PHYSICS
Class – VI

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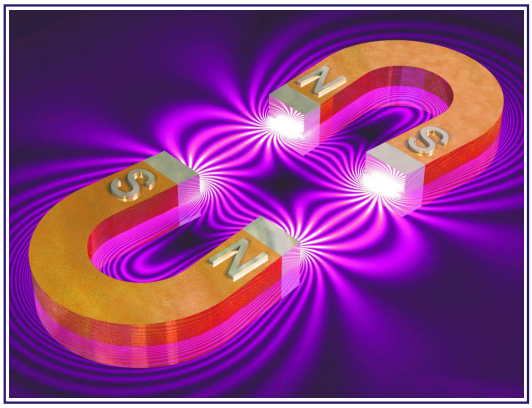

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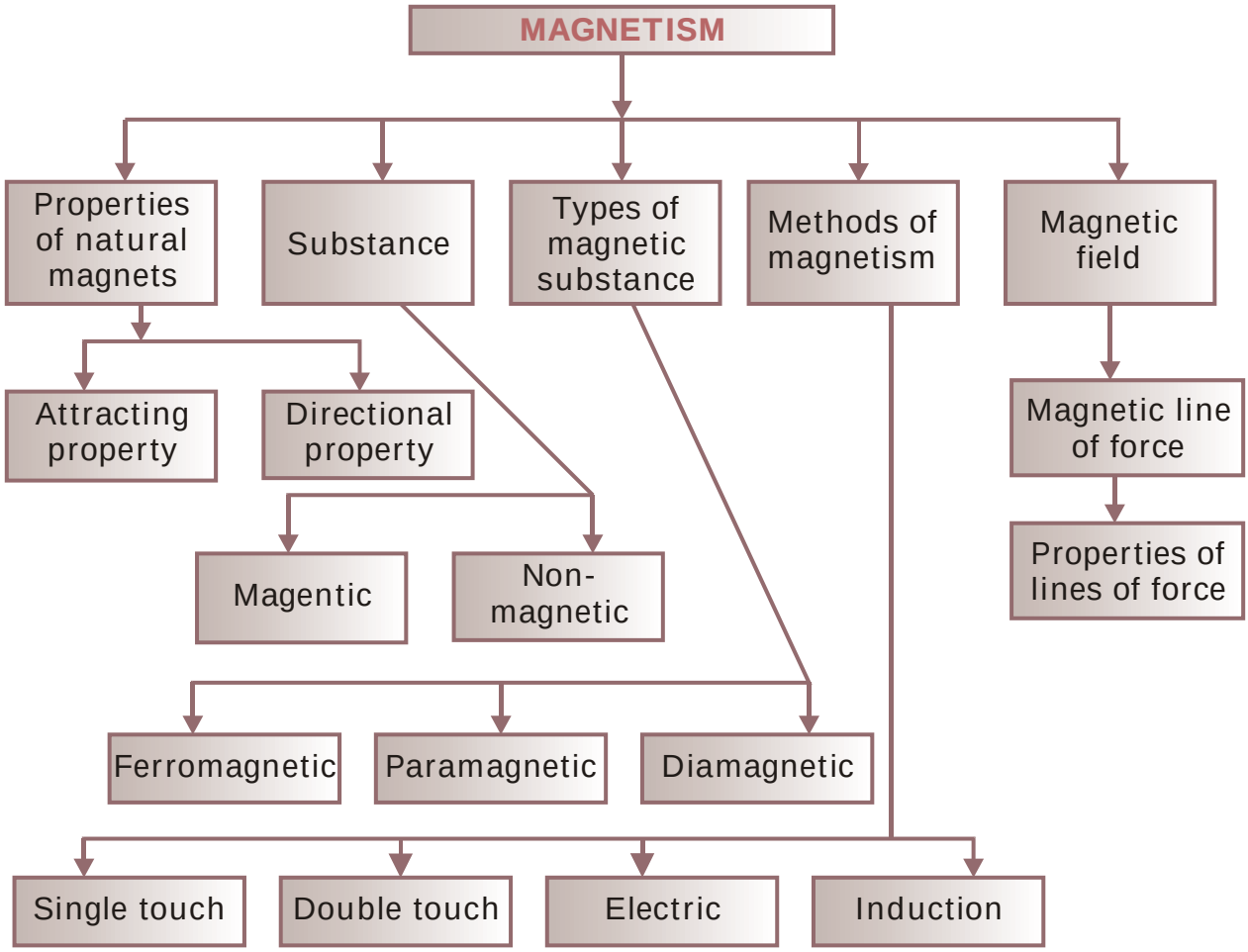
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PLAYING WITH MAGNETS

KNOW YOUR SCIENTIST

Hans Christian Ørsted (177-1851)

Hans Christian Ørsted (177-1851)

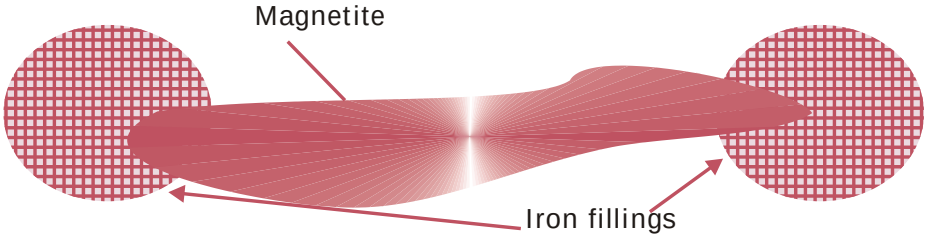
Hans Christian Ørsted (often rendered Oersted in English; 14 August 1777 – 9 March 1851) was a Danish physicist and chemist who discovered that electric currents create magnetic fields, an important aspect of electromagnetism. He shaped post-Kantian philosophy and advances in science throughout the late 19th century.

In 1824, Ørsted founded Selskabet for Naturlærens Udbredelse (SNU), a society to disseminate knowledge of the natural sciences. He was also the founder of predecessor organizations which eventually became the Danish Meteorological Institute and the Danish Patent and Trademark Office. Ørsted was the first modern thinker to explicitly describe and name the thought experiment.

A leader of the so-called Danish Golden Age, Ørsted was a close friend of Hans Christian Andersen and the brother of politician and jurist Anders Sandøe Ørsted, who eventually served as Danish prime minister (1853–54).

MAGNETISM — SYNOPSIS-1

- A certain ore of iron was found to possess a property that it attracted small pieces of iron towards it.
- The ore was first extracted in Magnesia [a small town in Asia minor (Egypt now) (120 A.D)]. The ore of iron was named as “MAGNETITE” (Chemical formula: Fe_3O_4)



Activity : A piece AB of the magnetite is dipped in a heap of small iron fillings.

Observation: It is observed that a cluster of iron filling stick to the ends A and B, while there is practically, no iron filling sticking to its central region.

Conclusion: The ends A and B (where iron filling stick) are called POLES, while the central region is called neutral region.

- This piece of magnetite (Fe_3O_4) which is found in nature and is endowed with the property of attracting other small pieces of iron towards it is called a ‘NATURAL MAGNET’.

DID YOU KNOW?

Magnetic - field dollar bill
If you hang a dollar bill from one end and bring a large magnet (with a nonuniform field) toward it, the bill will move toward one of the pole faces why?

The ink in the dollar bill contains magnetic salts, probably iron salts, that are attracted to one of the magnet's poles.

Properties of Natural Magnets (N.M)

ATTRACTING PROPERTY
Natural magnet is capable of attracting small pieces of iron towards it.

DIRECTIONAL PROPERTY
When a freely suspended, by means of a suspension thread, it always points in a particular direction. Because of this property the magnetite was also called 'LEADING STONE' or LODE STONE (stone which leads)

SUBSTANCES

Magnetic Substances
Substances which are influenced or affected by a magnet is called a magnetic substances.

Non-Magnetic Substances
Substances which are neither attracted nor repelled by a magnet are called non-magnetic substances. These cannot be magnetised.
Ex: Paper, wood, glass etc.

- It is possible to turn a piece of magnetic substance into a magnet, which will also show the properties as shown by a natural magnet. "A piece of iron or steel to which attractive and directive properties of lodestone (magnetite) are imparted by artificial means is called an "ARTIFICIAL MAGNET".

KINDS OF ARTIFICIAL MAGNETS:

1. Bar Magnet: N S

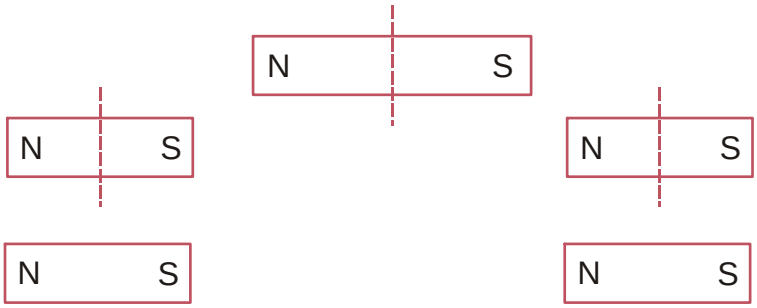
- It is a rectangular steel bar, at the ends of which are marked letter N and S.
- The N stands for "Geographic North" and S stands for "Geographic South".
- If this magnet is suspended freely, then the end marked with N points towards

geographic north and the end marked with S points towards geographic south.

2. Horse shoe magnet etc..

General properties of a Bar magnet:

1. It attracts small pieces of iron toward itself.
2. A freely suspended magnet points in north-south direction.
3. Like poles of the magnets repel each other and the unlike poles attract each other.
4. It can magnetise another piece of iron when rubbed several times in one direction.
5. Magnetic poles exist in pairs (dipole). These cannot be a monopole.



Types of Magnetic Substances

Ferromagnetic Substances	Paramagnetic Substances	Diamagnetic Substances
Substances which are strongly attracted by magnet are Feromagnetic substances. Ex: Iron Steel, Nickel, Cobalt etc.,	Substances which are weakly attracted by a magnet are called Paramagnetic substances. Ex: Aluminium, Manganese, Chromium, Platinum etc.,	Substances that are repelled by a magnet are called Diamagnetic substances. Ex: Copper, bismuth, phosphorus, water, gold, antimony etc.,

MAGNETISM_WORKSHEET - 1

CUQ 1. Chemically natural magnet is :

1) Feo 2) Fe_2O_3 3) Fe_3O_4 4) None of the above

2. We do not use natural magnets in various devices because :

1) They are brittle and can not be shaped

2) They are very weak magnetic strength

3) Both (A) and (B) 4) None of the above

3. The substances that con not be magnetised/attracted by a powerful magnet are called :
   1) Ferro magnetic substances 2) paramagnetic substances
   3) non-magnetic substances 4) none of the above
4. Which is a magnetic substance?
   1) Cobalt 2) Glass 3) Paper 4)Both(2) and (3)
5. A metal scrap contains steel, copper, zinc, nickel and iron. The metals that can be removed from the scrap with help of a powerful magnet are :
   1) Steel and iron 2) Steel and nickel
   3) Steel, nickel and copper 4) Steel, nickel and iron.
6. Similar poles of the bar magnets :
   1) Attract each other 2) Repel each other
   3) neither attract nor repel each other 4) none of the above

JEE MAINS

Single Correct Choice Type:

1. Which of the following is a not magnetic material
   1) Nickel 2) Cobalt 3) Bismuth 4) Wood
2. Copper, Gold are the examples of the following magnetic materials
   1) Ferro 2) Dia 3) Para 4) Both A and B
3. Which of the following are paramagnetic substances
   1) phospheres 2) water 3) antimony 4) platinum
4. Which of the following is a magnetic material
   1) wood 2) Plastic 3) Iron 4) Paper
5. One of the following is an artificial magnet
   1) Horse shoe magnet 2) Magnetic needle
   3) Magnetic compasses & electro magnet 4) Above all
6. The subnstances that are repelled by a magnet are called
   1) para magnetic 2) Ferro 3) Dia 4) Anti ferro

Multi Correct Choice Type:

7. Choose the correct statements from the following:
   1) A freely suspended magnet points in N-S direction
   2) Magnetic poles exist in pairs(dipole)
   3) A freely suspended magnet points in E-W direction
   4) Magnetic poles does not exist in pairs

Reasoning Type:

8. Statement I : A freely suspended bar magnet always comes to lie in North-South direction.

   Statement II : Magnetic poles have the property of directionality

   1) Both Statements I and II are correct.
   2) Both Statements I and II are incorrect.
   3) Statement - I is correct, Statement - II is incorrect.
   4) Statement - I is incorrect, Statement - II is correct.

Comprehension Type:

A piece AB of the magnetite is dipped in a leap of small iron filings. It is observed that a cluster of iron filings stick to the ends A and B while there is practically no iron filing stick to its central region.

9. The central region is called

   1) Neutral Region 2) Pole 3) Equator 4) none of these

10. End A is called

    1) Neutral Region 2) Pole 3) Equator 4) none of these

11. End B is called.

    1) Neutral Region 2) Pole 3) Equator 4) none of these

Matrix Match Type:

12.

Column-I	Column-II
a) The rest position of a magnet is along N-S when suspended	1) Ferromagnetic substance
b) Magnetic poles exist in pairs	2) diamagnetic substance
c) Iron is strongly attracted by magnet so it is	3) directive property
d) Gold is repelled by a magnet so it is	4) Dipole
	5) paramagnetic substance

Integer Answer Type:

13. All Substances can be divided into _____ classes on the basis of their magnetic properties

Multi Correct Choice Type:

14. Choose the correct statement/s from the following:

    1) magnetite can be called as lode stone
    2) Natural magnets possess attractive property only
    3) natural magnets possess attractive and directional properties
    4) Natural magnets possess directional property only

MAGNETISM SYNOPSIS-2

General Definitions of Bar Magnet:

1. **Pole:** Each end of a bar magnet is called its pole.
2. **Geometric pole:** The geometric end of a bar magnet is called its geometric pole.

A, B ⟶ Geometric poles

3. **Magnetic pole:** The point situated slightly inside a bar magnet, where most of its magnetic power is concentrated is called its magnetic pole.

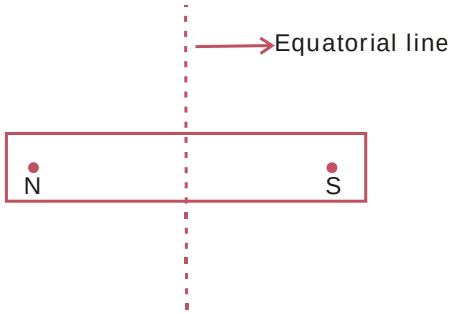
N, S ⟶ Magnetic poles

Magnetic North pole
The pole of a freely suspended bar magnet which point towards geographic north is called its magnetic north pole (N).

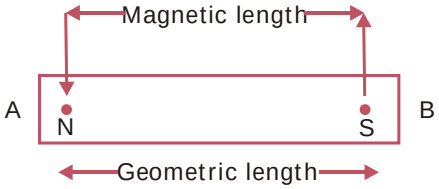
Magnetic South pole
The pole of a freely suspened bar magnet which points towards geographic south is called its magnetic south pole (S).

Magnetic axis: An imaginary line joining the magnetic north and south poles of a bar magnetic is called its magnetic axis (or) axial line. (XY = magnetic axis)

Equatorial line: The line passing through the centre of magnet and perpendicular to the axial line is called equatorial line.



Magnetic length: The distance between the two poles of a magnet is called magnetic length of magnet.



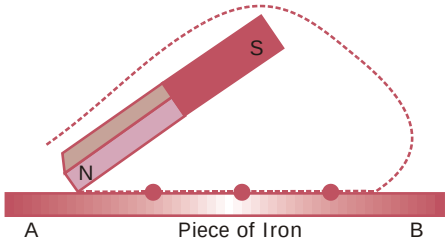
NS $\rightarrow$ Magnetic length AB = Geometric length

The relation between magnetic length and geometric length is

$$\text{MAGNETIC LENGTH} = \frac{5}{6} \times \text{GEOMETRIC LENGTH}$$

A piece of iron can be magnetized by the following ways.

a) **Single touch method:** A piece of iron can be magnetized by rubbing it with a magnet from one end to another as shown in the figure.

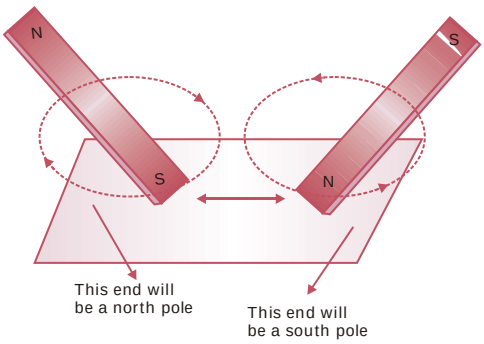


b) **Electric method:** Strong magnets are now adays made by the electrical method. The principle used in it is that a wire carrying electric current behaves like a magnet. Magnetism can be induced in a steel bar by winding a coil of wire around it and passing current through the coil. Then the steel bar magnet becomes an electromagnet.

