Unit EU

Mensuration is a system to quantify measurements in real life. Measures like perimeter, area, surface area and volume help us solve optimisation problems involving 2D or 3D spaces.

Unit EQs

- What is perimeter?
- What is area?
- What is volume?
- What is surface area?

Unit Objectives

- Calculate perimeter and area of composite plane figures, including parallelogram and trapezium
- Calculate volume and surface area of composite solids, including cube, cuboid, prism, cylinder, pyramid, cone and sphere
- Convert between cm2 and m2, and between cm3 and m3

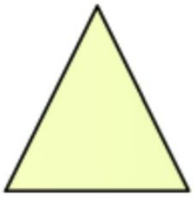
GCE O-Level Syllabus

G5	**Mensuration**	• area of parallelogram and trapezium • problems involving perimeter and area of composite plane figures • volume and surface area of cube, cuboid, prism, cylinder, pyramid, cone and sphere • conversion between cm^2 and m^2, and between cm^3 and m^3 • problems involving volume and surface area of composite solids • arc length, sector area and area of a segment of a circle • use of radian measure of angle (including conversion between radians and degrees) **Will be covered in Sec 3 and 4.**

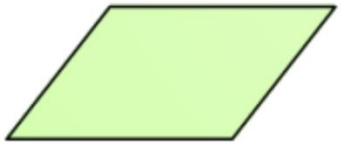
Plane figures are two-dimensional (**2-D**).

Square

Rectangle

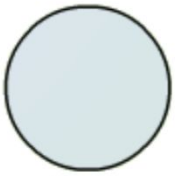


Triangle



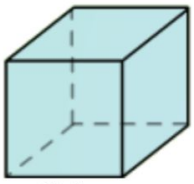
Parallelogram

Trapezium

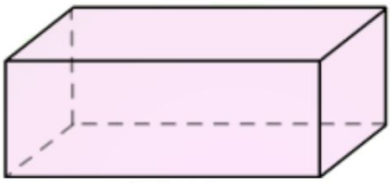


Circle

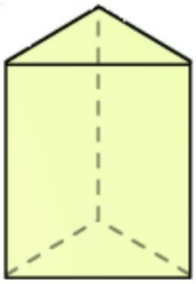
A solid is three-dimensional (**3-D**).



