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THEME : MATTER AND ENERGY

TOPIC : MEASUREMENT

SUB TOPIC: MASS AND WEIGHT

CONTENT : MASS AND WEIGHT

By the end of this lesson, you should be able to:

- state the meaning of mass and weight
- identify the units for measuring mass and weight
- give the differences between mass and weight

Read and spell the words correctly

-Mass -weight -gramme -Newton -gravity -constant

INTRODUCTION

The word measure means to find the size, amount, or quantity of an object or substance.

Take a study on what happens in local shops or markets and identify the items that are measured.

What is used to measure each item identified?

Mass ; Mass is the amount of matter in an object.

Units for measuring mass

i) The basic units – grammes (g)

ii) The standard units – kilogrammes (kg)

NB: Mass is always constant (It doesn't change)

Weight

- Weight is the force an object has due to gravity.
- It can also mean the amount of gravity acting upon an object
- Weight is measured in Newtons (N)

Gravity (gravitational force)

- This is the force that pulls objects toward the centre of the earth.

Importance of gravity

- It enables rain to fall
- It enables fruits to fall from plants / trees
- It prevents objects from floating in air by pulling them downwards to the ground

NOTE:

- Weight of an object changes depending on the amount of gravity. When gravity is high, weight increases and when gravity is low, weight reduces
- Objects weigh less on the moon than on earth because there is less force of gravity on the moon than on earth

Differences between mass and weight

- Mass is constant while weight changes
- Mass is measured in kilogrammes while weight is measured in Newtons.

Comparison of objects in measurements

- The bigger the object in mass, the bigger the weight it has and the smaller the object in mass, the smaller the weight it has.

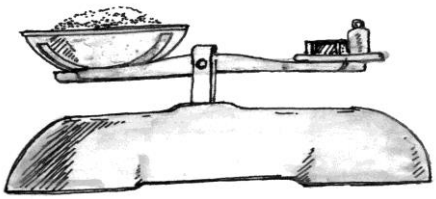
Note

- Both mass and weight can be measured by weighing.
- The mass of an object is always constant while the weight changes
- When an object is put in water, it weighs less than what it weighs in space-
- Water has a force that acts on an object to reduce its weight. That force is called up thrust / buoyancy force)

Instruments used to measure mass and weight

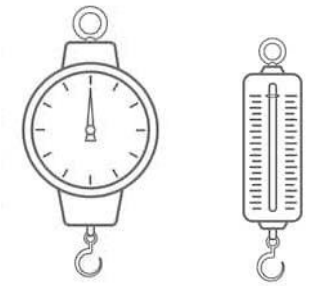
i) Sets of scales
ii) Beam balance
iii) Spring balance
iv) Compression balance scale

Set of scales

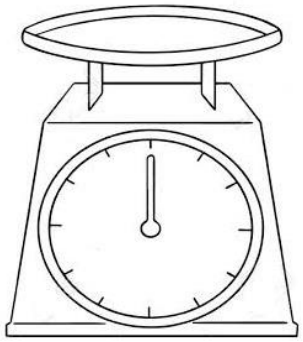


Beam balance

Spring balance



Compression balance scale



Exercise

1. Name the units for measuring the following:-
    a. Mass
    b. Weight
2. State two differences between mass and weight.
3. Name two equipments used for measuring weight and mass.
4. In which one way is gravity useful to people?
5. Why do objects weigh less on the moon than on earth?
6. Why do objects weigh less in water than in air?

LESSON 2

THEME : MATTER AND ENERGY
TOPIC : MEASUREMENT
SUB TOPIC : CAPACITY AND VOLUME
CONTENT : CAPACITY AND VOLUME

By the end of the lesson, you should be able to:

- state the meaning of capacity
- identify the units for measuring capacity
- find the capacity of given containers

Read and spell these words correctly

-capacity -weight -litre -gravity -constant

INTRODUCTION

- At home, market, fuel stations or shops find out some liquid /items that are measured in litres.
- List the examples of such liquids. Measure the litres of water that fill different containers at school or home. That is their capacity**.**

CAPACITY

- Capacity is the amount of liquid a container can hold.
- Capacity of liquids is measured in litres.