A steel piece which becomes a magnet when electric current passes through the wire wound round it is called **electromagnet.**

Application of Electromagnets: Electromagnets are used in electric bells.

Double touch method : In this double touch method, two strong magnets are placed at the centre of the soft iron piece to be magnetised, keeping the opposite poles of the magnets facing each other. Move the magnets simultaneously over the surface of the soft iron piece taking them away from one another. Lift the magnets on reaching the ends of the piece and place them again at the centre.



Repeat this exercise 30 to 40 times, on testing the soft iron piece, it would be found to have become a magnet.

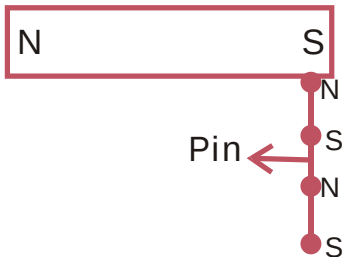
A piece of iron can be strongly magnetised by double touch method than the single touch method.

STAR FACT

Bubbles moved by magnetic field
A large magnet placed near a carpenter's bubble level will force the bubble to move. How does the magnetic field do that? Does the bubbles move toward or away from the magnet?

The fluid in the leveler is diamagnetic, that is, when it is placed in a magnetic field, it produces a magnetic field in the opposite sense. The fluid is repulsed from the magnet, thereby forcing the bubble toward the magnet.

Magnetic induction : The phenomenon due to which magnetism is produced in a magnetic substance by the mere presence of a magnet, which is not actually in physically contact with magnet is called magnetic induction.



Note: The end of an unmagnetised substance nearer to the pole of inducing magnet acquires opposite polarity, whereas the further end from inducing magnet acquires similar polarity. Magnetic induction precedes magnetic attraction.

Temporary magnets: The magnets which lose their magnetism as soon as the cause producing them is removed, are called temporary magnets.

Examples: Electromagnets and the magnets made from soft iron are temporary magnets.

ii) Permanent magnets: The magnets which do not lose their magnetism, when the cause producing them is removed, are called permanent magnets.

Examples: The magnets made from steel,cobalt etc., are permanent magnets.

Note : Soft iron is a temporary magnet whereas Steel is a permanent magnet.

Demagnetisation : The loss of magnetic property of a magnet is called demagnetisation. By heating or by hammering or by rough handling, a magnet loses its property.

MAGNETISM_WORKSHEET - 2

CUQ 1. Each end of a bar magnet is called its ____.

1) magnetic length 2) equilatoral line 3) pole 4) all the above

2. The geometric end of the bar magnet is called

1) pole 2) magnetic pole 3) geometric pole 4) magnetic length

3. The point situated slightly inside a bar magnet, where most of its magnetic power is concentrated is called its

1) pole 2) magnetic pole 3) geometric pole 4) magnetic length

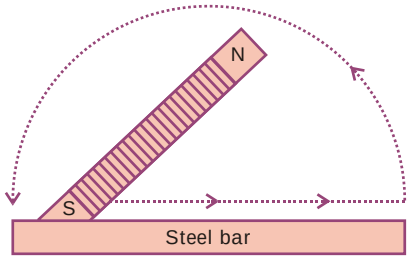
4. Most of the permanent magnets are made from

1) Soft iron 2) Chromium 3) Glass 4) Steel

5. One end of a bar magnet is brought near the south pole of a freely sus pended magnetic needle. It is seen that south pole of the magnetic needle gets repelled. The polarity of the end of the bar magnet is :

1) North 2) South 3) Either (a) or (b) 4) none of the above

6. A permanent bar magnet is rubbed many a times on a steel bar as shown in figure. The end A of the steel bar acquires :



1) South polarity 2) North polarity 3) non polarity 4) none of the above

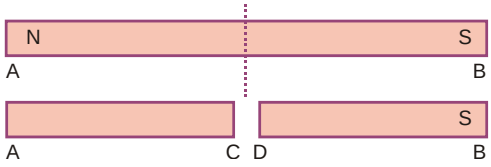
JEE MAINS

Single Correct Choice Type:

1. Which one is used for making temporary magnet?

1) Copper 2) Steel 3) Glass 4) Soft iron

2. A bar magnet AB is cut into two pieces AC and DB. The ends C and D will have.



1) north polarity 2) South polarity

3) C as south polarity and D as north polarity

4) C as north polarity and D as south polarity

3. A bar magnet is hammered for some time. Its magnetic strength :

   1) Is likely to increase 2) Is likely to decrease

   3) Will not change 4) none of the above

4. A piece of iron rubbed with magnetite is called a

   1) magnet 2) Natural magnet 3) Artifical magnet 4) iron ore

5. One of the following is not a property of a magnet

   1) Attraction 2) Repulsion 3) Induction 4) Reflection

6. The magnets which do not lose their magnetism , when the cause producing them is removed are called

   1) demagnetisation 2) permanent magnets

   3) temporary magnets 4) none of these

7. Which of the following are made as permanent magnets?

   1)steel 2) cobalt 3) solf iron 4) both (1) and (2)

Multi Correct Choice Type:

8. An imaginary line joining the magnetic north and south pole of a bar magnet is its

   1)magnetic axis 2) axial line 3) equitorial line 4)pole

Reasoning Type:

9. Statement I : A piece of iron can be strongly magnetised by double touch method than the single touch method.

   Statement II : Electromagnets and the magnets made from soft iron are temporary magnets.

   1) Both Statements I and II are correct.

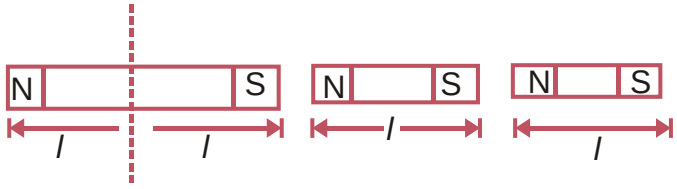
   2) Both Statements I and II are incorrect.

   3) Statement - I is correct, Statement - II is incorrect.

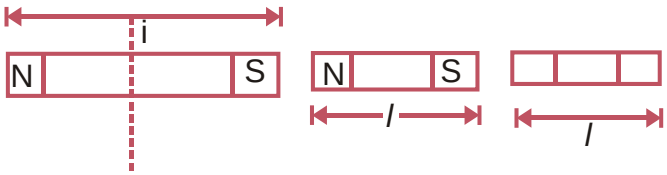
   4) Statement - I is incorrect, Statement - II is correct.

Comprehension Type:

Magnetic poles exist in pair. We can not get a magnetic monopole. When we cut a magnet, each piece will behave like a magnet with two poles.

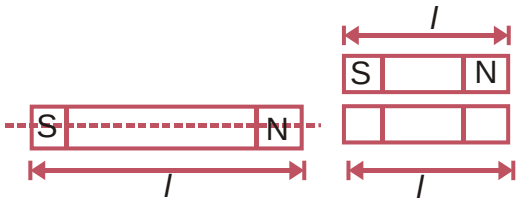


Based on the above, answer the following Questions.

10. 

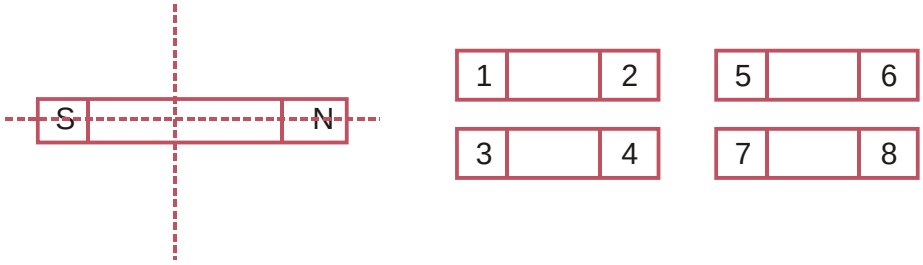
A bar magnet is cut as shown in the figure. Mark the polarity of each pole (from left to right) for the polarity missed piece.

1) South, North 2) North, South 3) North, North 4) South, South

11. 

A bar magnet is cut as shown in the figure. Mark the polarity of each pole (from left to right) for polarity missed piece.

1) South, North 2) North, South 3) North, North 4) South, South

12. 

A bar magnet is cut as shown in the figure. choose the correct polarity.

1) 1 → south, 2 → north; 3 → south, 4 → north

2) 5 → south, 6 → north; 7 → south, 8 → north

3) Both (1) and (2) 4) neither (1) nor (2)

Matrix Match Type:

13.

Column-I	**Column-II**
a) Magnetization	1) Electro magnet
b) Temporary magnet	2) Heating a magnet
c) Demagnetisation	3) Double touch method
d) Electric bell	4) Single touch method
	5) Hammering on magnet

Integer Answer Type:

14. The relation between magnetic length and geometric length is Magnetic length $=\frac{x}{6}\times$ Geometric length ,then the value of x is ___

MAGNETISM SYNOPSIS-3

Magnetic field : Whenever a magnetic substance is placed at a distance from the magnet, it is affected by it. The magnetic substance is said to be in a field called magnetic field. Magnetic field is a region (or space) around the magnet, in which its influence can be felt.

Representation of magnetic field:

A magnetic field is represented by a set of lines (may be curved or straight) called lines of force. A line of force if it were free to move when placed on the field. The direction of arrow head gives the direction of motion of unit north pole. If the lines are spaced widely apart, it is a weak field. If the lines are situated close to each other, it represents a strong field.

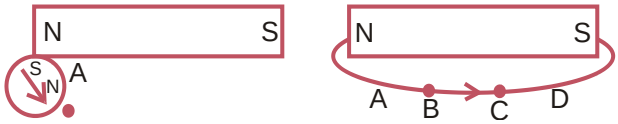
Direction of magnetic field:

The direction of a magnetic field at a point in the field is the direction in which an isolated North pole would move, if free to do so. (An isolated north pole is a hypothetic assumption which is introduced for better understanding).

Magnetic field can be understood properly through magnetic lines of forces.

Magnetic line of force:

Keep a small magnetic needle near the north pole of a magnet and it orients as itself shown below:



This curve is called magnetic line of force.

In a uniform magnetic field the magnetic lines of force are parallel to each other.

(A magnetic field is said to be uniform if it has same strength (in magnitude and direction at all points).

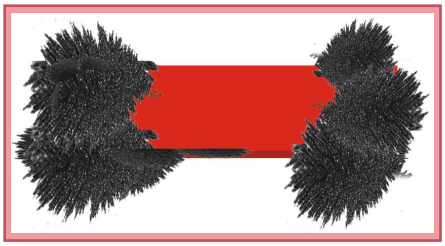
Ex: Earth's magnetic field is an uniform magnetic field in a given region. Hence the lines in it are parallel to each other.

ACTIVITY

To observe the poles of magnet:

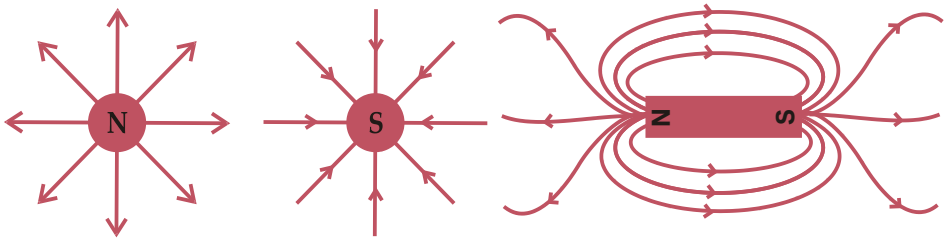
Take a bar magnet, horseshoe magnet, iron filings and a plastic tray (or a sheet of paper).

Spread a layer of iron filings on the plastic tray (or sheet of paper). Now bring the bar magnet and the horseshoe magnet and place them on the tray. What do you see? You will observe that the magnets attract the iron filing.



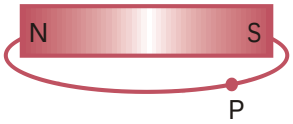
i) Magnetic lines of force due to an isolated

North pole Isolated south pole Bar magnet

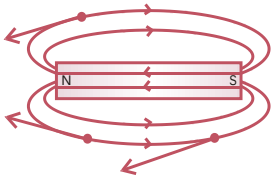


Properties of lines of force:

1. Lines of force are directed away from a north pole are directed towards a south pole. Externally they move from North pole of a magnet to its south pole.

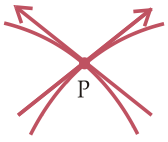
2. 

The direction of the field at any point on the magnetic line of force is obtained by drawing a tangent to it at that point.



Inside the magnet, the magnetic lines of force travel from south to north.

Magnetic lines of force do not intersect.



Let us assume that two lines intersect at P. Let us get the direction of field at P by drawing tangents to the two curves.

We get two tangents at P as shown above indicating two directions for the same field at point P which is impossible. Hence they donot intersect.

- The density of magnetic line of force gives the intensity of magnetic field.

  More the density, the more is the intensity of the magnetic field.

MAGNETISM_WORKSHEET - 3

CUQ 1. In magnetic lines of force, the direction of arrow head gives the direction of motion of (conventionally)

1) unit north pole 2) unit south pole
3) north pole 4) south pole

2. Inside the magnet, magnetic lines of force

1) intersect 2) do not intersect 3) can't say 4) both (1) and (2)

3. Inside the magnet the magnetic lines of force travel from

1) N to S 2) E to W 3) S to E 4) S to N

4. The magnetic lines of force of earth is magnetic field are

1) parallel to each other 2) perpendicular to each other
3) inclined at an angle of 60^0 to each other
4) inclined at an angle of 45^0 to each other

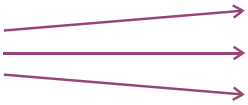
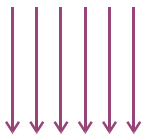
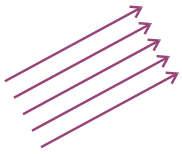
5. Inside the magnet the magnetic lines of force travel from

1) north to south 2) south to north
3) south to south 4) north to north

JEE MAINS

Single Correct Choice Type:

1. Study the magnetic line of force :

1)  2)  3)  4) 

Which of the above has a week magnetic field?

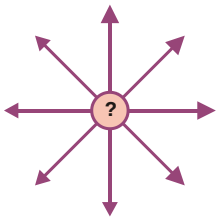
1) 1 2) 2 3) 3 4) 4

2. Which of the following is a uniform magnetic field?

1)  2)  3)  4) both (1) & (3)

3. Which of the following is employed for tracing magnetic lines of force of a magnet.

1) Load stone 2) Needle 3) Tracing compass 4) Bar magnet

4. 

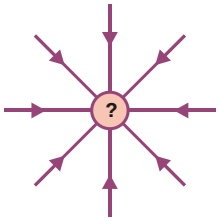
? is isolated ..... pole

1) North pole 2) South pole 3) Both 1&2 4) Neither 1 nor 2

5. The density of magnetic line of force gives the

1) Intensity of the magnetic field 2) Intensity of the magnetic pole

3) Both (1) and (2) 4) neither (1) nor (2)

6. 

? is isolated ..... pole

1) North pole 2) South pole 3) Both 1&2 4) Neither 1 nor 2

7. The space (or) region around the magnet is

1) magnetic distance 2) magnetic field

3) Both (1) and (2) 4) Neither (1) nor (2)

Multi Correct Choice Type:

8. The magnet have a general property(ies) if

1) A freely suspended magnet points in east- west direction

2) Magnetic poles always exists in pairs

3) Like poles of a magnet attacts each other

4) Inside the magnet , the magnetic lines of force travels from south to north

Reasoning Type:

9. Statement I : The direction of the magnetic lines of force out side the magnet is from north pole to south pole of a magnet

Statement II : The direction of the magnetic lines of force in side the magnet is from north pole to south pole of a magnet

1) Both Statements I and II are correct.

2) Both Statements I and II are incorrect.

3) Statement - I is correct, Statement - II is incorrect.

4) Statement - I is incorrect, Statement - II is correct.

Comprehension Type:

Magnetic filed can be understood properly through magnetic lines of forces.

