4 Measurements

• **Mass :**

What is required? Two cups, water

What to do?

• Take two cups of same size.
• Fill one of the glasses up to half level and the other completely with water.
• Put these glasses (with the help of a friend) on your palm, simultaneously.

   (1)   Which cup appears heavy?

_____

_____

   (2)   Why?

_____

_____

• The glass completely filled with water contains more quantity (mass) of water.
• The amount of quality of material possessed by the object is known as mass. It is expressed as 'm'
• The mass of the same object increases with increase in quantity of mass.

Fill one cup with water and the other with sand completely and put them on your palm simultaneously.

   (1)   Which glass appears heavier?

_____

_____

   (2)   Why?

_____

_____

• The mass of different types of substances having same volume is different.

_____

_____

- Repeat the same activity by taking two different type of substances. Which substance has higher mass? Note it.

_____

_____

_____

So far as the quantity of the substances presant in does not change the mass of the substances does not change. Mass of substances remains same every where.

Different types of physical balances and weight boxes are used for the measurements of mass.

Fig. 4.1 Different types of balance

Where do we use these types of balances (physical balances)?

For the measurements of mass of chemicals with specified volume in laboratory, gold, silver, or diamond, the balances shown in fig. 4.2 are used.
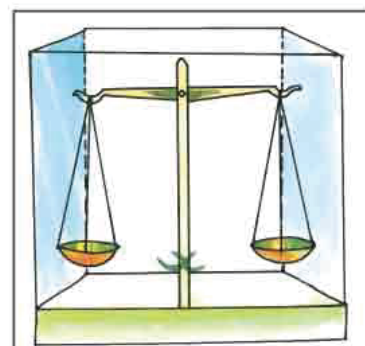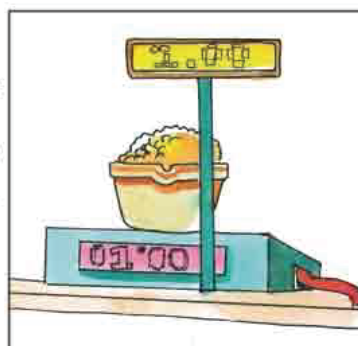

Fig. 4.2

Why are these types of balances kept in glass box?

_____

_____

_____

● **Measurement of mass :**

Figure 4.3 (Differant weights)

What is required? Balance, weights, sand, wheat

What to do?

●   Take a balance as shown in fig. 4.4.

●   Get different weights from weight box.

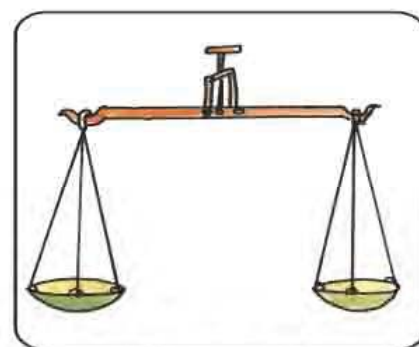●   Weigh500 gm same with this balance.

Figure 4.4

What have you done for that?

_____

_____

_____

●   Pour wheat in one of the part of the balance. Find what is the mass of wheat.

Mass of Wheat = _____

What have you done for that?

_____

_____

We measure the mass of wheat or sand in gram or kilogram. Gram (gm) and kilogram (kg) are the units of measure of mass.

Kilogram is a standard measure of mass. It is expressed as kg.

What is required : Balance, weights

What to do?

- Take one balance. Put 1 kg weight in one of the pans.
- Put the different weights in grams in the other pan and balance the balance.
- What is the weight of gram measurement equivalent to 1 kg in other pan?

_____

_____

_____

- 1 Kilogram (kg) = 1000 gram (gm)

We use the unit like ton for purchase of quantities in more proporations.

- 1 Ton = 1000 (kg) kilogram.

The units of mass used in prace line are as follows.

1 share = Approximately = 500 gram (g)
1 man = 20 kilogram (kg)
1 quintal = 100 kilogram (kg)
1 Qunintal = 1000 kilogram (kg)

- **Weight**

Fig. 4.5   Different weighing units

What is gravitational force ?

