIGNMENT-

Q-6

A solid iron pole consists of a cylinder of height 220 cm and base diameter 24 cm, which is surmounted by another cylinder of height 60 cm and radius 8 cm. Find the mass of the pole, given that 1 cm^3 of iron has approximately 8 g mass. [Use $\pi = 3.14$]

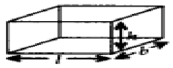
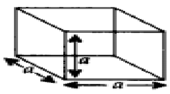
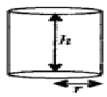
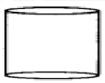
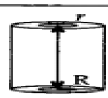
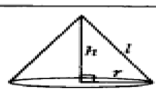
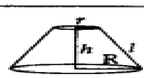
Q-7

A solid consisting of a right circular cone of height 120 cm and radius 60 cm standing on a hemisphere of radius 60 cm is placed upright in a right circular cylinder full of water such that it touches the bottom. Find the volume of water left in the cylinder, if the radius of the cylinder is 60 cm and its height is 180 cm. $\left[\text{Use } \pi = \frac{22}{7}\right]$

H w- Q-8 (13.2)

Summary-

TABLE FOR SURFACE AREA AND VOLUME

Solid	Figures	Curved surface area (1)	Plane area (2)	Total area [1 + 2]	Volume	Remarks
Cuboid		Also known as lateral surface area $= 2(lh + bh)$	Area of: Top face $= lb$ Bottom face $= lb$ $\therefore lb + lb = 2lb$	$2(lb + bh + hl)$	$l.b.h$	l : length b : breadth h : height
Cube		Lateral surface area $= 4a^2$	Area of: Top face $= a^2$ Bottom face $= a^2$ $\therefore a^2 + a^2 = 2a^2$	$4a^2 + 2a^2 = 6a^2$	a^3	a : Side of cube
Right circular cylinder closed at top		Curved surface area $= 2\pi rh$	Area of: Top face $= \pi r^2$ Bottom face $= \pi r^2$ $\therefore \pi r^2 + \pi r^2 = 2\pi r^2$	$2\pi r^2 + 2\pi rh$ Or, $2\pi r(r + h)$	$\pi r^2 h$	r : radius h : height of cylinder
Right circular cylinder open at top		Curved surface area $= 2\pi rh$	Area of: Top face $= 0$ Bottom face $= \pi r^2$ $\therefore 0 + \pi r^2 = \pi r^2$	$2\pi rh + \pi r^2$ Or, $\pi r(2h + r)$	$\pi r^2 h$	r : radius h : height of cylinder
Hollow cylinder (Pipe)		$2\pi Rh$ • External surface area $= 2\pi Rh$ • Internal surface area $= 2\pi rh$	Area of: Top face $= \pi(R^2 - r^2)$ Bottom face $= \pi(R^2 - r^2)$	$2\pi Rh + 2\pi rh + 2\pi(R^2 - r^2)$	$\pi R^2 h - \pi r^2 h$ (External Vol. – Internal Vol.)	R : Radius of outer base r : radius of inner base h = height
Cone		πrl	Area of: Bottom Face $= \pi r^2$	$\pi r^2 + \pi rl$ Or, $\pi r(r + l)$	$\frac{1}{3}\pi r^2 h$	h = height of cone r = radius of cone l = slant height $= \sqrt{h^2 + r^2}$
Frustum		$\pi l(R + r)$	Area of: Top Face $= \pi r^2$ Bottom Face $= \pi R^2$	$\pi r^2 + \pi R^2 + \pi l(R + r)$	$\frac{1}{3}\pi h \cdot (R^2 + r^2 + Rr)$	h = height of frustum r = radius of top face R = Radius of base l = slant height
Sphere		$4\pi r^2$	None	$4\pi r^2$	$\frac{4}{3}\pi r^3$	r : radius of sphere
Hemisphere		$2\pi r^2$	πr^2	$3\pi r^2$	$\frac{2}{3}\pi r^3$	r : radius of hemisphere
Spherical shell		$4\pi R^2$ (Outer) $4\pi r^2$ (Inner)	None	$4\pi R^2 + 4\pi r^2$	$\frac{4}{3}\pi \cdot (R^3 - r^3)$	R:Radius of outer shell r:Radius of inner shell