Cube

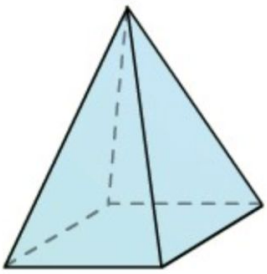


Cuboid

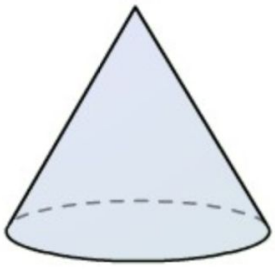


Prism

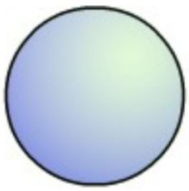
Cylinder



Pyramid

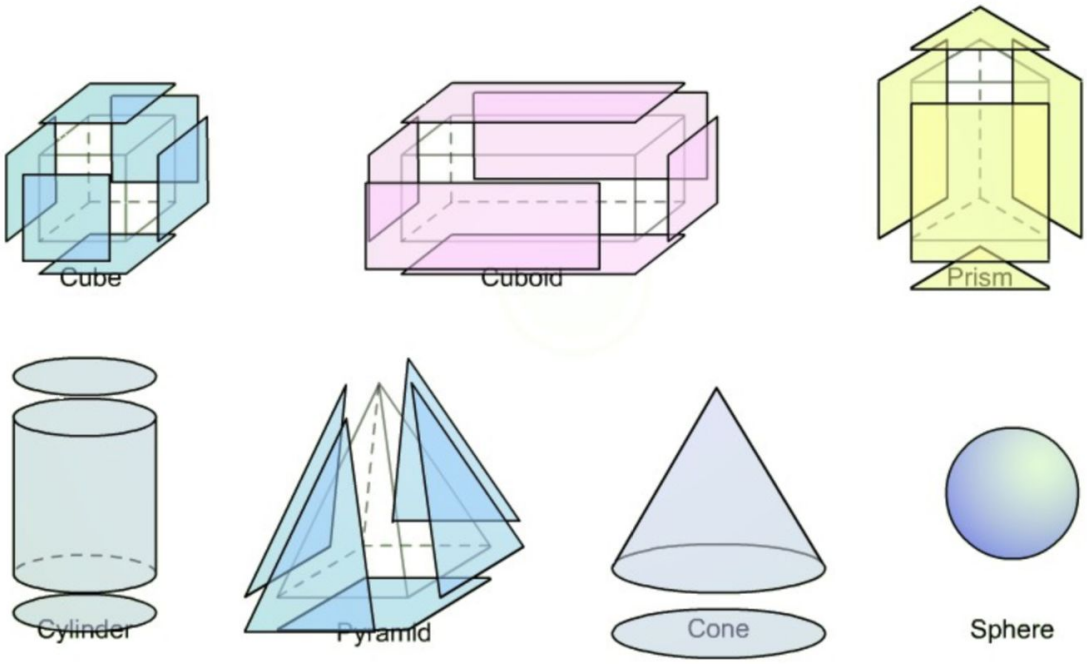


Cone

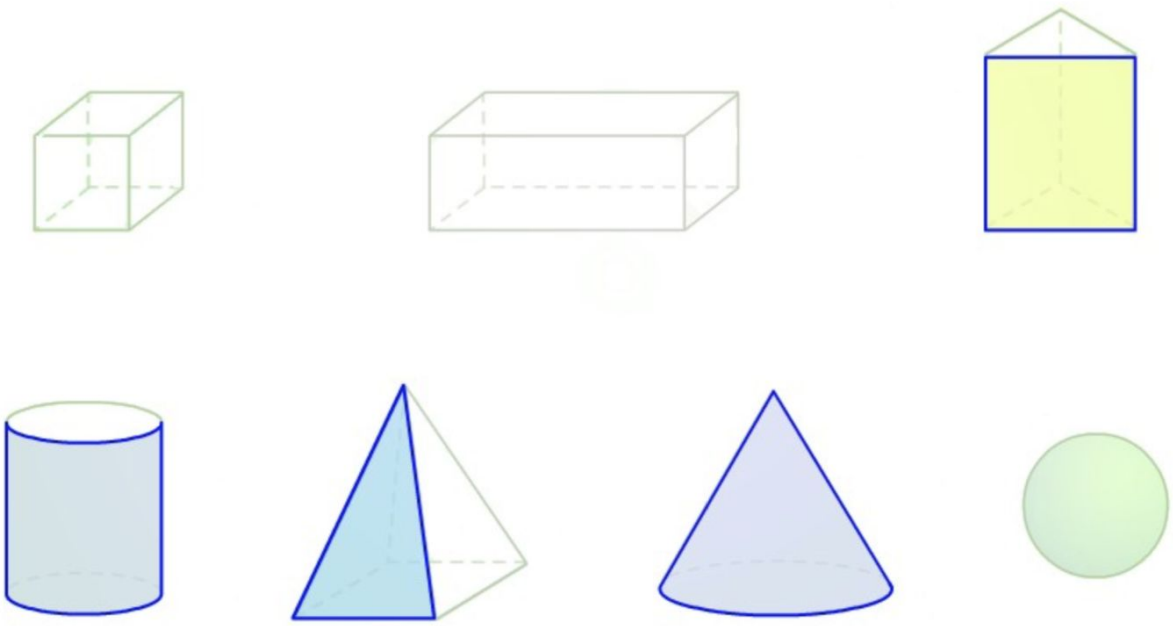


Sphere