10. Which of the following are the properties of magnetic lines of force

1) They are closed continuous curves 2) They mutually repel each other

3) They never interset with each other 4) All of these

11. In a uniform magnetic field the magnetic lines of force are

1) Perpendicular to each other 2) parallel to each other

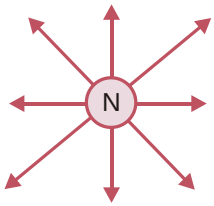
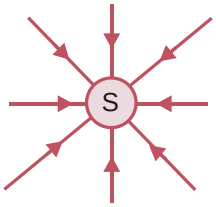
3) Both (1) and (2) 4) Neither (1) nor (2)

12. A magnetic field is represented by a

1) Set of lines 2) curved lines 3) straight lines 4) all of these

Matrix Match Type:

13.

Column-I	Column-II
a) Magnetic field	1) 
b) a unit north pole	2) 
c) A unit south pole	3) Three dimensional
d) magnetic lines of force inside the magnet	4) travel from north pole to south pole
	5) travel from south pole to north pole

Integer Answer Type

14. In a bar magnet no. of poles exist _____

Multi Correct Choice Type:

15. A magnetic field is said to be uniform if it has

    1) Same strength

    2) Same in magnitude and direction at all points

    3) unequal strength

    4) Different in magnitude and direction at all points

16. Choose the worng options

    1) A magnetic field is said to be uniform if it field if it has same strength

    2) A magnetic field is said to be uniform if it field if it has unequal strength

    3) If density of magnetic lines more ,the intensity of the magnetic field is also more

    4) If density of magnetic lines more, the intensity of the magnetic field is also less

MAGNETISM WORKSHEET-1_KEY

CUQ:

1) 3 2) 4 3) 3 4) 1 5) 4 6) 2

JEE MAINS :

1) 4 2) 2 3) 4 4) 3 5) 4 6) 3 7) 1,2 8) 1

9) 1 10) 2 11) 2 12) a-3;b-4;c-1;d-2 13) 3 14) 1,3

MAGNETISM WORKSHEET-2_KEY

CUQ:

1) 3 2) 3 3) 2 4) 4 5) 2 6) 2

JEE MAINS :

1) 4 2) 2 3) 2 4) 3 5) 4 6) 2 7) 4 8) 1,2

9) 1 10) 3 11) 1 12) 2 13) a-3,4;b-1;c-2,5;d-1 14) 5

MAGNETISM WORKSHEET-3_KEY

CUQ:

1) 1 2) 3 3) 4 4) 2 5) 2

JEE MAINS :

1) 1 2) 2 3) 3 4) 2 5) 1 6) 1 7) 1

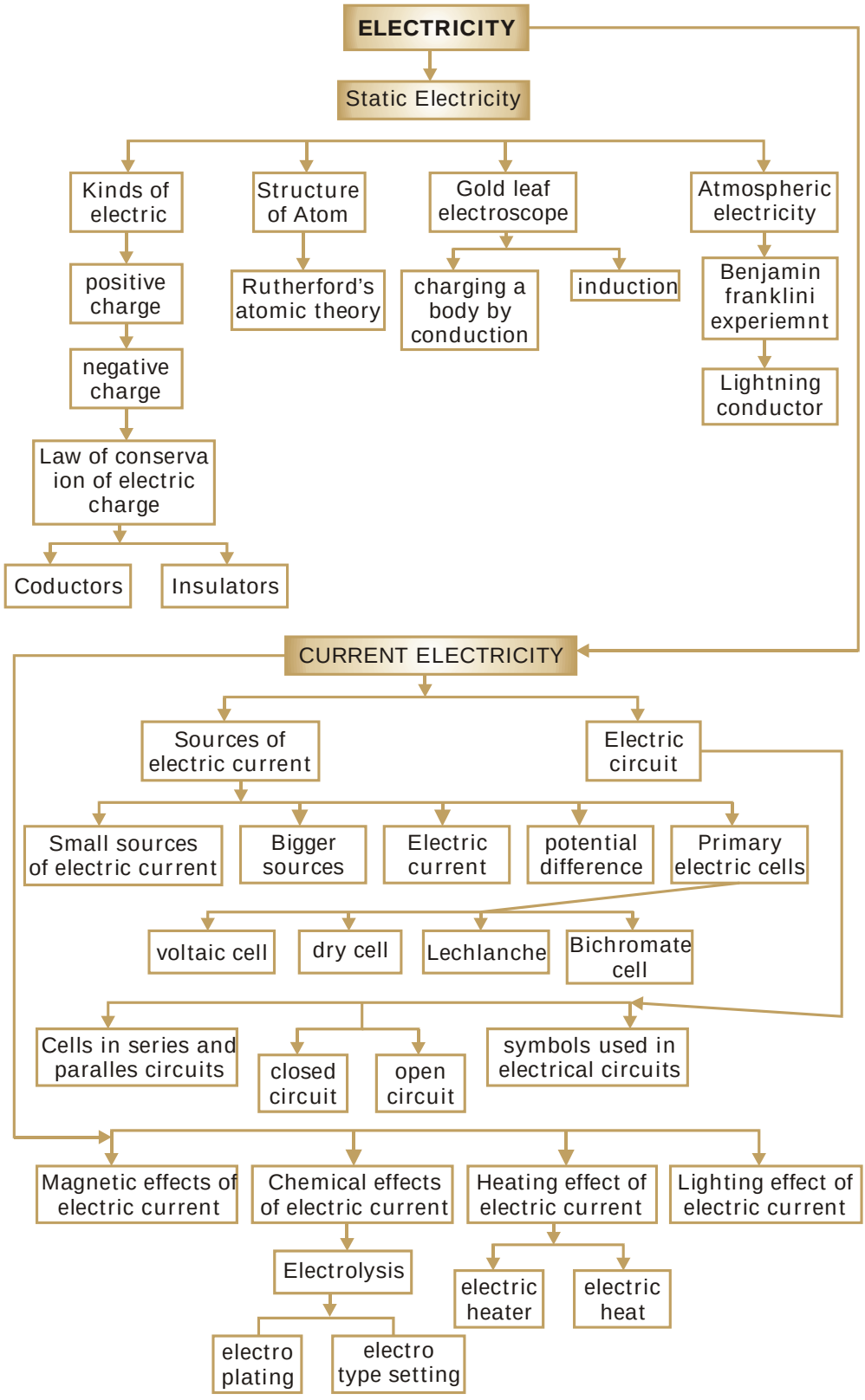
8) 2,4 9) 3 10) 4 11) 2 12) 4 13) a-3;b-1;c-2;d-5

14) 2 15) 1,2 16) 2,4

SIMPLE ELECTRIC CIRCUITS

Contents

MEMO GRAPH


ELECTRICITY
Static Electricity
Kinds of electric
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negative charge
Law of conserva ion of electric charge
Coductors
Insulators
Structure of Atom
Rutherford's atomic theory
Gold leaf electroscope
charging a body by conduction
induction
Atmospheric electricity
Benjamin franklini experiemnt
Lightning conductor
CURRENT ELECTRICITY
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Bigger sources
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Primary electric cells
voltaic cell
dry cell
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Electrolysis
electro plating
electro type setting
Heating effect of electric current
electric heater
electric heat
Lighting effect of electric current

SIMPLE ELECTRIC CIRCUITS

KNOW YOUR SCIENTIST

Charles Augustine Coulomb
(1736 - 1806)

Charles Augustine Coulomb (1736 - 1806)

(born June 14, 1736, Angoulême, France — died Aug. 23, 1806, Paris) French physicist. After serving as a military engineer in the West Indies, he returned to France in the 1780s to pursue scientific research. To investigate Joseph Priestley's law of electrical repulsions, he invented a sensitive instrument to measure the electrical forces involved. A light rod made of an insulator, with a small conducting sphere at each end, was suspended horizontally by a fine wire so that it was free to twist when another charged sphere was brought close to it. By measuring the angle through which the rod twisted, Coulomb could measure the repulsive forces. He is best known for formulating Coulomb's law. He also did research on friction of machinery, on windmills, and on the elasticity of metal and silk fibres. The coulomb, a unit of electric charge, was named in his honour.

Synopsis-1

Introduction to Electric Current

We know that when we switch on the fans at homes,schools etc., they run. Computers,transistors,radios, television, electric trains etc. also run when they are switched on.Similarly at night when we switch on the bulbs, tubelights etc., they glow. All these things are possible because of **Electricity.**

Electricity is a form of energy. The flow of electricity is called **electric current.**

Electric current is nothing but flow of electrons in a conductor.

Sources of electric current:

The substance which produce electric current is called **a source of electric current.**

Based on supply of electric current, sources are classified into two types: They are

a) Small source of electric current

b) Big source of electric current

a) Small source of electric current

When the electric supply fails at night, we immediately look for a torch placed nearby. When we press its switch **ON**, its bulb glows up. The small source of electric current are called **cells.** Cells are used to operate the torch.

Cells are also used to operate small devices like transistors, radios, bicycle lamps, small tape recorders, cameras etc.

b) Big source of electric current

The electric current used in our homes for running fans; refrigerators; heaters etc. is of very large

magnitude. Similarly, the energy used in factories, electric trains etc. is of very very large magnitude.

Cells cannot provide this energy. For producing a large amount of energy **big power houses** are

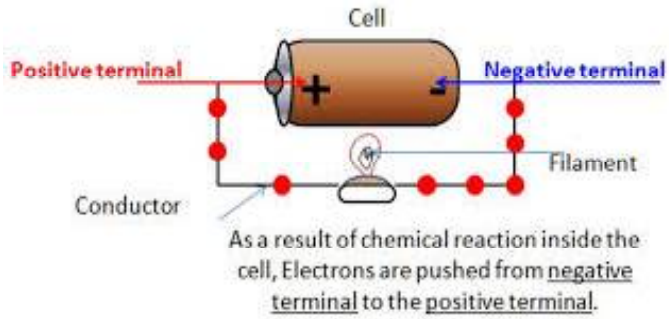
constructed.

Cell

An electric cell produces electricity from the chemicals stored inside it. What is stored in a cell is chemical energy.

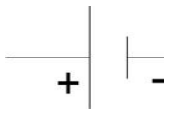
Terminals of Cell

There is a **'+' sign** close to one end of each cell and a **'–' sign** close to the other. These signs stand for the positive and negative terminals of the cell.



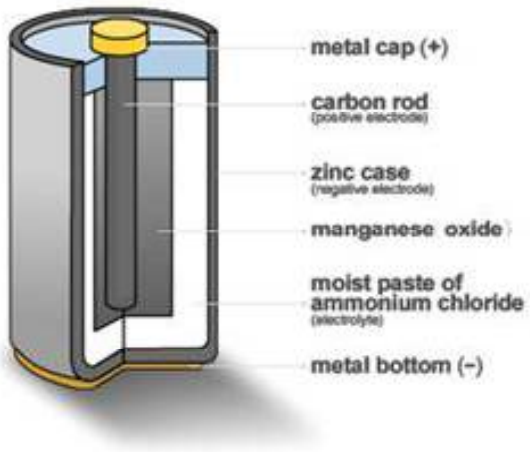
The metal cap at one end of the cell is the **positive terminal.** The flat metal base is the **negative terminal** as shown in the above figure.

Symbol of Cell

The symbol for electric cell is 

Internal structure of the cell

A simple representation of the inside of a cell is shown in the figure.



The zinc acts as the negative terminal of the cell. It is sealed on top and covered with thick paper or a metal sheet to prevent leakage. The metal cap fitted over the carbon rod acts as the positive terminal of the cell.

Types of Cells

We throw away cells, once their chemicals are used up. This type of cells are called **primary cell.** Eg: In torch.

The rechargeable cells are called **Secondary cells.**

Eg: In mobiles, digital cameras etc.,

Some more Cells

Button Cell: Button cells are small in size like a button. They are used in wrist watches, calculators, mini-microphones and the earphones. These cells are made from nickel and cadmium. They are small in size but give out more electrical energy than large sized cells. They have a longer life and occupy less space.

Solar Cell

Solar cells are specially designed cells to collect solar energy from sun. Solar cells are used in many homes, street lights, calculator and in space satellites.

Batteries

Sometimes one cell may not provide enough energy. Quite often, two or more cells are needed to operate an electrical device.

Example: The cells inside a torch or transistor radio may be connected in either of the two ways shown in figure.

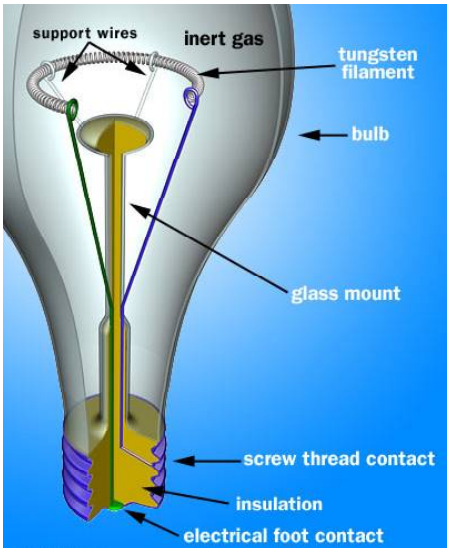
A group of connected cells is called a **battery.**

The batteries being used in cars, buses and trucks are a combination of six or more cells inside. Once exhausted, they can be recharged with the help of an electric charger and used again and again.

Note When cell is connected in a circuit, the chemical energy is converted into electrical energy.

Electric Bulb: A bulb is a device which converts electrical energy into light energy. An electrical bulb has a thin spring like wire inside it, called the**filament.** The filament is fixed to two copper rods, which also provide support to it. When electricity

flows through the filament it gets heated up and gives out light.



Wire 1: One of these thick wires is connected to the metal case at the base of the bulb.

Wire 2: The other thick wire is connected to the metal tip at the centre of the base as shown in the figure. The base of the bulb and the metal tip are the two terminals of the bulb. These two terminals are fixed in such a way that they do not touch each other.

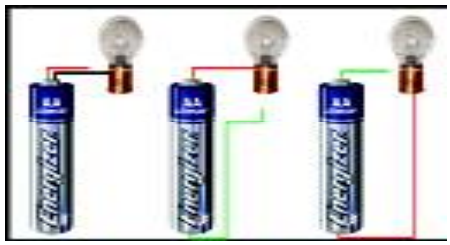
Different ways of connecting bulb:

The bulb will **glow** only when the two terminals of the cell form a complete loop, or path as shown in the figures. It does not matter which terminal of the bulb is connected to the positive terminal of the battery and which, to the negative terminal.

Try to join the wires in the different ways to the bulb.

Case 1: If both the terminals of the bulb are connected to the **same terminal** of the cell the **bulb does not glow** as shown below:

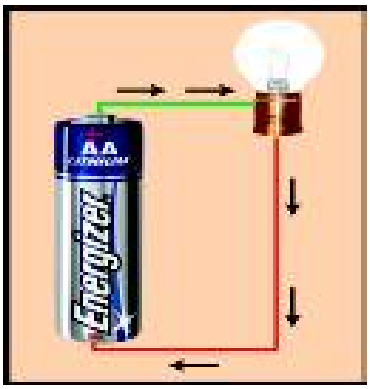
Case 2: Nor does it glow if there is a **break in the path** as shown below:



Electric circuit We know the flow of electricity is known as current or electric current. An electric current can flow only when there is a closed path for it to travel along. The path along which an electric current can flow is called **an electric circuit.** The cell, the bulb and the connecting wires are all part of the circuit. When the bulb glows, we say that an electric current is flowing round the closed circuit. If there is any break in the wires or in the filament of the bulb, the circuit is broken and the bulb does not glow.

Direction of Current: The electric current always flows from the **positive terminal** to the **negative terminal** of the cell in the circuit, as shown in the diagram: This is called conventional current. Modern concept is that electrons flow from lower

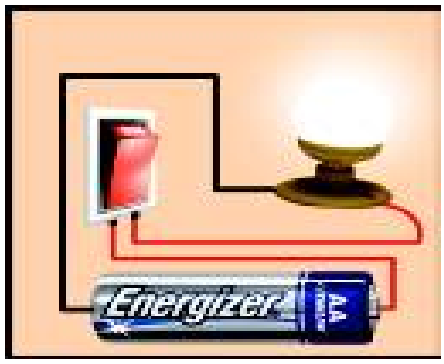
potential to higher potential. This will be made clear to you in higher classes.



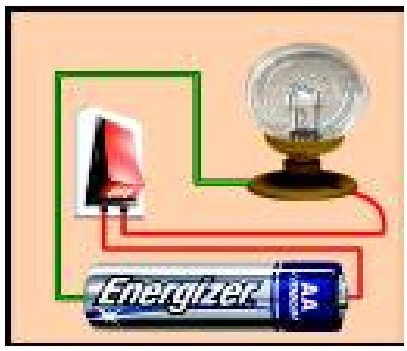
Switch: Once the circuit is complete, the bulb starts glowing. The only way you can turn off the bulb is by disconnecting one of the wires. A more convenient thing to do would be to use a **switch.** Switches come in various shapes and sizes.