Metric table for capacity of liquids

KL	HL	DL	L	dl	cl	ml
1	0	0	0	0	0	0
	1	0	0	0	0	0
		1	0	0	0	0
			1	0	0	0
				1	0	0
					1	0

1 litre =1000cubic centimeters

Practical activity

This is on finding the capacity of a container

What you need (apparatus):

a) A polythene paper bag
b) Hard paper box
c) One litre of water

What to do (procedure/steps)

- Make a cubic box with each side 10cm, from the hard paper box.
- Put the polythene paper inside the cube. This prevents water from flowing out or wetting the container
- Fill the polythene inside with water,

Observation

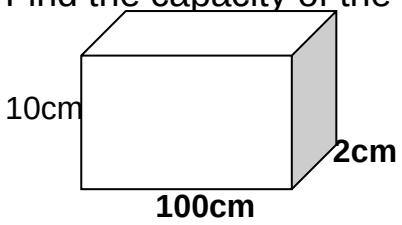
- The water which fills the cubic container will be equivalent to one litre..
- If more water is added, it will over flow.

Conclusion

- The water that can be held inside the container is its capacity

Example

1. Find the capacity of the cuboid below.



Steps

- First find the volume of the cuboid.

- Divide the volume by 1000cc in order to get the capacity since 1litre = 1000cc.

Solution

V=SxSxS

V=100cm x 2cm x 10 cm

V=2000cc

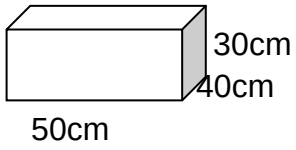
1000cc = 1litre

2000cc= $\frac{2000cc}{1000cc}$

= 2 litres

Exercise

1) Convert 6000cc to litres.
2) What is the capacity of the cubic tin below?



3) How many litres of water can fill a tank with a volume of 4000cc?
4) In which units is volume measured?
5) How much water can a container measuring 20cm by 30cm by 50cm hold when full?

LESSON 4

THEME : MATTER AND ENERGY

TOPIC : MEASUREMENT

SUB TOPIC: VOLUME

CONTENT : VOLUME

By the end of this lesson, you should be able to:

- state the meaning of volume
- identify the units for measuring volume
- find the volume of given objects

By the end of this lesson, you should be able to:

-capacity -weight -irregular -cubic -cuboid

INTRODUCTION

- Study the different objects in the house and outside the house. Do you realize that they occupy or take up some space?
- The space each object takes up or occupies is its volume.

- Volume is the amount of space occupied by an object.
- Volume is measured in cubic units e.g.
  - Cubic centimeters- cm^3 or cc
  - Cubic millimeters – mm^3
  - Cubic meters – m^3

Types of objects

- Regular objects
- Irregular objects

Regular objects – These are objects with definite shapes.

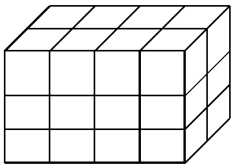
Examples of regular objects

i. Cuboids
ii. Cube
iii. Cylinder
iv. Cones

Volume of regular objects

Examples 1

i. Find the volume of the box below



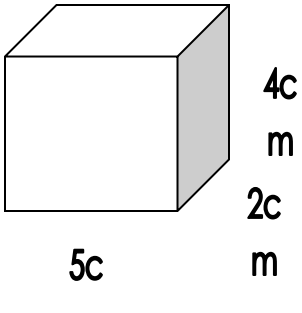
L = 4 units
W = 2 units
H = 3 units

Volume = (L x W) x H

= (4 x 2) sq. unit x 3units
= 8 sq. unit x 3cm
∴ Volume = 24 cubic units

Example II

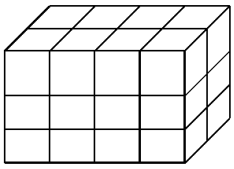
Calculate the volume of the object below