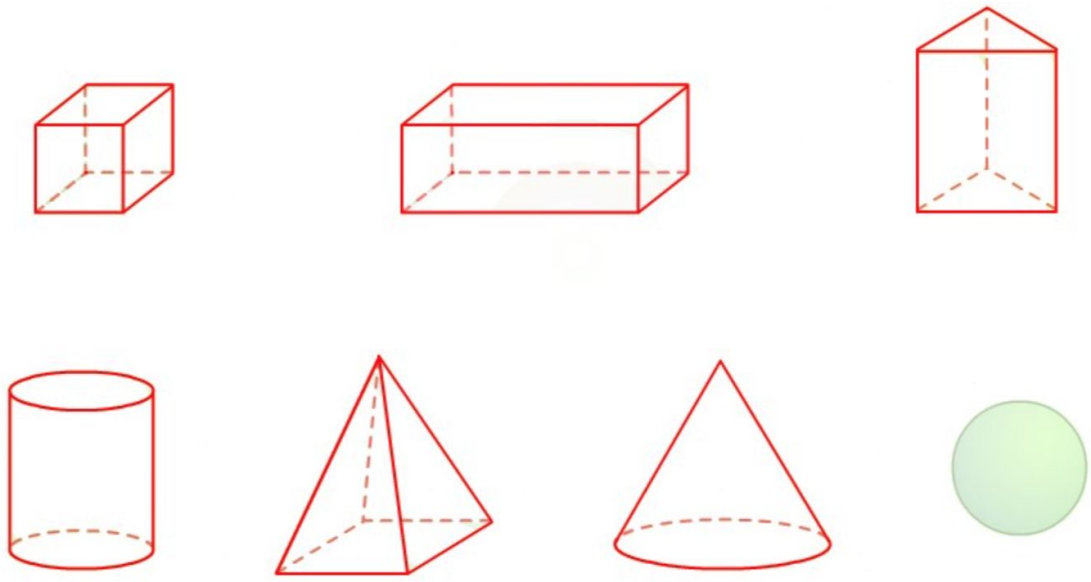
Each of these plane surfaces is called a **face** of the solid.



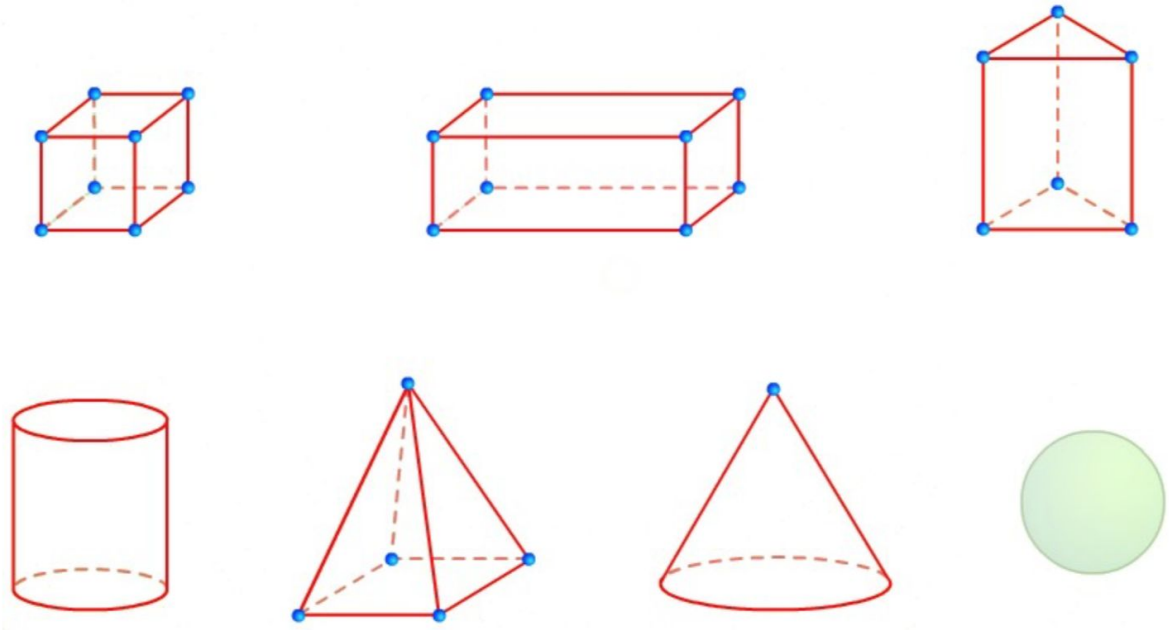
The face of a solid on its sides, that is, any face that is not the end faces, is known as the **lateral face**.