A switch is a device used for opening (breaking) and closing an electric circuit. It has two terminals, to which wires can be connected. The electric appliances are connected to the electric wires through a tiny device called **switch**. When we want to use any electrical appliance we put the switch in the **ON** position. When we want that appliance should stop working we put the switch in the **OFF** position. In the **ON** position the electric current flows through appliance. In the **OFF** position electric current does not flow through the appliance.

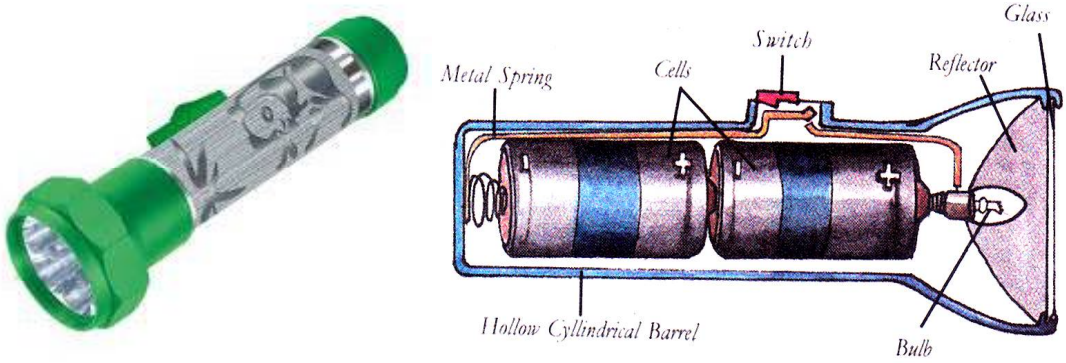
When the switch is **ON**, a metal strip (usually inside the switch) closes the circuit and allows the current to flow through it.



When the switch is turned **OFF,** the metal strip moves away, and opens the circuit at the terminals.



Torch: When the electric supply fails at night we use torch. **The inside** of a torch is as shown in the figure.



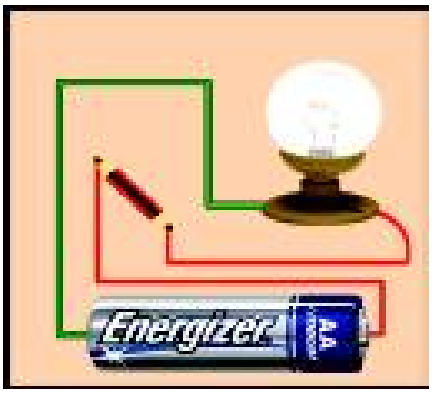
When we close **(ON)** the switch, the circuit gets completed and the bulb lights up.

Conductors and Insulators:

Materials are classified into two types based on passage of an electric current. They are i) Conductors and ii) Insulators.

i) Conductors: Materials that allow electric current readily to pass through them, are called **good conductors** or simply **conductors.**

Examples: All metals, lead of pencil (graphite), human body etc.



But not all metals conduct electricity equally well. Silver conducts electricity better than any other metal.

ii) Insulators: Materials which donot allow electricity to pass through them are called **insulators.**

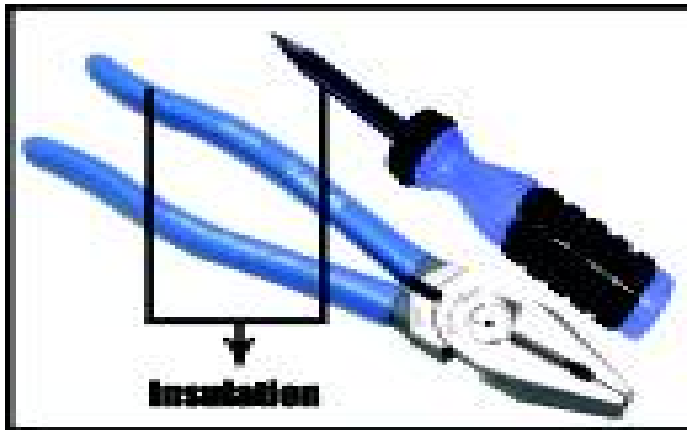
Examples: Wood, plastics, glass, rubber, cork, paper, pure water and mica.

Insulators play an important role in electrical circuits and equipment.

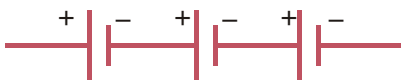
Normally, gases are bad conductors of electricity. That is why the bulb does not glow if you let the probes hang in air. In switches, an insulating material (plastic or Bakelite) separates the metal terminals from each other. The electric wires used in most circuits are insulated either by a plastic or rubber cover. The insulation on wires prevents shock.

The tools used by electricians, such as like testers, screw drivers and pliers, have insulated handles to protect them from electric shocks.

Note: Under certain conditions i.e., at low pressure and high voltage gases do allow electricity to pass through them.

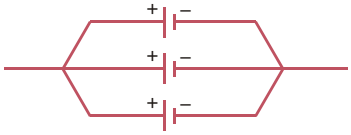


WORKSHEET-1

CUQ: 1. 

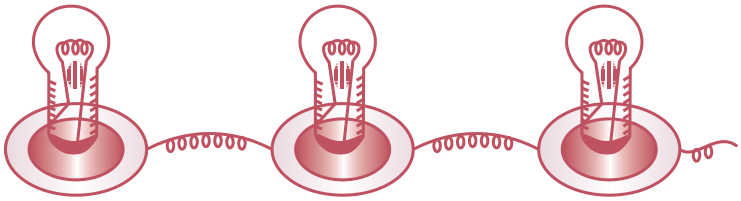
in the above figure the three cells are connected in

1) parallel 2) series 3) both 1 & 2 4) neither 1 nor 2

2. 

in the above figure the three cells are connected in

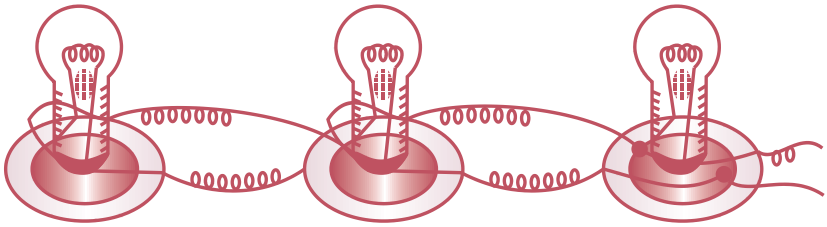
1) parallel 2) series 3) both 1 & 2 4) neither 1 nor 2

3. 

In the above figure, the three bulbs are connected in

1) parallel 2) series 3) both 1 & 2 4) neither 1 nor 2

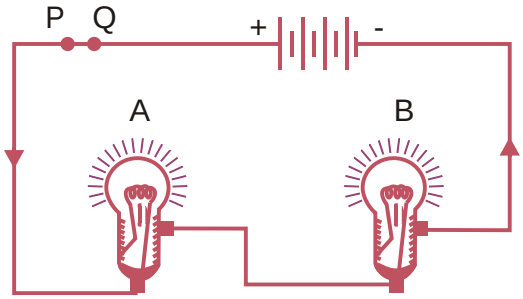
4.



In the above figure, the three bulbs are connected in

1) parallel 2) series 3) both 1 & 2 4) neither 1 nor 2

5.



Study the above figure and choose the correct statement from the following.

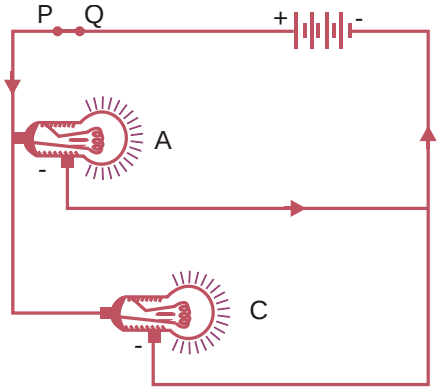
1) Only bulb 'A' glow dimly

2) Only bulb 'B' glow dimly

3) both bulbs 'A' and 'B' will not glow

4) both bulbs 'A' and 'B' will glow dimly

6.



Study the above figure and choose the correct statement from the following.

1) Only bulb 'A' glow brightly 2) Only bulb 'B' glow brightly

3) both bulbs 'A' and 'B' will not glow 4)both bulbs 'A' and 'B' will glow brightly

JEE MAINS

1. The flow of electricity in a circuit is known as

   1) current 2) resistance 3) potential 4) work

2. The small source of electric current are called

   1) cell 2) battery 3) bulb 4) torch

3. The symbol for electric cell is

   1)  2)  3)  4) 

4. A group of connected cells is called a

   1) cell 2) battery 3) bulb 4) torch

5. A_____ is a device which converts electrical energy into light energy.

   1) cell 2) battery 3) bulb 4) torch

6. Substances which allow the flow of electricity are known as _____of electricity.

   1) conductors 2) insulators 3) bad conductors 4) Both (2) and (3)

7. Substances which do not allow the flow of electricity are known as _____of electricity.

   1) conductors 2) insulators 3) semi conductors 4) Both (2) and (4)

8. The signs of terminals of a cell are

   1) positive (+) , positive (+) 2) positive (+) , negative (–)

   c) negative (–) , negative (–) d) can't say

9. The bulbs have a filament made of a metal called _____

   1) iron 2) plastic 3) tungsten 4) cobalt

10. _____ is an arrangement to close or open a circuit.

    1) electric circuit 2) resistance 3) potential 4) work

11. The current is does not flows in a_____ circuit.

    1) colse 2) open 3) both(1) & (2) 4) neither (1) nor (2)

12. The current is flows in a _____ circuit.

    1) colse 2) open 3) both(1) & (2) 4) neither (1) nor (2)

13. In which of the following secondary cells are used?

    1) mobiles 2) digital cameras 3) torch 4) both(1) & (2)

JEE ADVANCED

Multi Correct Choice Type:

14. Torch-light consists of _____ .

1) cell 2) switch 3) spring 4) bulb

15. Which of the following is/are insulator?

1) wood 2) plastic 3) rubber 4) iron

16. Which of the following is/are conductor ?

1) led 2) human body 3) paper 4) iron

Matrix Match Type:

17.

Column-I			Column-II	
a)	Cell	( )	p)	Conductor
b)	Switch	( )	q)	Source of electricity
c)	Safety pin	( )	r)	Insulator
d)	Eraser	( )	s)	To close or open a circuit

SIMPLE ELECTRIC CIRCUITS

WORKSHEET-1_KEY

CUQ: 1) 2 2) 1 3) 1 4) 2 5) 4 6) 4

JEE MAINS AND ADVANCED:

1. 1	2. 1	3. 1	4. 2	5. 3	6. 1
7. 2	8. 2	9. 3	10. 1	11.2	12. 1
13. 4	14. 1,2,3,4	15. 1,2,3	16. 1,2,4	17. a-q; b-s; c-p; d-r	

UNITS AND DIMENSIONS

KNOW YOUR SCIENTIST

Pierre Vernier
(19 August 1580)

Pierre Vernier (19 August 1580)

Pierre Vernier (19 August 1580 at Ornans, Franche-Comté, Spanish Habsburgs (now France) – 14 September 1637 same location) was a French mathematician and instrument inventor. He was inventor and eponym of the vernier scale used in measuring devices.

He was born in Ornans, France, in 1580, he was taught science by his father. He later became captain and castellan of the castle at Ornans, for the King of Spain. He was also later councillor and director general of moneys in the County of Burgundy.

SYNOPSIS - 1

INTRODUCTION TO PHYSICS

Observe the following **events** which we come across in our daily life:

- How the water entered into coconut even though it had a hard shell ?
- How can a large ship which can float in water, but a small stone can not float ?
- We see Lightning first and then we hear a thunder. Similarly in Television we here sound first then we see picture why ?
- How rain comes ?
- Who is catching the Earth for it to rotate ?
- How does a flower turns into fruit ?
- How can a bird can fly ? Why Human beings can not fly ?
- What is there beyond Sun ?
- How can Sun gives us Light and Heat ?
- Why Stars appear so small ?
- Why can' t Animals speak with Human beings ?

There are so many other numerous Questions and Problems which are need to be Answered and to be Solved. The Answers for the above Phenomena is possible only through the study of **PHYSICS**.

Physics is the study of laws of nature.

Introduction to Measurement

Measurements have an important role not only in physics but also in every branch of science and everywhere in our day-to-day life. Measurement should be made for knowing about the physical quantity. For example,

Imagine that you take a piece of cloth to a tailor for stitching a shirt.

What will the tailor do ?

He will first find **'how much'** quantity of cloth is required to prepare a shirt for you.

To know how much quantity required is called measuring**.** The act of measuring the quantity required is called **measurement**.

In the above example, the quantity measured by the tailor using a tape is **length. Quantity**

Quantity means size, amount, magnitude or simply stated as the answer for 'how much?' or 'how many?'

Physical Quantity: The quantities which are measurable are called physical quantities.

Ex : Length, mass, time, speed, etc.

Note : Love, sadness, hatred, affection are not physical quantities because you cannot measure them.

The information about a physical quantity, by description of its external properties like colour, taste etc. is incomplete with out knowing its temperature, size (dimensions), which depends on measurement. i.e., with out measurements it is impossible to know about the external properties of any object. So, it becomes necessary to measure it.Thus Measurement is thus the comparison of an unknown quantity with a known constant quantity.

This constant quantity which is used to measure the standard physical quantity is called **unit**. Unit is a standard to measure the physical quantity.

Measurement of the physical quantity

Measurement of the physical quantity involves two steps.

Step 1: Choose the standard value as a unit of measurement (unit)

Step 2: Find how many times that unit is contained in the given physical quantity (Numerical Value)

i.e., A measurement consists of two parts, the numerical value and the unit.

Ex : Length of the table = 5 metre. Here length is the physical quantity

5 is the numerical value and metre is the unit.

$\therefore$ Physical quantity = numerical value × unit

Note : The number of times a standard quantity is present in a given physical quantity is called **Numerical value** of physical quantity.

Unit : In the early days, people used to measure length with the help of various parts of a body, such as handspan, footspan , arm or cubit etc.,

Look at a boy measuring the length of a table:

Here, the boy is measuring the length of the table using handspan and the length was found to be **8 handspans.**

We can also say that **handspan** is present 8 times during the measurement of length of the table.This **handspan** (a part of the body) which is used to measure the length was called a **unit**.

ACTIVITY *Ask four students to measure the length of your text book by using palm and note the values. Let them compare the values and find that the values vary as their palms are of different sizes. This indicates that hand measurements like, span, cubit and fathom differ from person to person. But measurement should be the same whoever and wherever it is measured.*

Standard Unit: Imagine now boy's father is measuring the length of the table using his handspan.

Length of the table measured by his father is found to be **6 handspans** whereas length of the table measured by the boy was **8 handspans.**

So, using **handspan** as a **unit,** length found by the boy and his father is not same.

Hence, we need a **unit** which gives same length when used by the boy or his father or infact any one, and this unit is called **standard unit**.

For example, Meter is the standard by which we can measure length, Second is the standard by which we can measure time etc.,

Note: Magnitude of a physical quantity is constant (does not change with choice of unit)

Magnitude Physical Quantity(P) = Numerical value(N) × Unit(U)

i.e., P = constant $\Rightarrow$ NU = constant $\Rightarrow$ $N \propto \frac{1}{U}$ (as p is constant) $\Rightarrow$ $N_1U_1 = N_2U_2$

Example : Height of a girl is 1.2m= 120 cm

in 1.2m the unit is m and the numerical value is 1.2.

in 120 cm the unit is cm and numerical value is 120.

"Think it Over!"

gm/cm³ and kg /m³ are the units of density and 1gm/cm³ =1000 kg/m³. Is the above relation Violating the rule $N_1U_1=N_2U_2$?