The gravitational force acting on any substance at any place is known as weight of the substance at that place. It is denoted by 'W'. Spring balance is used to measure weight.

The weight of any object can be calculated using the following formula :

w=mg [where m=mass of the substances
g= gravitational acceleration)
$g = 9.8$ m/sec^2 and the of g is m /sec^2]

What is the unit (measure) of mass?

_____

_____

What will be the unit of weight?

_____

The unit of weight 'N' is known as Newton in memory of Newton)

● **Measures of weight**

● Mass of Jay is 30 kg, find his weight

w = mg

= 30 x 9.8

= 294 N or 294 kgm / sec^2

Similarly, find the weight of your five different friends.

No.	Name of friend	Mass (m) (kg)	Weight W (N)

Measure the weight using spring balance.

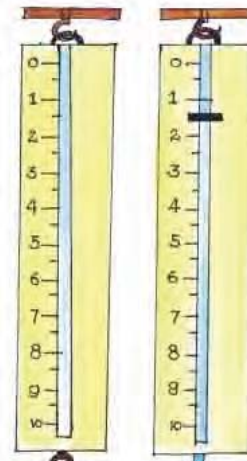| No	Object	Weight W (N)
1	stone	
2	Compass box	
3	Book	
4		
5		
6		
7		

Figure 4.6

Gravitational force on the moon is one sixth that acts on the objects on the earth : hence weigh of substances ing 60 N on the earth will be 10N on the moon.

Earth is bulged at equator and The valuse gravitational force is zero at the centre of the earth. The value of gravitational force increases as we move away from the centre of the earth, while substances on the polar region is comparatively near to the centre of the earth, its weight is more there.

Write the differences : mass and weight

Mass	Weight

Measurement of volume :

What is required? two bowls, grains of peas and mung.

What to do?

- Get two equal bowls.

- Fill the grains of peas in one and grains of mung in the other

- Which grains are required more in number to fill boal?

  why?_____

  _____

Which type of ball, from volley ball or cricket ball, occupies more space?

_____

_____

What a compass box or your text book of science and technology, occupies more space?

_____

_____

The space occupied by a substances is known as volume, Volume of a substances is what is expressed as 'V'

What is required? one jug, one cup, water.
What to do?

- Take the jug and the cup and fill both with water. _____

- In which is there more of water? _____

"The capacity of any vassel to accommodate more amount of the liquid is called or holdering capacity or beaming "

- **Units of (measure) of volume :**

  - The standard unit of volume is cubic meter or meter^3.

  - The smaller unit of volume is cubic centrimeter (C.C.) or cm^3

    1 cubic meter = metre^3

    $$= 1 \text{ meter} \times 1 \text{ meter} \times 1 \text{ meter}$$

    $$= 100 \text{ cm} \times 100 \text{ cm} \times 100 \text{ cm}$$

    $$= 1000000 \text{ cubic (centimeter) or .cm}^3 = 10^6 \text{ cm}^3.$$

- Litre and milliliter are otherunits of measurement of volume of, their symbols are L and ml respectively.

What is required? Different measuring units, water

What to do?

- Fill the litter measuring unit with water using milliliter measuring units.

- How much of water is required to fill 1 liter? _____

    1 Litter = 1000 milliliter _____

    1 litter = 1000 cubic (cm) = 1000 cm^3. ∴ 1 milliliter = 1 cubic cm (1 cm^3)

- Volume of liquid can be measured by two methods.

    (1) With the help of measuring units

    (2) With the help of scaled measuring flasks.

With the help of measuring units

Where do we use the measuring units shown in figure 4.7?