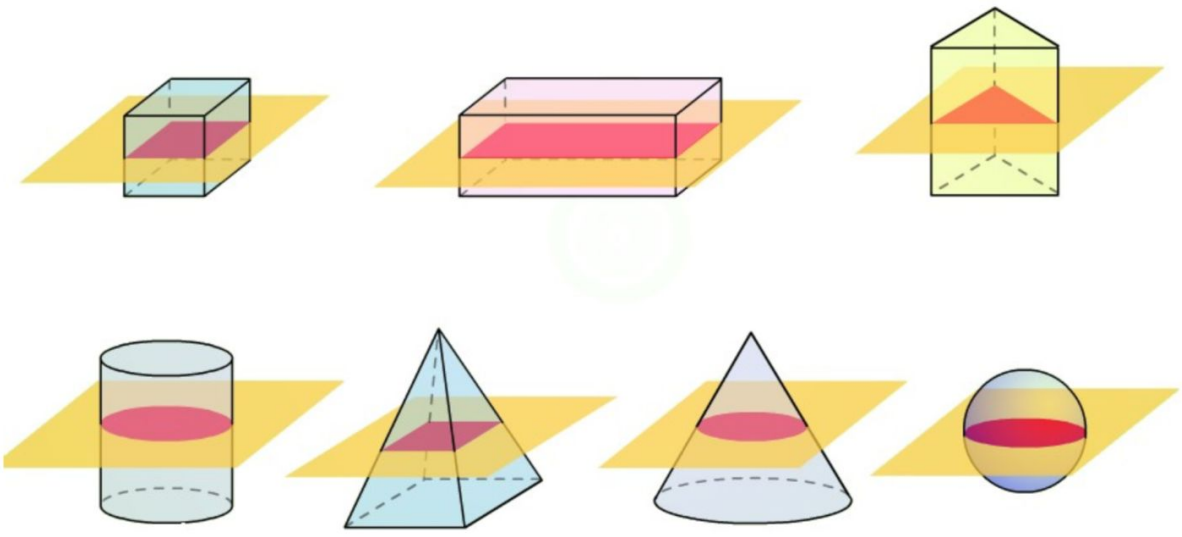
The **edge** is the line where 2 faces meet.



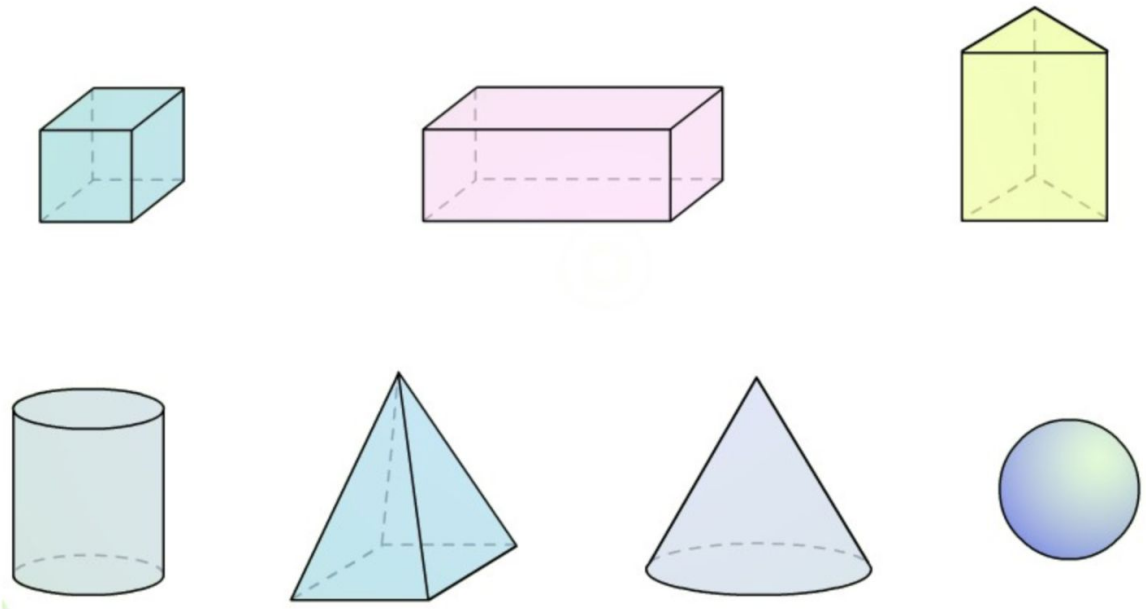
The **vertex** is the point where edges meet.



The **cross-section** is obtained by the intersection of that solid with a plane.