WORKSHEET - 1

CUQ

1. The act of measuring the required quantity is called_____.
   1) Instrument 2) Measurement 3) Quantity 4) devise
2. The quantity which is measurable is called a
   1) Physical quantity 2) standard quantity
   3) Natural quantity 4) General quantity
3. The number of times a standard quantity is present in a given physical quantity is called
   1)Numerical quantity 2) Unit
   3)Physical quantity 4) General quantity
4. A constant quantity used for comparison during the measurement of unknown quantity is called
   1)Numerical quantity 2) Unit
   3)Physical quantity 4) General quantity
5. Which of the following is an example of physical quantity ?
   1) weakness 2) mass 3) sadness 4) affection
6. A standard in a given physical quantity, which is used to measure it is called
   1) unit 2) cubit 3) quantity 4) numerical value
7. Physical quantity = Numerical value × _____.
   1) Number 2) standard unit
   3) Value 4) Quantity
8. The numerical value of physical quantity (N) is related to the unit of the quantity (U) as
   1) $N \propto U$ 2) $N \propto \frac{1}{U}$ 3) $N \propto U^2$ 4) $N \propto \frac{1}{U^2}$

9. If U_1, U_2 are the units of physical quantities and N_1, N_2 are their numerical value then

1) $\frac{N_1}{N_2}=\frac{U_1}{U_2}$ 2) $\frac{N_1}{N_2}=\frac{U_2}{U_1}$ 3) $\frac{N_1}{N_2}=\sqrt{\frac{U_2}{U_1}}$ 4) $\left(\frac{N_1}{N_2}\right)^2=\frac{U_1}{U_2}$

1. To measure any physical quantity _____is required.

1) Time 2) Mass 3) Unit 4) Length

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LEVEL-1 Single Correct Type:

1. The magnitude of the physical quantity is

1) The product of numerical value and unit

2) The ratio of numerical value and unit

3) The sum of numerical value and unit

4) The differance between numerical value and unit

2. The mass of a boat is AB in one system and the mass of the same boat CD in another system A and C are numerical values and B and C are unit.

1) AB $\neq$ CD 2) AB=CD

3) Both 1 & 2 correct 4) neither 1 & nor 2 are correct

3. If pressure (P) is inversely propotional to volume (V) then

a) PV=constant b) $V\alpha\frac{1}{p}$ c) $P_1V_1=P_2V_2$ d) $\frac{P}{V}=$constant

1) a & b are correct 2) c & d are correct

3) a,b,c are correct 4) all are correct

4. Height of boy is measured as PQ in one system and as RS in another system. P,R are numerical value and Q,S are units if $\frac{P}{R}=100$, Then $\frac{Q}{S}=$

1) $\frac{1}{100}$ 2) 1 3) 0 4) 100

5. Height of Zerafi is measured as I,J in one system and as K,L in another system. I,K are numerical value and J,L are unit if $\frac{I}{K}=70$, Then $\frac{J}{L}=$

1) 70 2) 0 3) $\frac{1}{70}$ 4) 80

6. A & B are the numerical values of a physical quantity and C & D are units in two systems of measurement respectively. If C<D, Then

1) A<B 2) A=B 3) AD=BC 4) A>B

Matrix Match Type:

7.

Column-I	Column-II
a) length	p) metre
b) mass	q) second
c) time	r) kilogram
d) system of unit	s) F.P.S
	t) C.G.S

SYNOPSIS - 2

System of Units : The scientists all over the world have developed basic set of standard units for measuring various quantities. This set is also known as system of units and named as Standard **I**nternational **S**ystem of Units or **SI system.** At present the system adopted by all the scientists in the world is SI. Some other units still in use are

(i) F.P.S system (**F**oot, **P**ound,**S**econd)

(ii) C.G.S. system (**C**entimetre, **G**ram, **S**econd)

(iii) M.K.S. system (**M**etre, **K**ilogram, **S**econd)

System	Fundamental Physical Quantities		
	Length	Mass	Time
FPS	Foot (ft)	Pound(*lb*)	Second (s)
CGS	Centimeter (cm)	Gram (g)	Second (s)
MKS	Metre (m)	Kilogram(kg)	Second (s)

Conventions for writing the symbols of units :

1. The symbol for a unit which is not named in the honour of some scientist is written in lower letter.

   Ex: The symbol for metre is 'm' for kilogram is 'kg' and for second as 's'.

2. The symbol for a unit which is named in the honour of some scientist is written with initial capital letter.

   Ex: The symbol for unit of force (newton) is N.

   The symbol for unit of temperature (Celsius) is °C.

   The symbol for unit of work (joule) is J.

   The symbol for unit of power (watt) is W.

3. Full name of the unit named in the honour of scientist is written with lower initial letter.

   Ex: The full name for the unit of force is newton and not Newton.

   The full name for the unit of power is watt and not Watt.

4. Negative powers are used for compound units obtained by dividing one unit with another unit.

   Ex: The unit of speed is m/s. It is expressed as ms^{-1}.

5. A unit in short form is never written in plural.

   Ex: 30 kilogram in short form is written as 30kg and not 30kgs.

WORKSHEET - 2

CUQ

1. The unit of length in FPS system is
   1) Foot 2) Centimeter 3) Metre 4) All of these
2. The unit of mass in F.P.S system is
   1) second 2) pound 3) meter 4) centimeter
3. The unit of length in C.G.S system is
   1) second 2) pound 3) centimeter 4) meter
4. The unit of mass in M.K.S system is
   1) kilogram 2) second 3) centimeter 4) meter
5. Which among the following is the international system of units ?
   1) S.I. 2) F.P.S 3) C.G.S 4) M.K.S
6. Unit of mass in C.G.S system is
   1) gram 2) kilogram 3) centigram 4) milligram
7. The unit of length in M.K.S system is
   1) Foot 2) Centimeter 3) Handspan 4)Metre
8. The fundamental unit which is common in C.G.S and S.I System is
   1) meter 2) second 3) gram 4) centimeter
9. The symbol for unit of length in C.G.S system is
   1) centimeter 2) C.M 3) cm 4) Cm
10. The symbol for unit of length in M.K.S system is
    1) Meter 2) m 3) M 4) mr

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LEVEL-1 Single Correct Type:

1. The symbol for unit of mass in F.P.S system is
   1)p 2)pd 3) lb 4)po
2. The symbol for unit of time in M.K.S system is
   1)t 2)s 3)T 4)S
3. The symbol of unit of force is
   1) N 2) newton 3) F 4) n
4. The symbol for unit of work is
   1) S 2) K 3) J 4) I

Comprehension Type:

Unit is a standard which is used for the measurement of a physical quantity.

5. In C.G.S. system the unit of volume is (volume = length × breadth × height)

   1) m^2 2) cm^3 3) kg^2 4) s^2

6. 60 kilogram in short form is written as

   1) 60 kgs 2) 60 kg 3) 60KG 4) 60KI

7. In which physical quantity, unit is same in all systems?

   1) length 2) mass 3) time 4) temperature

Matrix Match Type:

8.

Column-I	Column-II
a) unit of length in F.P.S	p) gram
b) unit of mass in C.G.S	q) foot
c) unit of time	r) metre
d) unit of length in S.I	s) pound
	t) second

SYNOPSIS - 3

Based upon the nature of dependence and independence, physical quantities are classified into two types:

1) Fundamental physical quantities 2) Derived physical quantities

Fundamental quantities : The physical quantities which are independent of other physical quantities are called fundamental physical quantities.

Ex : Length, mass and time etc.,

Fundamental units : Fundamental units are the units for measuring fundamental quantities. These are independent of other units. These are also called basic units.

Ex: metre, kilogram and second etc.,

Fundamental quantities and units in S.I system:

Fundamental Quantity	S.I. unit	Symbol
Length	Metre	m
Mass	Kilogram	kg
Time	Second	s
Strength of electric current	ampere	A
Thermodynamic temperature	Kelvin	K
Amount of substance	Mole	mol
Luminous Intensity	Candela	cd

Supplementary quantity	Unit	Symbol
Plane Angle	radian	rad
Solid Angle	steradian	sr

WORKSHEET - 3

CUQ

1. The physical quantities which are independent of other physical quantities are called
   1) Fundamental quantities 2) Derived quantities
   3) Fundamental units 4) Derived units
2. Which of the following are fundamental quantities?
   1) kilogram 2) second 3) acceleration 4) Time
3. The S.I unit of length is
   1) centimetre 2) metre 3) foot 4) gram
4. The symbol used for unit of time is
   1) T 2) t 3) s 4) ti
5. The unit of plane angle is
   1) radian 2) steradian 3) candela 4) mole
6. The unit of mass in S.I. system is_____.
   1)gram 2) second 3) kilogram 4) foot
7. The unit of strength of electric current in S.I. system is_____.
   1)kelvin 2) mole 3) candela 4) ampere
8. The unit of amount of substance in S.I. system is_____.
   1)mole 2) candela 3)ampere 4) kelvin
9. The unit of luminuous intensity in S.I. system is_____.
   1)kelvin 2) mole 3) ampere 4) candela
10. Which of the following is a fundamental quantity?
    1) volume 2) length 3) area 4) force

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LEVEL-1 Single Correct Type:

1. Which of the following is a fundamental quantity?
   1) weight 2) volume 3) density 4) temperature
2. The symbol of unit of strength of electric current is
   1) m 2) kg 3) i 4) A

3. The symbol of unit of thermodynamic temperature is

1) m 2) kg 3) K 4) θ

4. The symbol of unit of luminous intensity is

1) cd 2) kg 3) K 4) A

5. The symbol of unit of amount of substance is

1) mole 2) Cd 3) mol 4) A

Multi Correct Choice Type:

6. Choose the correct statement:

1) Number of fundamental quantities are limited

2) In M.K.S System there are 3 fundamental quantities

3) Number of fundamental quantities are unlimited

4) Units of fundamental quantities in M.K.S is same as in SI

Matrix Match Type:

7.

Column-I	Column-II
a) length	p) ampere
b) time	q) second
c) plane angle	r) centimeter
d) strength of electric current	s) metre
	t) radian

SYNOPSIS - 4

Derived quantities : The physical quantities which are dependent on fundamental quantities are called derived quantities.

Ex : Area, volume, density, speed etc.

Derived Units: Units of derived physical quantities are called derived units.

Ex: The unit of speed is expressed by dividing the unit of distance by unit of time.

Hence speed is a derived quantity and the unit of speed =m/s.

SI units of some derived physical quantities are as follows:

Derived Physical Quantities	Derived Units
Area	m^2
Volume	m^3
Speed	ms^{-1}
Force	$kgms^{-2}$ or newton (N)
Energy	kgm^2s^{-2} or joule (J)

NOBEL LAUREATE IN PHYSICS - 1901

WILHELM CONRAD RONTGEN (1845 - 1923)
Munich University, Munich, Germany
"in recognition of the extraordinary services he has rendered by the discovery of the remarkable rays subsequently named after him"

WORKSHEET - 4

CUQ

1. The physical quantities which are dependent on fundamental quantities are called _____
   1) Fundamental quantities 2) Derived quantities
   3) Fundamental units 4) Derived units
2. Which of the following is a derived quantity?
   1) depth 2) height 3) volume 4) mass
3. The unit of speed is a
   1) Fundamental unit 2) Derived unit
   3) Neither fundamental not derived 4) Both fundamental and derived
4. Unit of area is a
   1) Derived unit 2) Fundamental unit
   3) Fundamental and derived 4) Fundamental or derived
5. Volume is a _____ quantity.
   1) fundamental 2) derived 3) natural 4) numerical
6. The derived unit of area is
   1) m 2) m^2 3) m^3 4) m/s
7. Derived unit of volume is
   1) m 2) m^2 3) m^3 4) m^4
8. Derived units are the units of
   1) derived physical quantities 2) fundamental physical quantities
   3) single quantities 4) secondary quantities
9. Units of derived physical quantities are called _____
   1) Fundamental quantities 2) Derived quantities
   3) Fundamental units 4) Derived units
10. Among the following the odd one is
    1) kilogram 2) newton 3) candela 4) mole

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LEVEL-1 Single Correct Type:

1. Which of the following is a derived quantity?

   1) height 2) depth 3) mass 4) volume

2. If density = mass/volume, then which of the following quantities are used to derive the quantity density ?

   1) Mass only 2) time,Mass 3) length,Area 4) Mass,length

3. Which of the following is a fundamental quantity?

   1) area 2) volume 3) density 4) radius

Comprehension Type:

All derived quantities are derived from fundamental physical quantities.

4. If Speed = distance/ time then speed is derived from

   1) Length & Angle 2) Time & Angle 3) Time & Mass 4) Length & time

5. Force is derived from (Hint : force = (mass × length) / time)
   1) length & time 2) mass & length

   3) mass, length and time 4) mass & time

6. Volume is derived from

   1) length & time 2) mass & length

   3) mass, length and time 4) length

Matrix Match Type:

7.

Column-I	Column-II
a) Energy	p) m^2
b) speed	q) m^3
c) volume	r) kgm^2s^{-2} or $joule(J)$
d) Area	s) m/s
	t) m/s^2

SYNOPSIS - 5

Measurement of Length

Observe the following:

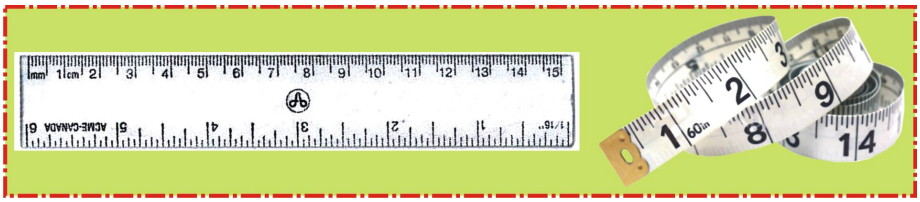
Here, we are measuring the distance between two points A and B.

This distance between two points is called **Length**.

Standard Unit of Length : According to SI system of units, the standard unit of length is **metre**. In short form it is written as **m**.

Measuring Instruments of length

Ruler, Tape are some instruments used to measure length.



Conversion of units:

To convert a unit from one system to another, the steps to be followed are:

Step-1 : First convert the given unit into SI unit.

Step-2 : Then, convert it into the desired system of units.

Note : Conversion is possible only between the units used to measure the same physical quantity.

Convert the following units of "length" into desired units.

a) Convert 20 cm into meter; **Step 1 :** 20 cm = 20×10^{-2} m= 0.2 m

b) Convert 20 cm into km; **Step 1:** 20 cm = 20×10^{-2}m = 0.2 m

Step 2: 0.2 m = $0.2 \times 10^{-3} \times 10^{3}$ m = 0.2×10^{-3} km

c) Convert 20 cm into μm; **Step 1:** 20 cm = 20×10^{-2}m = 0.2 m

Step 2: 0.2 m = $0.2 \times 10^{6} \times 10^{-6}$ m = 0.2×10^{6} μm

d) Convert 20 cm into nm; **Step 1:** 20 cm = 20×10^{-2} m=0.2 m

Step 2: 0.2 m = $0.2 \times 10^{9} \times 10^{-9}$ m = 0.2×10^{9} nm

Note : 12 inches = 1 foot; 3 feet = 1 yard; 5 ½ yards = 1 pole or rod; 4 pole = 1 chain

80 chain = 1 mile.

Now, find out 1 inch = _____ mile.

Read the Googly

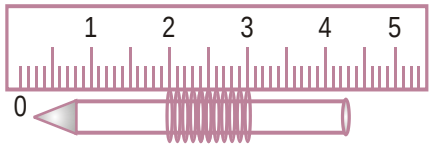
1Kilogram=_____meter

Ans : Conversion is not possible

ACTIVITY

Measuring the diameter of wire using scale.

Take the wire whose diameter has to be measured. Wind it around the pencil as shown in figure.



See that there is no gap between the turns of wire. Measure the length of coil. For example if the number of rounds wound are 24 and the length of coil is 4.8cm, then the diameter of wire is length of the coil / number of rounds wound

= 4.8/24 = 2mm.

Measurement of Mass: Imagine you have to buy vegetables from the market.

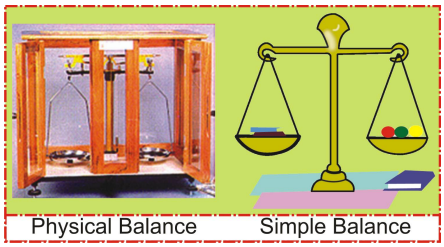
Here, the measuring quantity is **mass**.

The quantity of matter contained in the body is called its mass.

In S.I. system mass is measured in kilogram.

Standard unit of mass: According to SI system of units, the standard unit of mass is **kilogram**. In shortform it is written as **kg**.

Measuring Instruments of mass: Simple balance, Physical balance etc., are some instruments used to measure mass.