_____

_____

Fig. 4.7 (cone shaped measuring units)

Where do we use measuring units shown in fig. 4.8 ?
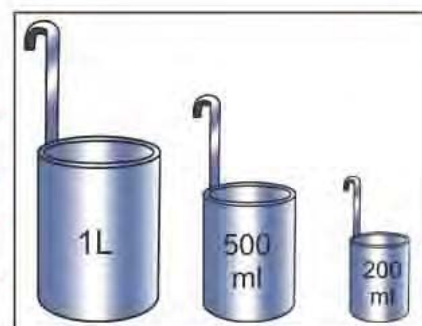

_____

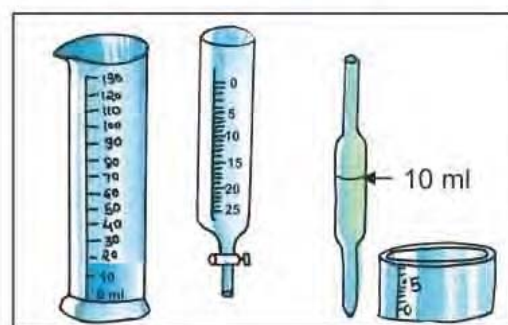_____

_____

Figure 4.8

What is required? a bucket, a jug, a pot, a glass, a water bottle and water

What to do?

• How much water is filled in each of the above vassles? Find with the help of measuring units.

No.	Vassel	Volume of the water (litre)
1.	Bucket	
2.	Jug	
3.	Cup	
4.	Earthen pot	
5.	Water bottle	
6.		
7.		

Where are the apparatus shown in fig. 4.9 used?

_____

_____

_____

Flask, burate pipet scaled units (Fig. 4.9)

Measurement of volume of liquid pipette.

What is required? Pipette, water

What to do?

- Take a pipette, observe it.
- How much volume of liquid a pipette can measure?
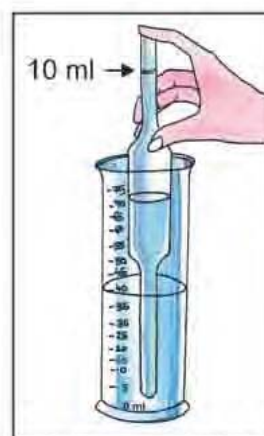
_____

_____

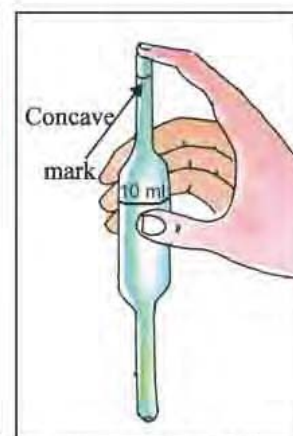10 ml →

Figure 4.10

Concave mark

10 ml

Figure 4.11

- As shown in fig. 4.10 dip the pointed tip of the pipette in the water.
- Suck the water through the open end of the pipette.
- Fill the pipette completely with water. Put your finger or thumb immediately on the upper open end of the pipette after removal from your mouth, so that the water will not from below. (as in fig. 4.11)

Figure 4.12

- Put the water level mark on pipet in front of your eyes (horizontally)
- Removing the finger slowly from the upper and of the the water will flow out. Remove from the pipette, so that the concave surface part of the water shown comes to the mark in the figure.

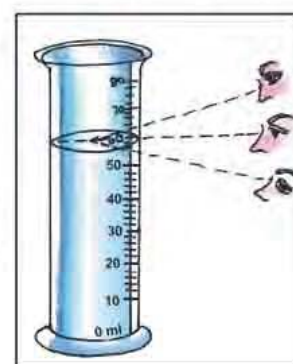**Volume Measurement by measuring cylinder :**

What is required? a pipette, a measuring cylinder, water

What to do?

- Take a pipette. Take 10 ml water with pipette and fill tin measuring cylinder.
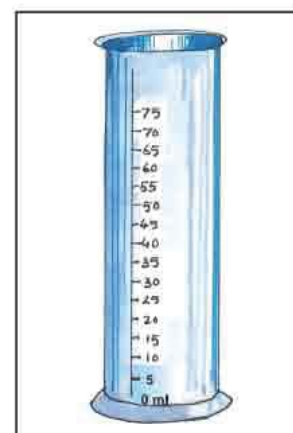- Place flask so that it is at its level.

  V = _____

Figure 4.13

- Put the measuring flask little slant as shown in the and read the level V = _____

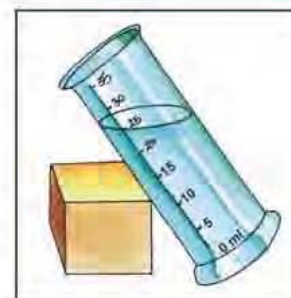
Figure 4.14

- When can accurate measurement be done ?