V = L x W x H
= (5cm x 2cm) x 4cm
= $10cm^2$ x 4cm
= $40cm^3$

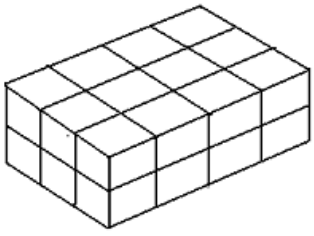
Exercise

1. Find the volume of the figure below

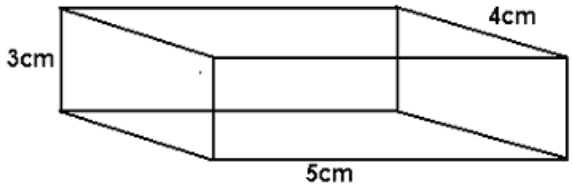


2. Name two examples of regular objects.
3. Find the volume of the following objects.

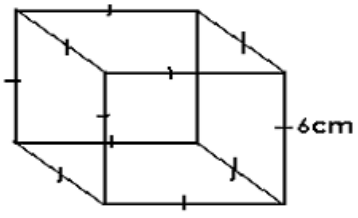
1.



2.



3.



4. Find the volume of a rectangular block whose length is 6cm, width 4cm and height 3cm.

LESSON 5

THEME : MATTER AND ENERGY

TOPIC : MEASUREMENT
SUB TOPIC: VOLUME
CONTENT: IRREGULAR OBJECTS

By the end of the lesson, you should be able to:

- state the meaning of irregular objects and their examples
- identify the method for measuring volume of irregular objects
- find the volume of irregular objects using a measuring cylinder

Read and spell these words correctly

-cylinder -eureka -irregular -displace

INTRODUCTION

- Put water in a transparent container, make it half full of water and mark the level of water.
- Gently lower an object such as a stone and observe what happens to the water level in the container

Irregular objects

These are objects that do not have definite shapes

- Pawpaw
- Potato
- Stones,
- Mango etc

Instruments used to measure the volume of irregular objects

i. Measuring cylinder
ii. An over flow can/ Eureka can

iii. String

Note:

i. The volume of an irregular object is got using the displacement method.
ii. It is called a displacement method because an object displaces the amount of water equal to its volume.

When finding volume of irregular objects using a measuring cylinder, subtract the first reading from the second reading of the water. i.e.

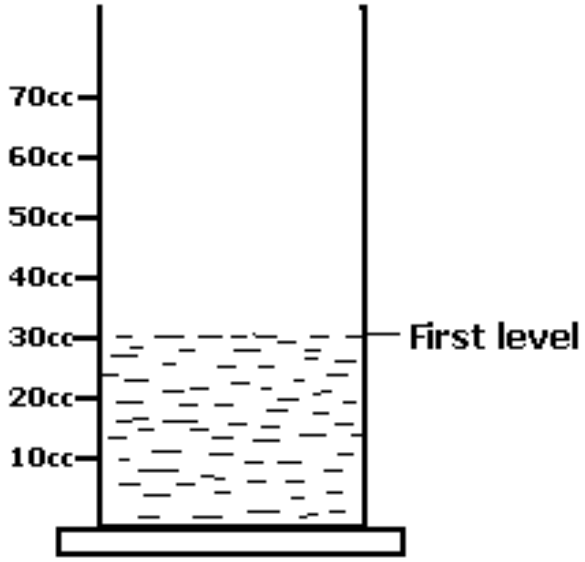
Volume = 2^{nd} reading – 1^{st} reading

Step I

1. Pour water into a measuring cylinder so that it is about half full
2. Record the first volume of water. Say 30cc as first level.

Note

The first level represents the volume of water used.

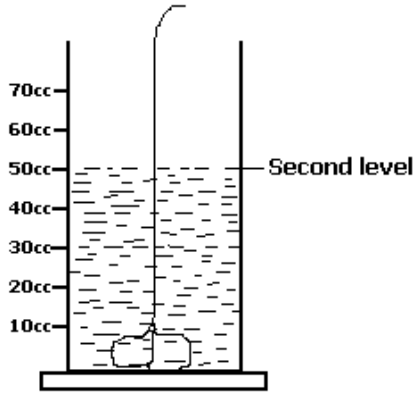


Step II

1. Get a stone tie it with a string.
2. Lower the object gently into the measuring cylinder using a string until the object is covered by water.
3. Record the new volume of water again. Say 50 cc as second level.