Conversions:

Convert the following units of 'mass' into desired units

a) Convert 300 g into kg; **Step 1:** 300 g = 300 × 10^{-3} kg = 0.3 kg

b) Convert 5 mg into kg; **Step 1:** 5 mg = 5 × 10^{-3} g

Step 2: 5 × 10^{-3} × 10^{-3}kg = 5 × 10^{-6} kg

c) Convert 400 kg into mg; **Step 1:** 400 kg = 400 × 10^{6} × 10^{-6} kg = 400 × 10^{6} mg
Now you have enough practice. From now onwards combine the two steps.

d) Convert 5 μg into ton; 5 μg = 5 × 10^{-6} g = 5 × 10^{-9} kg

5 × 10^{-9} kg = 5 × 10^{-9} × 10^{-3} ton = 5 × 10^{-12} ton

e) Convert 10 quintal into ng; 10 quintal = 10 × 10^{2} kg

10 × 10^{2} kg = 10 × 10^{2} × 10^{3} g = 10 × 10^{2} × 10^{3} × 10^{9} ng = 10^{15} ng

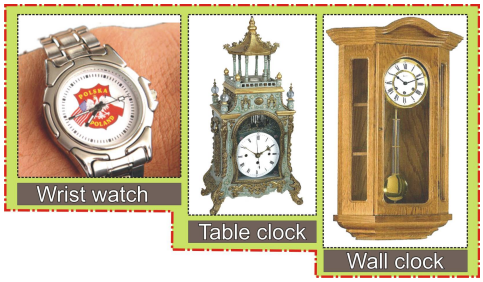
Measurement of Time: Imagine every day, after coming from school, you start playing at 5 PM. Here, the measuring quantity is **Time**.

Standard Unit of Time: According to SI system of units, the standard unit of time is **second**. In short form it is written as **s**.

Other Units of time

1 minute (min) = 60 seconds	1 hour (h) = 60 minutes = 360 seconds
1 day = 24 hours	1 year = $365\frac{1}{4}$ days
1 decade = 10 years	1 century = 10 decades
1 leep year = 366 days	1 millennium = 100 decades = 100 years

Measuring Instruments of Time: Watches and clocks are some instruments used to measure time.



Conversions: Convert the following units of 'time' into desired units.

a) Convert 32 s into ms; 32 s = 32 × 10^{3} × 10^{-3} s = 32×10^{3} ms.

b) Convert 40 min in to μs;

40 min = 40 × 60 s = 24 × 10^{2} s = 24 × 10^{2} × 10^{6} × 10^{-6} s = 24 × 10^{8} μs

c) Convert 1day into seconds;

1day = 24hrs = 24×60 min = 24×60×60s = 86,400s

WORKSHEET - 5

CUQ

1. The distance between any two points is called
   1) mass 2) length 3) velocity 4) weight
2. The standard unit of length is S.I. System is _____
   1) kilometre 2) metre 3) centimetre 4) millimetre
3. The quantity of matter contained in the body is called _____
   1) weight 2) Length 3) mass 4) time
4. The standard unit of mass is S.I. system is
   1) gram 2) milli gram 3) centimetre 4) kilogram
5. centimetre=_____metre.
   1) 1/10 2) 1/100 3) 1/1000 4) 1/10,000
6. 1 nm = _____.
   1) 10^{-9} m 2) 10^{-10} m 3) 10^{-7} m 4) 10^{-10} mm
7. 1 millimetre=_____metre.
   1) 1/10 2) 1/100 3) 1/1000 4) 1/10000
8. 1 millimetre =_____kilometre
   1) $\frac{1}{10}$ 2) $\frac{1}{100}$ 3) $\frac{1}{1000000}$ 4) 1000000.
9. 1 kilogram = _____milligram
   1) 10 2) 100 3) 10000 4) 1000000
10. 1 gram =_____milligram
    1) 10 2) 100 3) 1000 4) 1/1000

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LEVEL-1 Single Correct Type:

1. 1 gram =_____kilogram
   1) $\frac{1}{10}$ 2) $\frac{1}{100}$ 3) 1000 4) $\frac{1}{1000}$

Comprehension Type:

To convert a unit from one system to another, the steps to be followed are:

- first convert the given unit into S.I. unit.
- then, convert it into the desired system of units.

2. 20 cm = _____ km.
   1) 1.2×10^{-7} 2) 1.4×10^{-2} 3) 0.2×10^{-3} 4) 0.9×10^{-6}

3. 5 mg = _____ kg.
   1) 2×10^{-3} 2) 3×10^{-6} 3) 5×10^{-6} 4) 6×10^{-5}

4. 1 day = _____ sec.
   1) 34,600 2) 43,000 3) 56,230 4) 86,400

5. 1 centimetre =_____ millimetre
   1) 10 2) 100 3) 1000 4) 10000

6. 1 centimetre =_____kilometre
   1) 10 2) 100 3) $\frac{1}{10}$ 4) $\frac{1}{100000}$

Statement Type:

7. *Statement I :* $1ng = 10^{-6}\,mg$

   Statement II : $1\mu g = 10^{6}$ *picogram*

   1) Both statements I and II are correct.
   2) Both statements I and II are incorrect.
   3) Statement I is correct and statement II is incorrect.
   4) Statement I is incorrect and statement II is correct.

8. 1kg = _____ μg
   1) 10^3 2) 10^6 3) 10^9 4) 10^4

9. $1\,\mu s$ =_____ms
   1) 10^{-3} 2)10^3 3)10^{-6} 4)10^6

10. 1Mm= _____mm
    1) 10^3 2)10^6 3)10^{12} 4)10^9

LEVEL-2 & 3 Single Correct Choice Type:

11. Convert 300g into Kg
    1) 0.3 Kg 2) 0.03 Kg 3) 0.003 Kg 4) 3 Kg

12. Convert $400\,\mu s$ into ms.
    1) 40×10^{-3} 2) 0.4×10^{-3} 3) 4×10^{-3} 4) 0.04×10^{-3}

Comprehension Type:

To convert a unit from one system to another, the steps to be followed are:
First convert the given unit into SI unit.
Then, convert it into the desired system of units.

13. 1 cm/ns =_____ mm/μs .
    1) 10^4 2) 10^{-3} 3) 10^6 4) 10^{-6}

14. 1 mg/km=_____μg/mm .
    1) 10^3 2) 10^{-3} 3) 10^6 4) 10^{-6}

15. 1 $\mu s/nm$ = _____ ms/km.

1) 10^6 2) 10^{-6} 3) 10^9 4) 10^{-9}

16. Convert 40 min into μs

1) 24×10^8 2) 24×10^6 3) 24×10^{-6} 4) 24×10^{-8}

17. 1.hr 18 min= _____ S

1) 3600 2) 4680 3) 4860 4) 4800

18. Convert 500 Kg into mg.

1) 5×10^8 2) 50×10^8 3) 5×10^7 4) 5×10^6

19. Convert 50 μs to ns

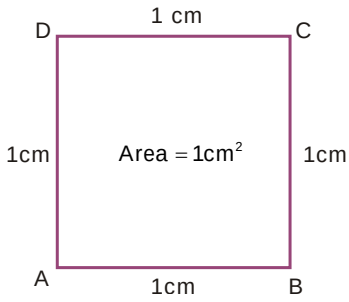
1) 5×10^4 2) 50×10^4 3) 0.5×10^4 4) 500×10^4

Multi Correct Choice Type:

20. 1 second= _____

1) $\frac{1}{86,400}$ 2) $\frac{1}{3600}$ 3) $\frac{1}{60}$ 4) $\frac{1}{6000}$

SYNOPSIS - 6



The relation between cm^2 and m^2 :

$1m^2 = 1\ m \times 1m = 100\ cm \times 100\ cm = 10000\ cm^2$ or $10^4 cm^2$.

$\therefore 1m^2 = 10^4 cm^2$ or $1cm^2 = \frac{1}{10000} m^2 = 10^{-4} m^2$.

Note : Millimeter square is another important submultiple of standard unit of area.

$1mm^2 = 1mm \times 1mm = \frac{1}{10} cm \times \frac{1}{10} cm = \frac{1}{100} cm^2 = \frac{1}{10^2} cm^2 = 10^{-2} cm^2$

Multiples of Standard Unit of Area : For measuring bigger areas, such as area of field or towns, metre square is a very small unit. Thus, a bigger unit is used, which is called **hectare. One hectare** is the surface area of a square whose each side is equal to 100 m. Note:100m is called hectometer and 1 square hectometer is called hectare. 1 square hectometer = 1 hectometer × 1 hectometer = 100m × 100m = $10000m^2$

$100 m^2$ is called acre.

$\because$ 1 hectare = 100 acres = $100 \times 100 m^2 = 10^4 m^2$.

1 hectare = 100 m × 100 m, 1 hectare = 10000 m^2

or $1 m^2 = \frac{1}{10000}$ hectare $= 10^{-4}$ hectare

For measuring further bigger areas, such as the area of district or a province or a country, even hectare is a very small and inconvenient unit. Thus, a bigger unit is used which is called **square kilometre (km^2).**

One square kilometre (km^2) is the surface area of a square whose each side is equal to 1 km

1 km^2=1000 m × 1000 m, 1 km^2 = 1000, 000 m^2, **1 km^2 = 100 hectares**

CONVERSION:

Convert the following units of 'area' into the required units.

a) Convert 20 cm^2 into m^2; 20 $cm^2 = 20 \times (10^{-2} m)^2 = 20 \times 10^{-4} m^2$

b) Convert 15 mm^2 into cm^2 ; $15 mm^2 = 15 \times (10^{-3} m)^2 = 15 \times (10^{-6} m^2)$

$= 15 \times 10^{-6} (10^2 cm)^2 = 15 \times 10^{-6} \times 10^4 cm^2 = 15 \times 10^{-2} cm^2$

c) Convert 20 sq.cm into sq.km

$20 cm^2 = 20 (10^{-2} m)^2 = 20 \times 10^{-4} \times 10^{-6} \times km^2 = 2 \times 10^{-9} km^2$

WORKSHEET-6

CUQ

1. The amount of surface occupied by an object is

   1) length 2) temperature 3) area 4) volume

2. In SI system the unit of area is

   1) Square centimeter 2) hectare 3) square metre 4) are

3. The area of a square surface, whose each side is equal to one metre is

   1) square millimetre 2) square centimetre
   3) square cube metre 4) square metre

4. $1 m^2$=

   1) $10^4 cm^2$ 2) $10^2 cm^2$ 3) $10^6 cm^2$ 4) $10 cm^2$

5. $1 cm^2$=

   1) $10^4 m^2$ 2) $10^{-4} m^2$ 3) $10^{-6} m^2$ 4) $10^2 m^2$

6. The surface area of a square whose each side is equal to 100 m is called

   1) are 2) Hectare
   3) square km 4) square meter

7. 1 Hectare = _____

1) $100m^2$ 2) $1000m^2$ 3) $1,00,000m^2$ 4) $10000m^2$

8. $1m^2$ =_____ hectare

1) 10^{-4} 2) 10^{-2} 3) 10^{-3} 4) 10

9. 1 sq. km= _____ m^2

1) 10^3 2) 10^4 3) 10^8 4) 10^6

10. 1 sq. km = _____ hectare

1) 1000 2) 10 3) 100 4) 10000

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LEVEL-1 Single Correct Type:

1. Which of the following is the unit of area?

1) m 2) m^2 3) m^3 4) m^4

2. 1 km^2 = _____ hectares

1) 10000 2) 1000 3) 100 4) 10

3. $20cm^2$ =_____km^2

1) 2×10^{-8} 2) 2×10^{-9} 3) 2×10^{-4} 4) 2×10^{-2}

4. The area of the town is 20 hectare, then the area in km^2 is

1) $0.2km^2$ 2) $2km^2$ 3) $200km^2$ 4) $2000km^2$

5. The area of a town is 40 hectares. The area in SI unit is

1) 4×10^5 m^2 2) 4×10^6 m^2 3) 4×10^4 m^2 4) 4×10^8 m^2

Multiple Correct Choice Type

6. 1 cm^2 =

1) 1/10000 m^2 2) 10^{-5} m^2 3) 1/100000 m^2 4) 10^{-4} m^2

Comprehension type:

cm^2 and m^2 are the units of area.

7. 1 cm^2 = _____km^2

1) 10^{-10} 2) 10^{-8} 3) 10^{-6} 4) 10^{-3}

8. 1 mm^2 = _____cm^2

1) 10^{-4} 2) 10^{-8} 3) 10^{-6} 4) 10^{-2}

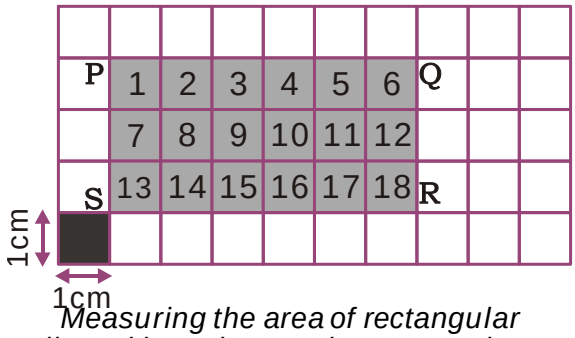
9. 1 km^2 = _____mm^2

1) 10^{-12} 2) 10^{-8} 3) 10^{-6} 4) 10^{-3}

SYNOPSIS - 7

Measurement of area of a regular surface

Suppose you want to measure the area of a rectangular cardboard of length 6 cm and breadth 3 cm as shown in figure. The convenient unit to measure the area of given cardboard should be cm^2.



Measuring the area of rectangular cardboard by using centimetre graph paper

Take a centimetre graph paper. Each small square on this graph paper has a side equal to 1 cm. Thus, the area of each small square on this graph paper is 1 cm^2 as illustrated in figure.

Place the cardboard PQRS on the centimetre graph paper and draw its outline with the help of a sharp pencil. Now remove the cardboard. Count the number of squares within the outline PQRS. The number of squares are 18.

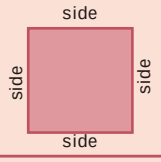
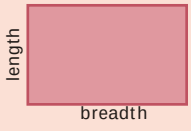
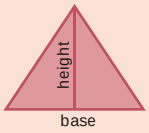
$\therefore$ Area of the face of cardboard PQRS = Area of 18 small squares = 18 × area of 1 small square= 18 × 1 cm^2 = 18 cm^2 ------- (1)

Notice that the length of the cardboard is 6 cm and its breadth is 3 cm. If we multiply length by breadth then :Length × Breadth = 6 cm × 3 cm = 18 cm^2 - - - (2)

If we compare (i) and (ii) then we can say that

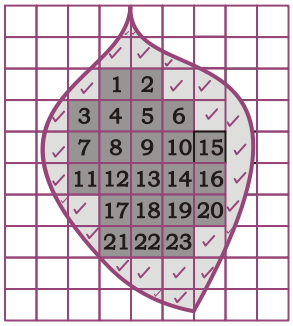
Area of the cardboard PQRS = Length × Breadth

Areas of some regular bodies:

S.No	Regular body	Figure	Formula
1	Square		side×side
2	Rectangle		Length×breadth
3	Triangle		½×base×height
4	Circle		π×square of radius

Measurement of Area of an irregular flat surface :

Suppose we want to find the area of the face of a big leaf, such as a peeple leaf or banyan leaf.



Measuring the area of face of a leaf

Place the leaf flat on the centimetre graph paper. With the help of sharp pencil mark the outline of the leaf.

Count the number of complete squares (each of 1 cm2 area) inside the boundary. Also count those squares, inside the boundary, which are half or greater than half. Add this to the number of complete squares. This total number of squares inside the boundary gives the area of the leaf. If there are 'n' squares inside the boundary, the are of the leaf becomes n cm^2.

Neglect those squares, inside the boundary, which are less than half. This process will gives us the value of area which is close to the actual area.