_____

_____

Observe the figure carefully. From which angle can correct measurement be observed ?

_____

_____

Figure 4.15

- Count the number of marks between '0' to '10' ml measuring flask.
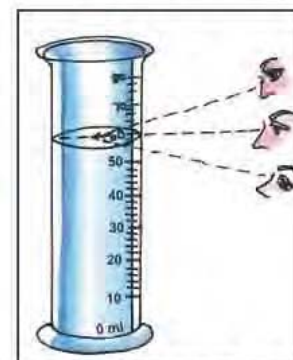- How many divisions of 10 ml are there on it ?

The volume of device like refrigerator is given in litters. Why?

Least count measure

What is required? Measuring cylinder, water

What to do?

- First of all take a measuring cylinder.
- Find the volume occupied between two consecutive big marks on the flask.
- Count the number of small divisions marked between the difference between two large consecutive marks.

Least count measure : The capacity to measur the volume of the minimum liquid at any vassel, is called least count measure of the vassel.

Thus, in general

Least count measure = $\dfrac{\text{Measure between two successive big marks}}{\text{Number of small divisions between two successive big}}$

- Determine the least count measure of the cylindrical flask you are having with you.
- Least count measure = _____

What is required? a measuring cylinder, colured water, a bowl.

What to do?

- Take measuring cylindrical

- Fill coloured water in the bowl

- Find the volume of coloured water in ml. and note down.

- Measure of volume of water = _____

- **Measurement of volume of solids.**

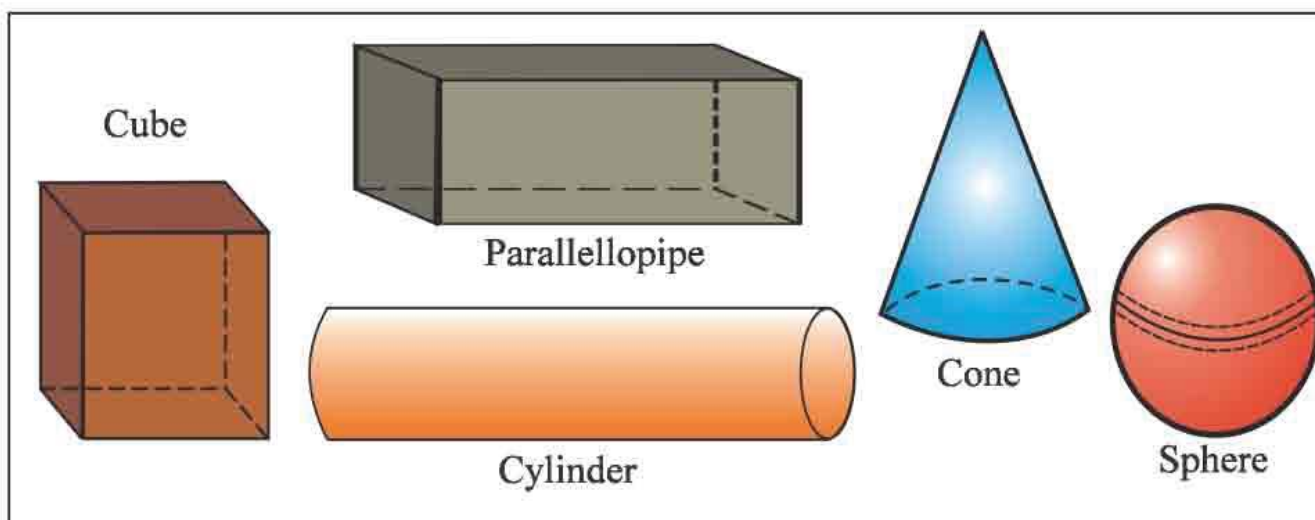 (1) Measurement of volume of regularly shaped (symmetric) solid.

Cube

Parallellopipe

Cylinder

Cone

Sphere

Figure 4.16

- Volume of well - regular shaped solids can be found using formula.