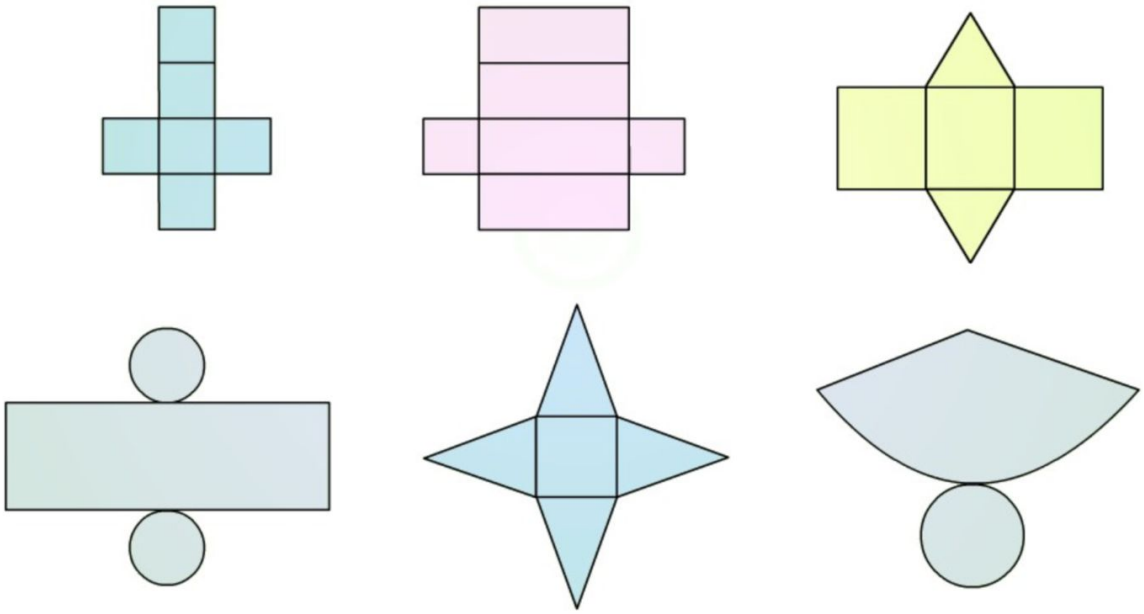


The **amount of space** a solid occupies is its **volume**.