Note

The first level is the volume of both the object and the water used



Volume of the stone will be equal to:

V = 2^{nd} level- 1^{st} level

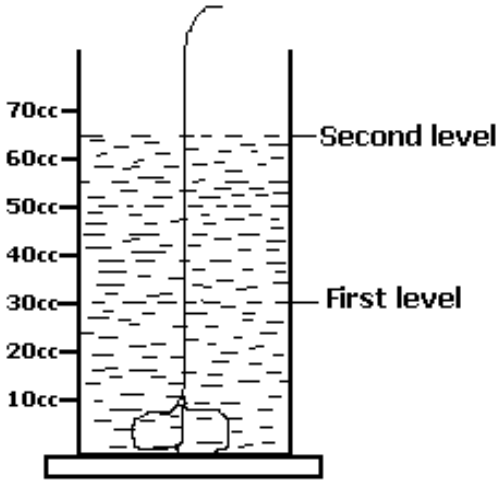
= 50cc- 30cc

= <u>20cc</u>

- The volume of the stone is 20cc because when an object is lowered in water, it displaces an amount of water equal to its volume.

EXERCISE:

An experiment was carried out by P.5 pupils to find the volume of the stone using a measuring cylinder as shown below.



1. Calculate the volume of the stone.
2. How important is the string in the above experiment?
3. Why is the volume of the stone equal to that answer you have given?
4. What do the following levels represent?
   a) First level _____
   b) Second level _____

LESSON 6

THEME : MATTER AND ENERGY

TOPIC : MEASUREMENT

SUB TOPIC: VOLUME

CONTENT: MEASURING THE VOLUME USING BOTH AN OVER FLOW CAN AND MEASURING CYLINDER

By the end of the lesson, you should be able to:

- states the meaning of irregular objects and their examples
- identifies the method for measuring volume of irregular objects
- finds the volume of irregular objects using a measuring cylinder

Read and spell these words correctly:

-cylinder -eureka -irregular -displace

INTRODUCTION

- Fill a container with water to the brim.
- Gently lower an object such as a stone and observe what happens to the water.
- The stone will displace the water and make it over flow.
- The water that over flows is equal to the volume of the stone

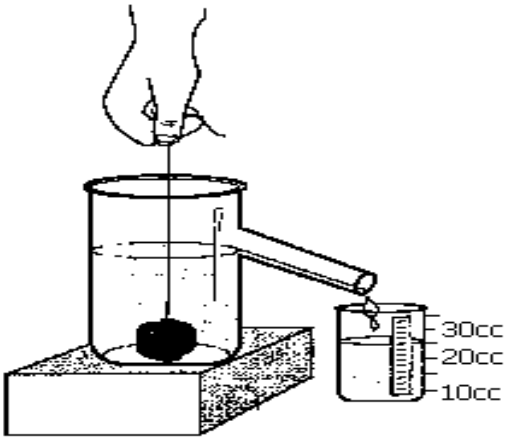
Measuring the volume using both an over flow can and measuring cylinder

Steps to follow

Practical

i. Fill the can with water till it over flows through the spout and stops.
ii. Put a measuring cylinder below the spout such that it can collect water which will flow through the spout
iii. Lower the stone whose volume you want to measure into the can gently with a sting.
iv. The object will displace water into the measuring cylinder

Illustratio



V=25cc

Note

- The amount of water collected in the measuring cylinder is equal to the volume of the object as shown in the diagram below.