- Volume measurements of cube and parallalo piped solids can be obtained using following formuls :

Volume of cube = Legnth x length x length = l x l x l = l³	Volume of parallalopipe = Length x breadth x height = l x b X h = l bh

Collect the cubic and parallalopied substances you get near by you. What will be its volums, calculate with the help of given formulaMeasure their volume using the formula and tabulate them in table

No.	Name of object	Lengthl(l)(cm)	Breadth(b)(cm)	Height (h) (cm)	Volume V (cm³)
1	book				
2					
3					
4					
5					
6					
7					

- Measurement of volume of solid substances. For solid substances of irregular shape.

(ii) Measurement of volume of solid which are sinkin g in water as well as remain insoluble.

(1) With the help of measuring cylindrer sbstances.

(2) With the help of displacement cylindrer.

1. With the help of neasuring flask.

What is required? Measuring cylinder, thin strong thread, irregularly shaped stone, coloured water.

What to do?

- Get the irregular shaped stone

- Tie it with strong thin thread.

- Take measuring flask. Fill coloured water in it.

- Note its level V_1 = _____

  ml of the surface with proper alignment.

- Immerse the stone tied with thread in the measuring flask slowly.
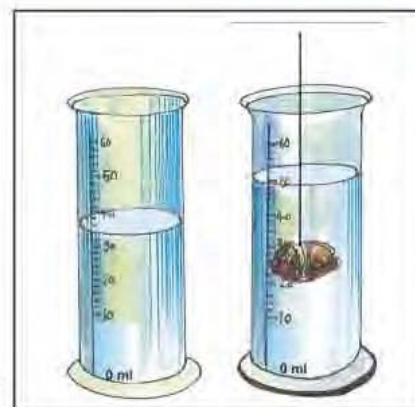
- Note down, what happens.

  _____

  _____

Figure 4.1

- Stone displaces coloured water equal to its own volume. Hence, its water level rises

- Note this reading volume v_2 ml

  V_2 = _____ ml

- $V_2 - V_1$ = _____ ml

- Thus, volume of stone $V_2 - V_1$ = _____ ml

Note : This method can also be used for regular shaped in soluable solid substances.

How do we measure the volume of irregular shaped solid substances this method?

With the help of displacement vassel

What is required? a displacement, a vessel, a container, a measuring cylinder, stone, thread, coloured water.

What to do?

- Take irregular shaped stone.
- Tie it with thin strong thread.
- Take the displacement vassel. Fill it with coloured water, closing its nozle with finger.
- Remove the finger and allow the excesswater to flow out of the nozle.
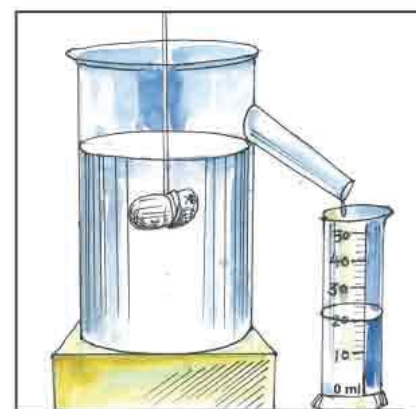- Adjust the measuring cylinder near end of the nozle.

Figure 4.18

Now,

- Imerse the stone tied with thread completely in water. What happens due to this?

- How much coloured water is collected in measuring cylinder ?

- Volume of the water = _____ ml

- Volume of the water collected in flask represents the volume of the stone.

- Therefore volume of stone = _____ cm³ = ml

Measure the volume of regularely shaped solids using measuring flask (cylinder)

> The volume of solid substances is measured in cubic meters or cubic centimeter, while,volume of the liquid substances is measured in liters.

- **Density**

What is required? Key, lid of pen (Plastic) bucket, water

What to do?

- Fill the bucket with water
- Immerse the key and the lid of pen in the water

What happens ?

Why?

If an iron piece dropped in water, it sinks in to it; while big ship prepared from iron does not sink, why ?

Here we can not say is lighter than water. Thus, on the basis of characteristic of floating only can not be said that only substances is heavy or light.