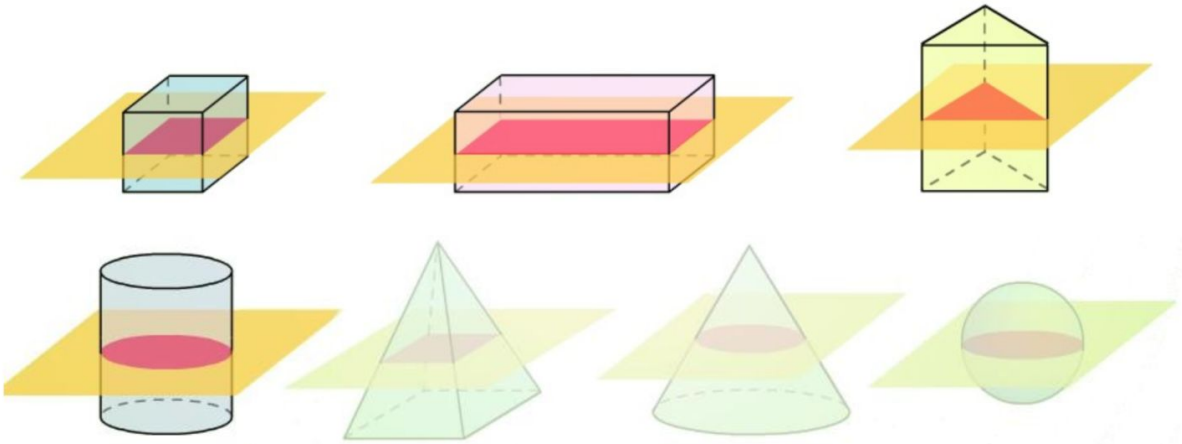


The **total area of the net** of a solid is the solid's **total surface area.**

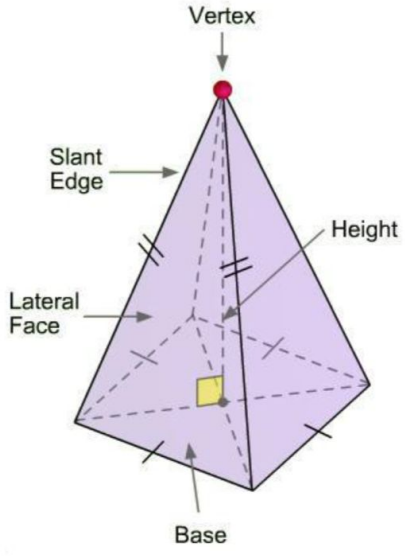
The net of a solid is a two-dimensional figure that can be cut out and folded up to form a solid.



A solid is said to have **uniform cross-section** if the cross-section is identical to its two parallel ends.



Parts of a pyramid



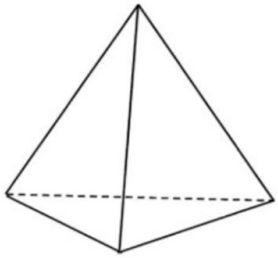
1. **Base:** Its shape defines the name of the pyramid.
2. **Lateral face:** The triangular faces between the base and the vertex.
   In a right pyramid, the lateral face is an isosceles triangle.
3. **Vertex (Apex):** Point where all the lateral faces meet.
4. **Height:** Perpendicular distance between the base and the vertex.
5. **Slant edge:** The common edge between two adjacent lateral faces.
6. **Slant height:** The distance between the vertex and the mid-point of an edge of the base.

A tetrahedron has the following properties:

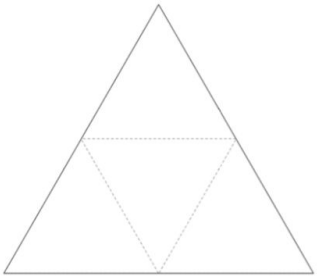
- it is a special pyramid with a triangle base (also called triangular pyramid)
- the net consists of all triangles only
- a <u>regular</u> tetrahedron has all sides as equilateral triangles

Volume and surface area is calculated in the same way as a pyramid.
For a regular tetrahedron, the surface area can be easily obtained by find the area of 1 side (triangle) and multiplying by 4.

Examples of tetrahedrons:



Solid



Net

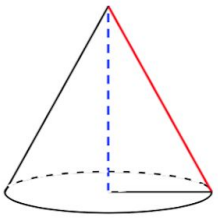
<u>Real Life Applications</u>

4-sided die

5 stones

A cone has the following properties:

- it is a special pyramid with a circle base (also called circular pyramid)
- it has 2 sides (base and curved side)



Volume is calculated using the formula: _____

(Derived from volume of pyramid)

Surface area is calculated using the formula: _____

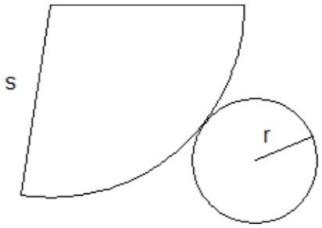
(Derived from the base and the curved side. Refer to handout)

<u>Real Life Applications</u>

Ice-cream cone

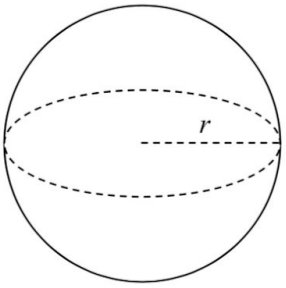
Traffic cone

Wheelock Place



A sphere has the following properties:

- equal radius /diameter throughout



Let's find the formula for the volume of a sphere by conducting an experiment.

3. Get a sphere with radius, r units, and an open cylinder (no lid) with base radius, r units, and a height of $2r$ units
4. Fill the cylinder with water.
5. Place the sphere into the cylinder; observing that there is a displacement of water.
6. Remove the sphere. Observe that the height of the water in the cylinder is only one-third left.

$$\begin{aligned}\text{Volume of a sphere} &= \frac{2}{3} \times (\text{Volume of a cylinder}) \\ &= \frac{2}{3} \times \text{Base area} \times \text{Height} \\ &= \frac{2}{3} \times \pi r^2 \times 2r \\ &= \frac{4}{3} \pi r^3 \text{ units}^3\end{aligned}$$