Mensuration

Learning Objectives

- Mensuration
- Visualizing Solid Shapes

Mensuration

Mensuration is the branch of mathematics which deal with the study of geometric shapes, their area, volume and related parameters. Some important formulae of area and volume are listed below.

Area of some plane figures:

Figure	Shape	Area
Rectangle		a×b
Square		a^{2} $\frac{1}{2}d_{1}d_{2}$ Where $d_{1} = d_{2} = \sqrt{2}a$
Triangle		$\frac{1}{2} \times b \times h$
Parallelogram	a h a	$b \times h$
Rhombus	a h d_2 a a a a	$a \times h$ $\frac{1}{2}d_1d_2$ where $d_1^2 + d_2^2 = 4a^2$
Trapezium	h b	$\frac{1}{2}h(a+b)$
Circle		πr^2

Area and volume of some solid figures:

Figure	Shape	Total Surface area	Volume
Cube	a	6a ²	a ³
Cuboid	h h	2(lb+bh+hl)	lbh
Cylinder	r h	$2\pi r (r + h)$ where $\pi r^{2} = \text{Surface area of top}$ $\pi r^{2} = \text{Surface area of bottom}$ $2\pi r h = \text{Curved surface area}$	$\pi r^2 h$
Cone	h n	$\pi r^{2} + \pi r l$ where $\pi r^{2} = \text{surface area of base}$ $\pi r l = \text{curved surface}$ Here	$\frac{1}{3}\pi r^2h$

Some important conversions should also keep in mind.

 $1 cm^2 = 1 mL$ $1 L = 1000 cm^3$ $1m^2 = 10000 cm^3 = 1000L$

Visualizing Solid Shapes

- **Polyhedrons:** A **polyhedron** is a solid in three dimensions with flat faces, straight edges and sharp corners or vertices.
- **Convex polyhedrons:** A polyhedron is said to be convex if its surface (comprising its faces, edges and vertices) does not intersect itself and the line segment joining any two points of the polyhedron is contained in the interior or surface.
- **Concave polyhedron:** A polyhedron is said to be concave if there exist two points inside it such that the line segment drawn between them contains points that are not in the polyhedron.
- **Regular polyhedrons:** A polyhedron is said to be regular if its faces are made up of regular polygons and the same number effaces meet at each vertex.
- **Euler's formula:** For any polyhedron, F + V E = 2 where 'F' stands for number of faces, V stands for number of vertices and E stands for number of edges.

Commonly Asked Questions

1. A 'T' shaped letter is made by sticking together 2 cuboids as shown in the diagram. What is the total volume of the letter 'T'?



(a) $57 cm^3$ (b) $64 cm^3$ (c) $48 cm^3$ (d) $25 cm^3$ (e) None of these **Answer: (c) Explanation:** Volume of upper part $= 7 \times 2 \times 2 = 28 cm^3$. Volume of lower part $= 5 \times 2 \times 2 = 20 cm^3$. Total volume $= 20 + 28 = 48 cm^3$.

2. A polyhedron has 12 faces and 20 vertices. It contains how many edges?

(a) 12 (b) 32 (c) 30 (d) 4 (e) None of these Answer: (c) Explanation: Using Euler's Formula, F + V - E = 2 \Rightarrow 12+20- $E = 2 \Rightarrow E = 32 - 2 = 30$