WORKSHEET-7

CUQ

1. The convenient unit to measure the area of regular surface should be ____

   1) m^2 2) cm^2 3) km^2 4) All of the above

2. Which of the following is regular bodies

   1) leaf 2) banyantree 3) cardboard 4) None

3. Which of the following is irregular bodies

   1) cardboard 2) leaf 3)circular ground 4) All of these

4. Triangle is a ____

   1) regular body 2) Irregular body 3) both 1&2 4) None

5. Circle is a ___

   1) regular body 2) Irregular body 3) both 1&2 4) None

6. Palm is a _____

   1) regular body 2) Irregular body 3) both 1&2 4) None

7. Area of square is _____

   1) side x side 2) side x breadth

   3) length x breadth x hight 4) None

8. Area of Rectangle is ____
   1) side x side
   2) length x breadth
   3) length x breadth x hight
   4) None
9. Area of Trangle is _____
   1) side x side
   2) side x breadth
   3) length x breadth x hight
   4) $\frac{1}{2}$ x base x height
10. Area of circle is ____
   1) $\frac{1}{2}$ x base x height
   2) $\pi^2 D$
   3) $\pi \times square\,of\ Radiaus$
   4) $\pi^2 \times square\,of\ Radiaus$

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LEVEL-1 Single Correct Type:

1. The area of a square cardboard is 625 cm^2. The side of the square cardboard is
   1) 15 cm 2) 35 cm 3) 25 cm 4) 18 cm
2. The area of a square of side 10cm is
   1) 100 cm 2) 100cm^2 3) 100m 4) 100m^2
3. Find the area of the square of side 20m?
   1) 400 km^2 2) 400 cm^2 3) 400 mm^2 4) 4×10^{-4} km^2
4. A School hall measures 20 m in length and 12 m in breadth. The area of hall is
   1) 1.666 m^2 2) 240 m^2 3) 8 m^2 4) 32 m^2
5. The length of the school play ground is 500m and breadth is 2000cm, then the area of the play ground is
   1) $10^4 m^2$ 2) $10^4 cm^2$ 3) $10^4 km^2$ 4) $10^4 mm^2$
6. 1 Hectare = _____
   1) $100m^2$ 2) $1000m^2$ 3) $1,00,000m^2$ 4) $10000m^2$
7. Find the area of a triangle of base 10cm, and height 5m?
   1) 25m^2 2) 25cm^2 3) 0.25m^2 4) 0.2m^2
8. The area of circular shaped ground of radius 200 m is
   1) 40000π 2) 400π 3) 40π 4) 4000π
9. The radius of a circle is 7cm, then the area of the circle is
   1) $49\pi cm^2$ 2) $154\pi cm^2$ 3) $22\pi cm^2$ 4) $84\pi cm^2$
10. The area of a square surface, whose each side is equal to one metre is

1) square millimetre
2) square centimetre
3) square cube metre
4) square metre

Matrix match type

11. **Column-I**

a) Area of square
b) area of rectangle
c) area of triangle
d) area of circle

Column-II

p) side × side
q) length × breadth
r) ½ × base × height
s) π × square of radius
t) π × radius

Integer type

12. The diameter of a circle is 14m. then the area of the circle is _____.

SYNOPSIS - 8

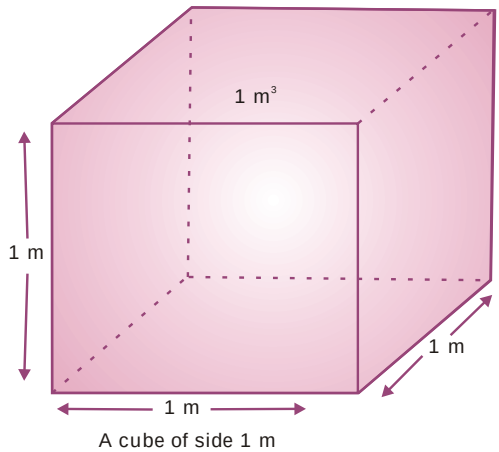
Observe the following:

Here, we say that quantity of milk or space occupied by the milk in the big vessel is more when compared to the quantity of milk or space occupied by the milk in the glass. This space occupied by the milk is called **volume** of the milk.

Definition of Volume : The space occupied by a substance (solid, liquid or gas) is called volume.

Units of volume : The unit of volume in standard international (SI) system is **cubic metre.** In short form cubic metre is written as **m^3**.

One cubic metre ($1m^3$) is the volume occupied by a cube whose each side is equal to 1 m.



A cube of side 1 m

Submultiples of unit of volume :

Cubic metre is a fairly inconvenient unit for measuring small volumes such as volume of a match box or volume of a glass full of water.

A small unit called cubic centimeter (cm^3) is used for measuring small volumes.

The C.G.S unit of volume is cm^3 or cc. which is used for measuring small volumes.

One cubic centimeter ($1cm^3$) is the volume occupied by a cube whose each side is equal to 1 cm.

Relation between 1 m^3 and $1cm^3$

$1\ m^3 = 1\ m \times 1\ m \times 1\ m = 100\ cm \times 100\ cm \times 100\ m$

$1\ m^3 = 1000{,}000\ cm^3$ or $1cm^3 = \frac{1}{1000{,}000} m^3$, **$1cm^3 = 10^{-6}\ m^3$ or $1m^3 = 10^6\ cm^3$**

Convert the following units of 'volume' into desired units.

a) Convert $20cm^3$ into m^3; $20cm^3 = 20 \times (10^{-2}m)^3 = 20 \times 10^{-6}m^3$

b) Convert $0.2m^3$ into km^3; $0.2m^3 = 0.2 \times (10^{-3}km)^3 = 0.2 \times 10^{-9}km^3 = 2 \times 10^{-10}km^3$

$1m^3 = 1 \times (10^3mm)^3 = 1 \times 10^9mm^3 = 10^9mm^3$

WORKSHEET - 8

CUQ

1. The space occupied by a substance is called
   1) area 2) length 3) volume 4) none of these
2. The volume occupied by a cube whose each side is equal to 1m is
   1) one metre 2) one square metre 3) one cubic metre 4) one litre
3. Volume is a
   1) derived quantity 2) fundamental quantity
   3) unit 4) number alone
4. Generally, the volume of the solid is measured in
   1) m 2) m^3 3) m^2 4) kg
5. Which of the following formula is used to measure the volume of a cube?
   1) side × side × side 2) length × breadth
   3) length × height 4) breadth × height
6. Which of the following formula is used to measure the volume of a cuboid?
   1) side × side 2) length × breadth × height
   3) area of cross section × height 4) breadth × height
7. $1\ m^3$ = _____cm^3.
   1) 10^3 2) 10^{-3} 3) 10^6 4) 10^{-6}

8. 1 cm^3 = _____m^3.
   1) 10^3 2) 10^{-3} 3) 10^6 4) 10^{-6}
9. One cubic metre is equal to
   1) 10^{-6} cc 2) 10^4 cc 3) 10^3 cc 4) 10^6 cc
10. One litre = _____ cm^3
   1) 100 2) 1000 3) 10 4) 10000

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LEVEL-1 Single Correct Type:

1. $7m^3 =$ $\times 10^4\ Cm^3$
   1) 700 2) 7000 3) 70 4) 0.7
2. $5cm^3$ = _____ m^3.
   1) 5×10^3 2) 5×10^{-3} 3) 5×10^6 4) 5×10^{-6}
3. 2 litre = _____ Cm^3.
   1) 2000 2) 200 3) 20 4) 200000
4. $3m^3 =$_____$\times 10^9\, mm^3$.
   1) 30 2) 300 3) 3 4) 30000
5. 2 litre = _____ m^3.
   1) 0.002 2) 0.2 3) 0.02 4) 2

Multiple Correct Type:

6. 5 litre = _____.
   1) 5000ml 2)5000 c.c 3) 5000 Cm^3 4) None
7. $7Cm^3 =$ _____ m^3
   1) 7×10^{-6} 2) $\frac{7}{10^6}$ 3) $\frac{10^6}{7}$ 4) $\frac{1}{7\times10^6}$

LEVEL-2 & 3 Single Correct Choice Type:

8. 1 m^3 = _____mm^3
   1) 10^6 2) 10^8 3) 10^9 4) 10^4
9. 1 $(mm)^3$ = _____ m^3
   1) 10^{-6} 2) 10^8 3) 10^{-8} 4) 10^{-9}

10. 1 m^3 = ____litres

1) 10^3 2) 10^6 3) 10^{-3} 4) 10^{-6}

11. One litre = _____ m^3

1) 10^{-3} 2) 10^3 3) 10^6 4) 10^{-6}

12. 1000 litre is equal to

1) $1cm^3$ 2) $1m^3$ 3) $1000m^3$ 4) $100cm^3$

13. $20cm^3$=_____m^3

1) 20×10^{-4} 2) 20×10^{-8} 3) 20×10^{-2} 4) 20×10^{-6}

14. $0.2m^3$ = _____ km^3

1) 2×10^{-4} 2) 2×10^{-6} 3) 2×10^{-7} 4) 2×10^{-10}

SYNOPSIS - 9

Measurement of volume of liquids

The volume of liquids is generally measured in **litres** (symbol *l*), the sub-multiple of one litre is **millilitre** (symbol ml).

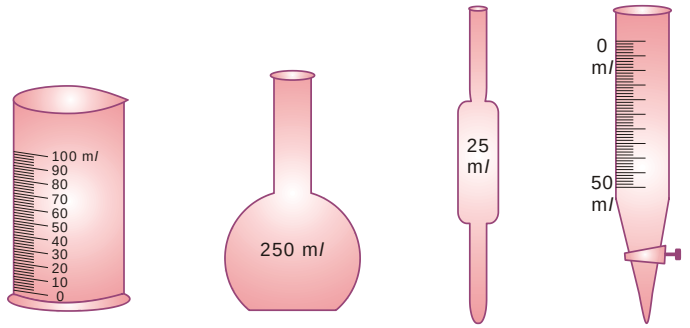
1(*l*) = 1000 ml.

One millilitre is also equal to one cubic centimeter ($1ml = 1cm^3$).

1(*l*) = 1000 m*l* = 1000 cc or 1000 cm^3. $1m^3 = 10^6 cm^3$ 1 metre^3 = 1000 liters.

The volume of a liquid is measured using a container of known capacity. The space (volume) inside the container is known as its **capacity.**

To measure the volume of liquids, measuring jars can be used directly.



(a) measuring cylinder (b) Measuring flask (c) Pipette (d) Burette

1. **Measuring Jar :-** It is cylindrical in shape, with graduations marked on its transparent body. Measuring jars are available in different capacities. It is used in laboratories to measure any desired volume of liquids (see Fig a.).

2. **Measuring flask :-** It is a metallic cylinder with a long vertical handle. Its capacity is marked on it. Such similar measures are also available in different shapes with capacities ranging from 50 ml. to 1 litre (1000 ml.). These devices are used for measuring milk, kerosene, oil, petrol etc., in daily life (see Fig b.).

3. **Pipette :-** It consists of a cylindrical bulb in the middle, to which a tube with nozzle is attached at one end and another tube with a circular marking attached at the other end.

   The circular marking is positioned such that the volume of the liquid from the tip of the nozzle to the circular marking is having a specified value (say 10cc, 20cc, etc.).The liquid is filled in the pipette by suction upto the circular mark.

   It is used in laboratories to take specified measure of liquid (see Fig c.).

4. **Burette :-** It is a graduated, cylindrical glass-tube provided with a stop-cock and narrow outlet (nozzle). This is used in laboratories for measuring the quantity of a liquid discharged.(see Fig d.)

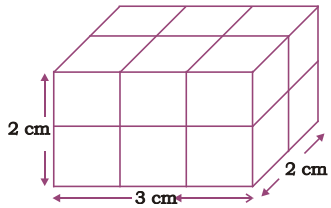
Measurement of volume of a rectangular glass slab (A regular body):

Volume of rectangular slab is the product of its length, breadth and height.

Volume = Length × Breadth × Height $V = l \times b \times h$

Suppose we want to find the volume of a rectangular slab of length = 3 cm, breadth = 2 cm and height = 2 cm as shown in figure. The most convenient scalar for finding volume is cm^3.

Take one dozen 1 cm^3 blocks. Place three 1 cm^3 blocks in a line so as to make the length of 3 cm. Behind this line place another line of three, 1 cm^3 blocks. This will make the length of block 3 cm and breadth 2 cm as shown in figure. However, the height of the block is 1 cm only.



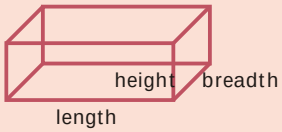
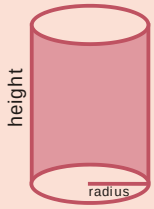
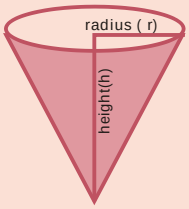
Over these blocks place more cubes so that height of block becomes 2 cm as shown in figure. Now count the number of blocks. It is found that total number of one centimetre blocks is 12.

Thus, the volume of the blocks is equal to 12 × 1 cm^3 = 12 cm^3. However, if we multiply length, breadth and height as under, the answer is again 12 cm^3.

Length × Breadth × Height = 3 cm × 2 cm × 2 cm = 12 cm^3

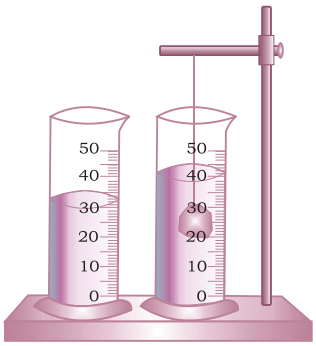
∴ We can say, **Volume = Length × Breadth × Height**

Volume of some regular bodies:

S.No	Regular body	Figure	Formula
1	Cube		side × side × side
2	Cuboid		Length×breadth × height
3	Cylinder		area of cross section × height (h) $=\pi r^2$ h
4	Cone		$1/3\pi r^2$ h

Measurement of volume of a stone (An irregular body):

Take a measuring jar. Fill half of it with water and note the reading. Hang the stone to the stand wilth a thread. Arrange the measuring jar as shown in the figure so that stone is dipped in the water.



The water level raises in the jar. Note the raised level. The difference between two levels is the volume of stone.

To measure the volume of lime stone which dissolves in water, liquid like kerosene should be used. Lime stone does not dissolve in kerosene.

WORKSHEET - 9

CUQ 1. The volume occupied by a cube whose each side is equal to 1m is

1) one metre 2) one square metre 3) one cubic metre 4) one litre

2. Generally, the volume of the liquid is measured in

1) litre 2) kilogram 3) metre 4) second

3. Which of the following formula is used to measure the volume of a cube of side a?

1) a × a × a 2) a × a

3) a 4) None

4. Which of the following formula is used to measure the volume of a cuboid of dimensions l,b,h?

1) l × b 2) l × b × h

3) l × h 4) b × h

5. Formula to find the volume of cylinder of radius 'r' and height 'h' is

1) πrh 2) πr^2h 3) πrh^2 4) πr^2h^2

6. The volume of cylinder is

1) Area of cross section × weight 2) radius × height

3) Area of cross section × radius 4) Area of cross section × height

7. The smaller unit for measuring volume of liquids is

1) cm^2 2) m^3 3) m^2 4) ml

8. Instandard international system volume is measured in

1) centymeter 2) meter 3) cubic meter 4) Both (1) & (2)

9. Find the volume of a cylinder of area of cross section $10cm^2$ and height 5cm.

1) $50m^3$ 2) $25cm^3$ 3) $25m^3$ 4) $50cm^3$

10. Find the volume of a cube of side 5cm?

1) $625cm^3$ 2) $25cm^3$ 3) $125cm^3$ 4) $500cm^3$

JEE MAIN & ADVANCED

LEVEL-1 **Single Correct Choice Type:**

1. Find the volume of cylinder of radius '2m' and hight 3m is

1) $6\pi\ m^3$ 2) $12\pi\ m^3$ 3) $18\pi\ m^3$ 4) $36\ m^3$

2. The volume of cylinder of radius '1m' and hight 4m is

1) $12.56\ m^3$ 2) $50.24\ m^3$ 3) $3.14\ m^3$ 4) $6.28\ m^3$

3. The volume of cylinder of area $12\ m^2$ and hight 4m is

1) $3\ m^3$ 2) $192\ m^3$ 3) $576\ m^3$ 4) $48\ m^3$

4. The volume of cylinder of area $5\ m^2$ and hight 7 m is

1) $35\ m^3$ 2) $\frac{5}{7}\ m^3$ 3) $175\ m^3$ 4) $245\ m^3$

5. A cuboid of dimensions 1m, 2m and 3m then find volume of cuboid

1) $6\ m^3$ 2) $12\ m^3$ 3) $18\ m^3$ 4) $6\ m^2$

6. A cuboid having length 2cm. breadth 5 cm and hight 8cm, then its volume is

1) $10\ cm^3$ 2) $80\ cm^3$ 3) $80\ cm^2$ 4) $10\ cm^2$

7. A cone of radius r and height is 'h' then its volume formula

1) $\frac{1}{3}\pi r^3 h$ 2) $\frac{1}{3}\pi rh$ 3) $\frac{1}{3}\pi r^2 h$ 4) $\frac{4}{3}\pi rh$

Multi Correct Choice Type:

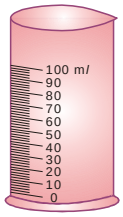
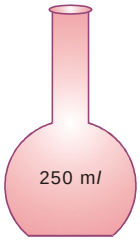
8. Which of the following measuring vessels are used to measure volume of liquids?
1) measuring jar 2) Burette 3) Pipette 4) Measuring flask

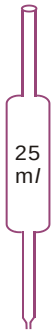
9. One litre = _____.