LESSON 7

THEME: MATTER AND ENERGY

TOPIC: MEASUREMENT

SUB TOPIC: VOLUME

CONTENT: DISPLACEMENT USING REGULAR OBJECTS

The learner:

-works out volume of regular objects using displacement method

By the end of the lesson, you should be able to:

-cylinder -eureka -irregular -displace

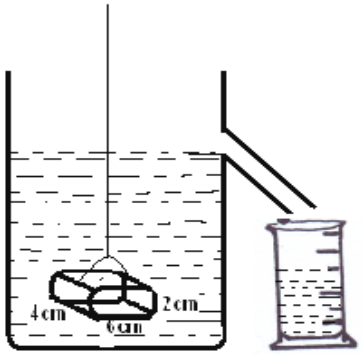
INTRODUCTION

- Displacement method can also be used to find volume of regular objects such as a brick as shown in the activities below

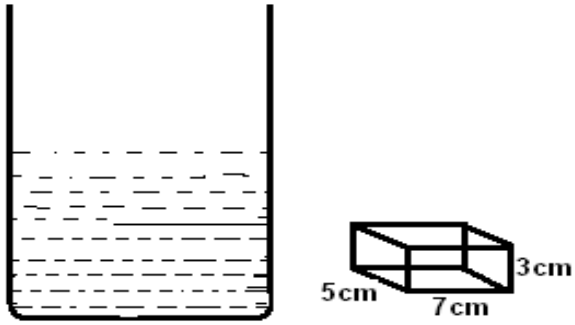
Note:

- When finding volume of regular objects using the displacement method, you have to find the volume of the give regular object given since it has a definite shape.

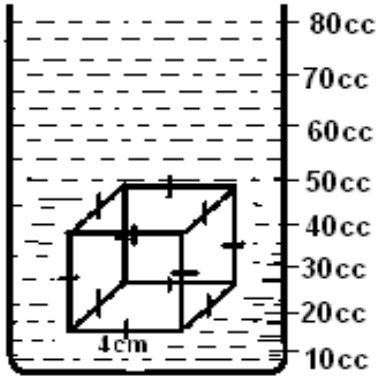
1. Find the volume of water that will be displaced by the block as shown below.



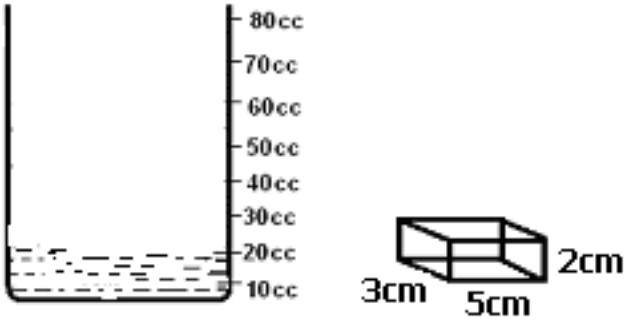
2. What volume of water will be displaced if the block below is immersed in the water?



3. What will be the level of water if the object is removed from the measuring cylinder?



4. What will be the level of water if the object is put into the measuring cylinder?



LESSON 8
THEME: MATTER AND ENERGY

TOPIC: MEASUREMENT

SUB TOPIC: DENSITY

CONTENT: DENSITY
By the end of this lesson, you should be able to:

- state the meaning of density
-identify the units for measuring density
-find the density of given objects

Read and spell these words correctly

-Volume -mass -volume -cubic -gram

INTRODUCTION

- Remember that mass is measured in grammess and volume in cubic units.
- If you divide a mass of given object by its volume, you get its density.

Study the examples in the content below.

1. Density is the mass of an object per unit volume.
2. Density is measured in g/cc.

Density is mass over volume. Density = $\frac{\text{mass}}{\text{volume}}$

Note:

The density of liquids is measured using an instrument called **hydrometer.**

Example 1

Calculate the density of an object whose mass is 150g and volume is 50cc

Solution

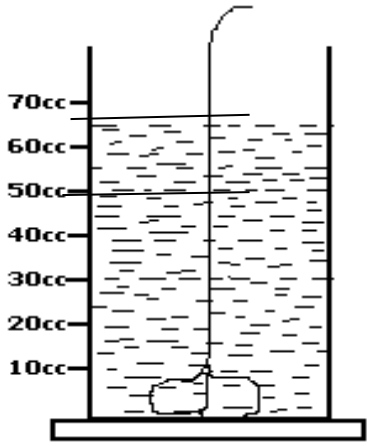
$D = \frac{m}{v}$

$D = \frac{\cancel{150}g}{\cancel{50}cc}$

D = 3g/cc

Example 2

A stone of mass 60g was lowered in water as shown below



Find its density

Solution

Volume = 2nd reading – 1st reading

= 65cc- 45cc

= 20cc

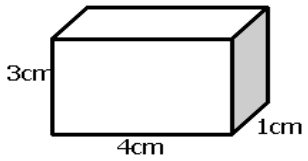
D = $\frac{m}{v}$

D = 60g/20cc

D = 3g/cc

EXERCISE

1. What is the density of an object whose mass is 30g and volume 5 cc.
2. Work out the density of an object whose mass is 24g and volume 6cc.
3. What is the density of an object whose mass is 10g and volume 5cc.
4. Find the density of the object below whose mass is 48g.



5. Work out the density of an object whose mass is 50g and volume 5cc.

LESSON 9

THEME : MATTER AND ENERGY

TOPIC : MEASUREMENT

SUB TOPIC : DENSITY, VOLUME AND MASS

By the end of this lesson, you should be able to:

- state the meaning of volume.
- identify the units for measuring volume.
- find the volume of given objects whose mass and density is given.

Reads and spell these words correctly

-Volume -mass -volume -cubic -gram

INTRODUCTION

- Remember that mass is measured in grams and density in grams per cubic units.
- If you divide a mass of given object by its density, you get its volume.

Finding volume when mass and density are given

Examples.

1. What is the volume of an object whose mass is 14g and density 2g/cc

Mass = 14g

Density = 2g/cc

Volume = ?cc

Volume = $\frac{Mass}{Density}$

= $\frac{\cancel{14}g}{\cancel{2}g / cc}$

= 7cc.

2. Work out the volume of an object whose mass is 15g and density of 5g/cc

Mass = 15g
Density = 5g/cc
Volume = ?cc
Volume = $\frac{Mass}{Density}$

= $\frac{\cancel{15}g}{\cancel{5}g / cc}$

Volume = 3cc.

EXERCISE

1. What is the volume of an object whose mass is 30g and density 6g/cc.
2. Work out the volume of an object whose mass is 24g and density 3g/cc.
3. What is the volume of an object whose density is 2g/cc and mass 10g.
4. Find the space occupied by a stone whose mass is 24g and density 4g/cc
5. An object has a mass of 45g and a density of 5g/cc. work out its volume.

Lesson 10

THEME : MATTER AND ENERGY

TOPIC : MEASUREMENT

SUB TOPIC : DENSITY, VOLUME AND MASS

By the end of this lesson, you should be able to:

-state the meaning of mass
-identify the units for measuring mass
-find the mass of given objects whose volume and density is given

Read and spell these words correctly

-Volume -mass -volume -cubic -gram

INTRODUCTION

- Remember that volume is measured in cubic units and density in grams per cubic units.
- If you multiply the density of given object by its volume, you get its mass.

FINDING MASS WHEN VOLUME AND DENSITY ARE GIVEN.

Mass = Density x Volume

Examples

1. Find the mass of an object whose volume is 5cc and density of 10g/ cc.

Volume = 5cc

Density = 10g/cc
Mass = ?g

Mass = Density x Volume

M = 10g/cc x 5cc

M = $\frac{10g}{cc} \times 5cc$

M = 50g

2. Work out the mass of an object whose volume is 3cm and density of 5g/cc

Volume = 3cc

Density = 5g/cc

Mass = ?g

Mass = Density x Volume

M = 5g/cc x 3cc

M = $\frac{5g}{cc} \times 3cc$

M =15g.

Exercise

1. What is the mass of an object whose density is 10g/cc and volume of 6cc?
2. Find the mass of a stone whose density is 20 g/cc and volume of 5cc.

3. Calculate the mass of an object whose volume is 12cc and density 4g/cc.
4. A stone has a volume of 7g and a density of 3g/cc. work out its mass.