

# Physics

## Chapter 39 – Measurement

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Quantity	Units	Measured with...
Length	Centimetre (cm) or metre (m)	Metre stick / ruler
Mass	Grams (g) or kilograms (kg)	Weighing scales
Volume	Cubic centimetres (cm <sup>3</sup> ) or litres (l)	Graduated cylinder
Area	Centimetres squared (cm <sup>2</sup> ) or metres squared (m <sup>2</sup> )	Length × width
Time	Seconds (s) or minutes	Stopwatch

### Measurement

#### **To measure the length of a curved line using an opisometer**

*An opisometer is a device used for measuring curved lines.*

#### **Procedure:**

Spin the wheel to the end of the thread. Run it along the full length of the line being measured. Run it backwards along a ruler and note where the opisometer stops. Read the length.

**Note:** The opisometer is often used to measure distances on a map, especially windy roads.



### To measure the length of a field using a trundle wheel

Stand at one end of the field and turn the trundle wheel to the zero mark.

Push the wheel along the ground to the other end of the field and note that it makes a loud clicking sound.

Count the clicks, each click represents 1 metre.

#### Result:

The length of the field is the total number of clicks.



### Vernier Callipers

Vernier callipers are used to measure the internal or external diameters of cylinders or to measure the thickness of something.

#### Procedure:

Place the object between the sliding jaws, close them firmly on the object and read the scale.

#### To find the thickness of a single page

Place 100 pages between the jaws of the vernier callipers; close firmly and read the scale.

Divide the thickness by 100 and the answer is the thickness of one page.



### To find the area of a page

#### Procedure:

Measure the length and breadth of the page in centimetres using a ruler.

Remember that  $\text{area} = \text{length} \times \text{breadth}$

Multiply the length by the breadth and the answer is the area of the page in  $\text{cm}^2$ .



Width

Length

### To find the volume of a cube

The volume of a cube is calculated using the formula:

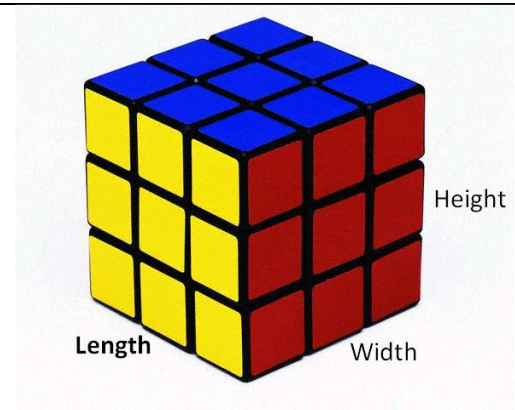
$$\text{Volume} = \text{length} \times \text{breadth} \times \text{height}$$

#### Procedure:

Measure the length, breadth and height of the cube using vernier callipers or a ruler.

Multiply these together to get the answer to get the volume of the cube.

**Note:** the unit that volume is measured in is the  $\text{cm}^3$  or litre.



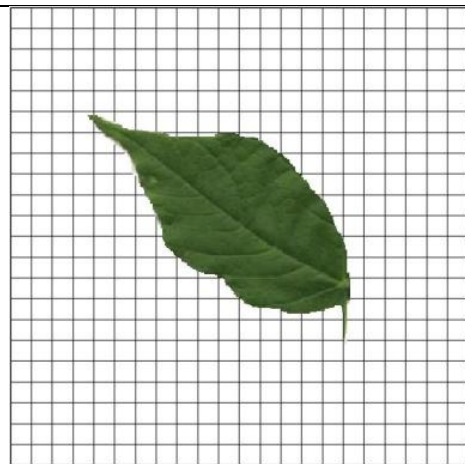
### To find the area of a leaf

#### Procedure:

Place the leaf on a sheet of graph paper. Mark the outline of the leaf with a pencil. Count the number of squares inside the line. If the line passes through a box, record it as half or nothing only. Add up the total and this is the area of the leaf.

#### Note:

Each square of the graph paper is usually  $1 \text{ mm}^2$



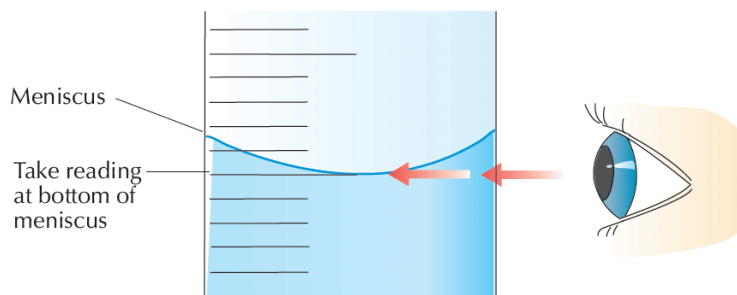
### To read a graduated cylinder accurately

The surface of water becomes curved when in a glass container. If the volume of water in a graduated cylinder is being read, care must be taken to read the lower meniscus because it gives a more accurate reading

#### Procedure:

Half fill a graduated cylinder with water.

Place your eye level with the surface of the water and read the lower meniscus.



The top surface of the water is called the **meniscus**.

#### Note:

Parallax error occurs when the scale on a graduated cylinder is being read without keeping your eye level with the scale. To avoid parallax error, keep the eye level with the mark on the scale that is being read.

### To measure the volume of a small stone

#### Procedure:

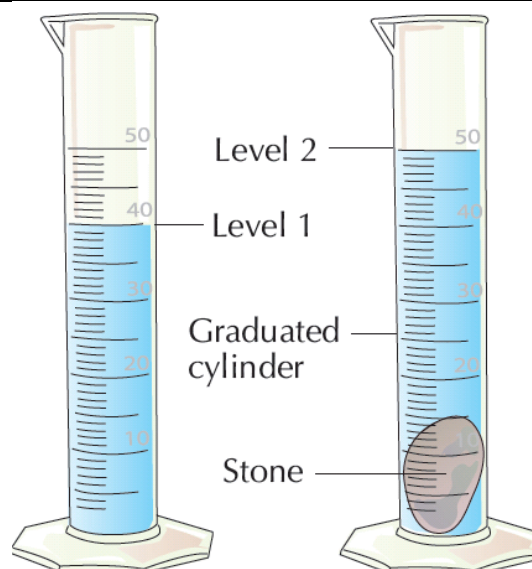
Half fill a graduated cylinder with water.

Read the volume.

Lower the stone into the cylinder.

Read the volume again.

Subtract the two readings and the answer is the volume of the stone.



## To measure the volume of a large stone

### Procedure:

Fill an overflow can above the spout and allow to overflow.

Lower in the stone carefully trying not to disturb the water too much.

Collect the overflow in the graduated cylinder.

Read the volume of water in the graduated cylinder and this is equal to the volume of the stone.