Densities are measured to compare their lightness or heaviness.

"The ratio of mass and volume of a substances is known as its density."

Density :

- What is the unit of mass ? _____
- What is the unit of volume? _____

$$\text{Hence unit of density } = \frac{\text{Unit of mass}}{\text{Unit of volume}} = \frac{gm}{cm^3} \text{ or } \frac{kg}{m^3}$$

Collect, different substances like an eraser, a key, a stone, a dice, water, oil, honey, a bar magnet, glass balls, a brick. Find mass of object and volume of each object and find its density.

No	Name of the substances	mass (g) m	V volume (cm³)	Density $g = \frac{m}{v}$ (gm/cm³)
1	Key			
2	Eraser			
3	Stone			
4	Dice			
5	Water			
6	Oil			
7	Bricks			
8	Honey			
9	barmagnet			
10	Glass ball (marble)			

- Which substances have density lesser than that of water?

  _____

  _____

- Will all the substances float on the water or sink in it?

  _____

  _____

- The substances with less density than that of water will float on the water.

- Which are the substances having density higher than that of water.

  _____

  _____

- Will all these substances float or sink in water.

  _____

  _____

- The substances having density higher than that of water will sink in water.

Name of substances Density (gm/cm³)		Name of the substances Density (gm/cm³)	
Ice	0.92	Lead	11.8
Water (pure)	1.00	Mercury	13.6
Sea water	1.03	Pure gold	19.3
Iron	7.8		

Q.1 Write the correct answer for the question listed below from given options :

(1) Which instrument is used to measure the mass of a substance ?

☐

(a) Spring balance(b) Burette (c) Balance(d) Measuring cylinder

(2) Which apparatus is used to measure volume of liquid?

☐

(a) Physical balance (b) measuring cylinder

(c) Spring balance   (d) Weights

(3) Which units is used for the measurement of weight?

☐

(a) Kilogram (b) gram (c) Newton (d) milliliter

Q.2 Match the following :

A	B
1 Kilogram	1000 millilitre
1 litre	1 cubic centimetre
1 millilitre	1000000 cubic centimetre
1 cubic meter	1000 gram

Q.3 Note, how much water is stored in water tank sited in your village.

Q.4 Note, how much of water is stored in water tank at your home.

Q.5 Note how many litre of water is stored in a pot at your home

Q.6 When you go for shopping in the bazar, in which units is the measuerment made ?

Q.7 Where will be correct measurement useful to you?

●

5 Mirrors and Reflections

When we observe objects, animals, birds, sceneries, colourful butterflies etc. in the vicinity, we enjoy it and feel happy.

Why are we able to see the objects?

_____

_____

What is required?   a small plain mirror and a laser torch
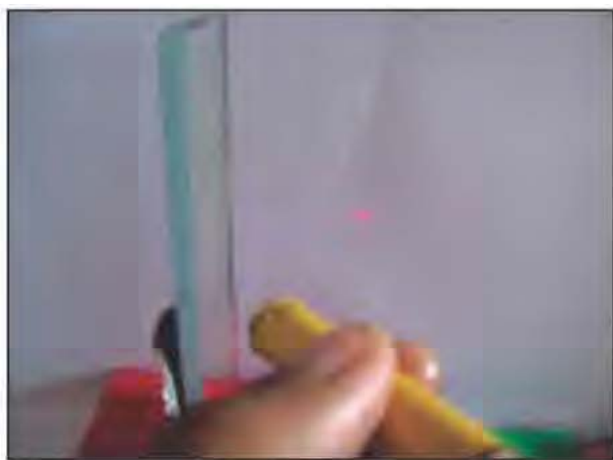
What to do?

Figure 5.1

Figure 5.2

- Take a small plane mirror. Allow light from lasser torch to fall on the mirror and try to see the reflection of light on a wall or on clothed screen.

- The bright ray of light is reflected from polished and smooth surface of the plane mirror. Similarly, light from the surrounding comes back from the objects, which enters in our eyes, which makes us see the objects but we do not see the reflected ray of light.

- The Phenomenon of ray of light, coming back after getting incident on surface of an object is known as reflection of light.