Assignment-

1. The ratio of lateral surface area to the total surface area of a cylinder with base diameter 1.6m and height 20cm is

a) 1:7 b) 1:5 c) 7:1 d) 5:1

2. If the radius of the base of a right circular cylinder is halved, keeping the height the same, then the ratio of the volume of the cylinder thus obtained to the volume of original cylinder is:

a)1:2 b) 2:1 c) 1:4 d) 4:1

3. What cross section is made by a cone when it is cut parallel to its base?
4. A solid shape is converted from one form to another. What is the change in its volume?
5. A cylinder, a cone and a hemisphere are of the same base and have the same height. What is the ratio of their volumes?
6. Find the length of the longest rod that can be put in a room of 10m X 10m X 5m.

1. Refer to the following links to practice more questions:

a)
https://diksha.gov.in/play/collection/do_3129243959686676481258?referrer=utm_source%3Ddiksha_mobile%26utm_content%3Ddo_3129243959686676481258%26utm_campaign%3Dshare_content

b) From Khan Academy Assignments

https://www.khanacademy.org/math/in-in-grade-10-ncert

c) www.examfear.com

d) http://www.ei-india.com/mindspark-math (free trial for 60 days)

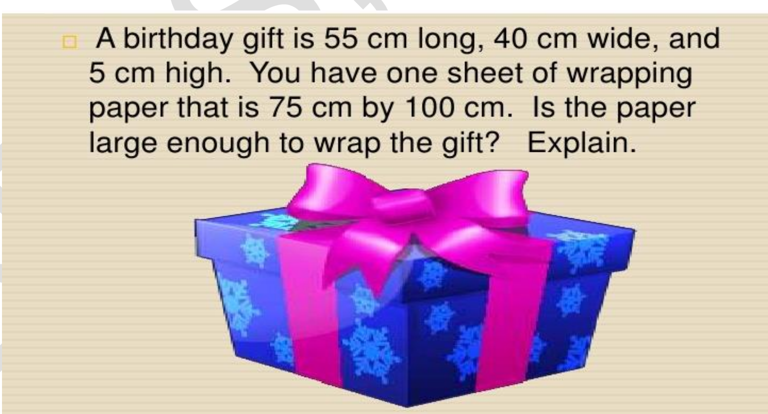
Applications of Surface Area and Volume in Real Life-

Uses of Volume in Daily Life

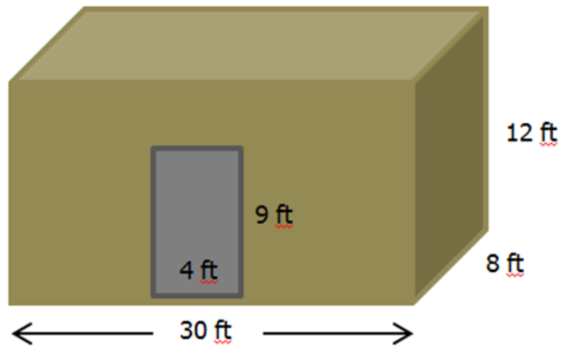
- Bottoms Up. One of the main ways **volume** is used **daily** is when calculating drinking amounts. ...
- Fueling Up. When you fill up your vehicle, the **volume** of gasoline your gas tank holds determines your purchase. ...
- Cooking and Baking. ...
- Cleaning House. ...
- Water Conservation. ...
- Swimming Pools and Hot Tubs.

Uses of Surface Area in Daily Life-

Wrapping



Construction


12 ft
9 ft
4 ft
8 ft
30 ft