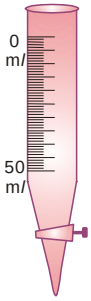
1)1000 cm^3 2) 1/ 1000 m^3 3) $10^6\ mm^3$ 4) $10^4\ m^3$

Matrix Match Type:

10.

Column-I	Column-II
a) Measuring flask	p) 
b) Pipette	q) 

c) Burette r) 

d) Measuring cylinder s) 

LEVEL-2 & 3 Single Correct Choice Type:

11. Find the volume of a cuboid of length 2m, breadth 1m and height 0.5m.

1) $1m^3$ 2) $1cm^3$ 3) $10m^3$ 4) $3m^3$

12. Find the volume of a given cube of side 12cm.

1) $12\,cm^3$ 2) $144cm^3$ 3) $1728\,cm^3$ 4) $12708\,cm^3$

Comprehension Type:

The volume of a cuboid = (area of the base) × (height) (or) length × bredth × height

13. If length, breadth and height of cuboid are 20 cm, 18 cm and 15 cm, then its volume is

1) 54000 cm^3 2) 5400cm^3 3) 54cm^3 4) 540cm^3

14. If length, breadth and height of cuboid are 30 m, 28 m and 12 m then its volume

1) 20800m^3 2) 30800m^3 3) 60800m^3 4) 10080m^3

15. If length, breadth and height of cuboid are 14cm, 10cm and 5 cm respectively, then find the volume of the cuboid.

1) 7 cm^3 2) 70 cm^3 3) 7000 cm^3 4) 700 cm^3

Comprehension Type:

Volume of Cuboid = l×b×h

The length, breadth, and height of a cuboid are in the ratio 3:2:1 and its volume is 48 m^3 then

16. The height of cuboid is

1) 6m 2) 4m 3) 2m 4) 8m

17. The length of cuboid is

1) 6 m 2) 4 m 3) 2 m 4)8 m

18. The breadth of cuboid is

1) 6 m 2) 4 m 3) 2 m 4)8 m

UNITS AND DIMENSIONS - KEY

WORKSHEET-1_KEY

CUQ

1. 2 2. 1 3. 1 4. 2 5. 2
6. 1 7. 2 8. 2 9. 2 10. 3

JEE MAIN & ADVANCED

1. 1 2. 2 3. 3 4. 1 5. 3 6. 4 7. a-p,b-r,c-q,d-s,t

WORKSHEET-2_KEY

CUQ

1. 1 2. 2 3. 3 4. 1 5. 1
6. 1 7. 4 8. 2 9. 3 10. 2

JEE MAIN & ADVANCED

1. 3 2. 2 3. 1 4. 3 5. 2 6. 2 7. 3
8. a-q,b-p,c-t,d-r

WORKSHEET-3_KEY

CUQ

1. 1 2. 4 3. 2 4. 3 5. 1
6. 3 7. 4 8. 1 9. 4 10. 2

JEE MAIN & ADVANCED

1. 4 2. 4 3. 3 4. 1 5. 3
6. 1,2,4 7. a-r,s; b-q; c-t; d-p

WORKSHEET-4_KEY

CUQ

1. 2 2. 3 3. 2 4. 1 5. 2
6. 2 7. 3 8. 1 9. 4 10. 2

JEE MAIN & ADVANCED

1. 4 2. 4 3. 4 4. 4 5. 3
6. 4 7. a-r; b-s; c-q; d-p

WORKSHEET - 5 KEY

CUQ

1) 2 2) 2 3) 3 4) 4 5) 2 6) 1 7) 3 8) 3
9) 4 10) 4

JEE MAINS AND ADVANCED

1) 4 2) 3 3) 3 4) 4 5) 1 6) 4 7) 1 8) 3
9) 1 10) 4 11) 1 12) 2 13) 1 14) 2 15) 3 16) 1
17) 2 18) 1 19) 1 20) 1,2,3

WORKSHEET - 6 KEY

CUQ

1.	3	2.	3	3.	4	4.	1	5.	2
6.	2	7.	4	8.	1	9.	4	10.	3

JEE MAIN & ADVANCED

1.	2	2.	3	3.	2	4.	1	5.	1
6.	1,4	7.	1	8.	4	9.	1		

WORKSHEET -7 KEY

CUQ

1.	4	2.	3	3.	2	4.	1	5.	1
6.	3	7.	1	8.	2	9.	4	10.	3

JEE MAIN & ADVANCED

1.	3	2.	2	3.	4	4.	2	5.	1
6.	1	7.	1	8.	1	9.	1	10.	3
11.	a-p;b-q;c-r;d-s;			12.	154m^2				

WORKSHEET -8 KEY

CUQ 1) 3 2) 3 3) 1 4) 2 5) 1 6) 2 7) 3 8) 4 9) 4 10) 2

JEE MAIN & ADVANCED

1) 1 2) 4 3) 1 4) 3 5) 1 6) 1,2,3 7) 1,2 8) 3 9) 4 10) 1 11) 1 12) 2 13) 4 14) 4

WORKSHEET -9KEY

CUQ 1) 3 2) 1 3) 1 4) 2 5) 2 6) 4 7) 4 8) 3 9) 4 10) 3

JEE MAIN & ADVANCED

1) 2 2) 1 3) 4 4) 1 5) 1 6) 2 7) 3 8) 1,2,3,4 9) 1,2,3 10) a-q;b-r;c-s;d-p 11) 1 12) 3 13) 2 14) 4 15) 4 16) 3 17) 1 18) 2

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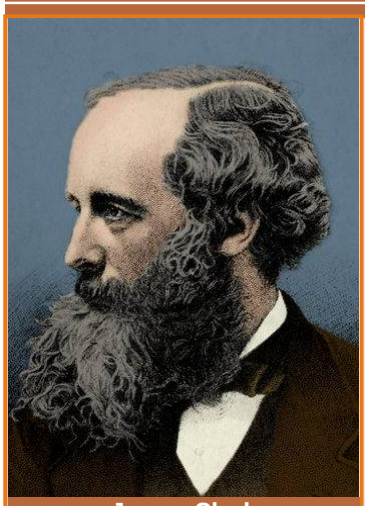
LIGHT

KNOW YOUR SCIENTIST



James Clerk Maxwell (1831 - 1879)

James Clerk Maxwell (1831 - 1879)

James Clerk Maxwell (13 June 1831 – 5 November 1879) was a Scottish physicist and mathematician. His most prominent achievement was formulating classical electromagnetic theory. This united all previously unrelated observations, experiments and equations of electricity, magnetism and even optics into a consistent theory. Maxwell's equations demonstrated that electricity, magnetism and even light are all manifestations of the same phenomenon, namely the electromagnetic field. Subsequently, all other classic laws or equations of these disciplines became simplified cases of Maxwell's equations. Maxwell's achievements concerning electromagnetism have been called the "second great unification in physics", after the first one realised by Isaac Newton. He was the first cousin of notable 19th century artist Jemima Blackburn.

LIGHT SYNOPSIS -1

Introduction to Light:

We see so many objects around us, colourful and different. On the way to school, we see things like buses, cars, cycles, trees, animals etc.,

Think of the same places at the night time in complete darkness, what will we see? We cannot see anything.

Suppose you go inside a completely dark room. Will you be able to see any objects in the room? You cannot see anything.

But, when you light a candle or a torch you can see the objects present in the room, Can't you?. So, we can say that we need **'light'** to see any object.

But even if you light a candle or a torch and ask a blind man to see the objects in the room, will he be able to see? He will not be able to see.

So we can say that we need **'eyes'** to see objects around us.

Thus, both the light and the eyes are necessary to see the objects around us.

The meaning of "we see the objects" is that we get the sensation of sight in our eyes.

So, it is the light which produces the sensation of sight in our eyes.

How do you think, we see all the objects?

When the light falls on an object, the object allows some light to bounce back (i.e., the object reflects some light). We see the object when these reflected light enters our eyes.

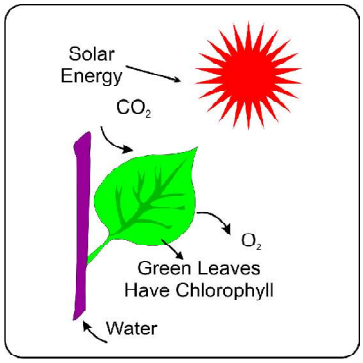
In a room objects are seen only when there is light. We see the object on which the light falls. Is the light between the lamp and the object visible?

We cannot see the light. You may argue that we can see sunlight streaming in through a window. Actually we are not seeing the light. There are some dust particles in the air. When the light falls on the dust particles they reflect the light falling on them into our eyes. So, what we see actually are dust particles reflecting the sunlight.

If there are no dust particles in the air, we cannot see anything. i.e., If there was nothing to reflect light you would not see anything.

So we can conclude that, **"LIGHT ITSELF IS NOT VISIBLE, THOUGH IT MAKES OTHER OBJECTS VISIBLE".** Light - A form of Energy, it consists of tiny packets of energy called photons.

The Sunlight is the main source of energy. The plants get energy from the sunlight and store energy. This stored energy is taken by animals, birds and human beings in the form of food.

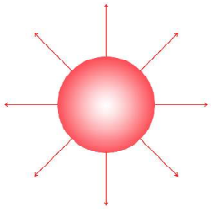


Food gives muscular energy to the animals and human beings. Since the animals and human beings get energy from the light (given by the sun) we can say that light is a form of energy.

From all the above observations, we can conclude that

"Light is a form of invisible energy which produces the sensation of sight in our eyes"

Sources of light:Consider a body emitting light as shown :



We observe that the body emits light in all directions. Such a body which emits light in all directions is said to be the **source of light.**

Types of Sources of Light: Observe sources of light such as Sun, bulb, candle etc.,

We observe that they emit their own light. Such sources of light which emit their own light are called **Self luminous sources or simply luminous sources.**

(ii) Non luminous source:

Observe objects such as book, pen, chair etc.,

We observe that they cannot emit light of their own.Such objects which cannot emit light of their own are called **non-luminous objects.**

Note We are able to see the book, pen, chair etc., when the light from them reaches our eye but these objects cannot emit light of their own. What they do is, they just reflect the light falling on them from the luminous sources like electric bulb, tube light, sunlight.

Speed of light : Light travels at very fast speed i.e., 3×10^8 m/s. It means the speed of light is 300000000 m/s or 300000 km/s.

Terms related to light:

I) Optical medium: Any material (or) non-material through which light energy passes wholly (or) partially is called optical medium

Ex:- vaccum,air,water, glass etc.

II) Homogeneous medium: An optical medium which has a uniform composition throughout is called homogeneous medium.

Ex:- vaccum,diamond, distilled water, pure alcohol etc.

III) Heterogeneous medium:- An optical medium, which has different composition at different points is called heterogeneous medium.

Ex :- Air ,muddy water, fog, mist, clouds, smoke etc .

IV) Transparent medium:- A medium which allows most of the light energy to pass through it is called transparent medium.

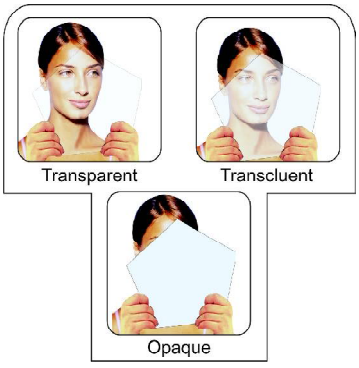
Ex:- vaccum,glass,clear air, alcohol, benzene etc.

V) Translucent medium:- A medium which partially allows the light energy to pass through it is called translucent medium.

Ex:- oiled paper,tissue paper ,ground glass, butter paper etc.

VI) Opaque bodies:- The bodies which do not allow the light energy to pass through them are called **opaque bodies.**

Ex:-Bricks,wood,metals etc.



VII) Point source of light :-A source of light which is of the size of pinhead is called point source of light. Ex:- The pinhole act as a point source of light.

VIII) Extended source of light :- Any source of light which is bigger than point source of light is called extended source of light

Ex:- Bulb, Tube light, burning candle etc.

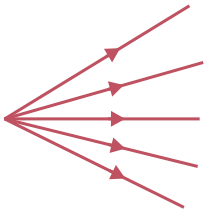
IX) Ray of light :- The path along which light energy travels in a given direction is called ray of light .

Ray of light

X) Beam of light:- A collection of number of rays of light is called beam of light.

XI) Parallel beam:- When the rays of light travels parallel to each other,then the collection of such rays is called parallel beam.

XII) Divergent beam:- When the rays of light originating from a point ,travel in various directions,then the collection of such rays is called divergent beam.



Ex:- The rays coming out from a bulb or a burning candle or a car headlight constitute a divergent beam.

Note:- A point source produces a divergent beam of light.

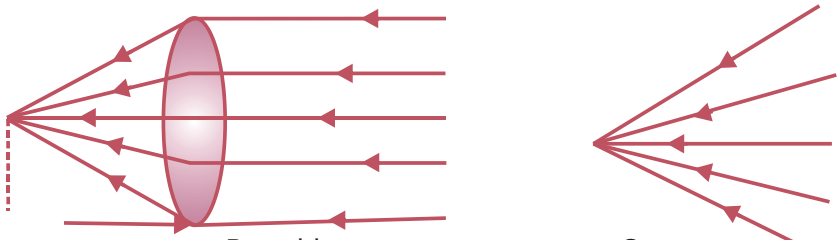
SCIENTIFIC FACT

Why do we experience a blinding feeling when we enter a dark room after standing in sunlight?

The mechanism of seeing in the dark involves two types of cells - rods and cones, in the eye. These cells are present in the light - sensitive innermost layer of the eye called the retina. They lie in front of a pigmented tissue layer. Cones are present in the area of greatest visual activity - fovea centralis, which lies at the centre of small yellow pigments spot behind the pupil. Rods and cones are present around the fovea.

Cones are active under intense illumination, whereas rods are active in dim light. In the dark rods are sensitised by a pigment called rhodopsin or the visual purple that is formed within the rods. Rhodopsin is bleached by light and is reformed by the rods in darkness. Hence a person who steps from sunlight into a dark room experiences a blinding feeling till the pigments begin to form. This process takes around 30 minutes to reach maximum sensitivity.

XIII) Convergent beam:- When the rays of light coming from different directions, meet at a point then the collection of such rays is called convergent beam.



Ex:- If a parallel beam is made to pass through a convex lens, then it meets at a point. This kind of collection of rays is called convergent beam of light.

Rectilinear propagation of light:

Light travels in a straight line as long as it is travelling in the same medium. We can observe that light travels in a straight line when we observe the beam of a car headlight on a misty night or a beam of a torchlight entering a smoky room. We can also perform an experiment to demonstrate that light travels in a straight line.

Experiment – 1

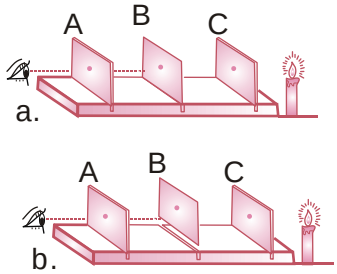
Aim: to demonstrate that light travels in a straight line

Aids: three square cardboard sheets of equal size, plasticine of suitable stands, candle, knitting needle, iron nail.

Method:

1. Take three cardboard squares of equal size. Locate the centre of each piece of cardboard by drawing the diagonals.
2. With the help of a nail, make a hole at the centre of each cardboard.
3. Now fix the three cardboards on plasticine or on stands so that they remain upright.
4. Arrange the three cardboards A, B and C, one behind the other such that their centres are in the same horizontal line. You may pass a knitting needle through the holes to conform if they are in a straight line.
5. Now place a burning candle in front of the board C and look through the pinhole in board A. The flame will be clearly visible. This shows that light travels in a straight line. Now, move board B slightly and again look through the pinhole in board A. You will not be able to see the flame. This shows that light does not travel in a zig–zag way.

Conclusion: light travels in a straight line. This property of light is called rectilinear propagation of light.



Rectilinear propagation of light

LIGHT WORKSHEET -1

CUQ 1. Light causes the _____
1) sensation of small 2) sensation of sound
3) sensation of sight 4) sensation of touch

2. Light is a form of _____ and it travels in a straight line path
1) Mass 2) Force 3) Energy 4) time

3. The path which light energy travels in a given direction is called
1) beam of light 2) source of light
3)ray of light 4) can't say

4. Stars are the example of
1) Luminous bodies 2) Non-Luminous bodies
3) Both(1) and (2) 4) Neither(1) nor (2)

5. Clear water is example of
1)Heterogeneous medium 2) Translucent medium
3) Transparent medium 4) Opaque medium

6. Which of the following is the example of optical medium?
1) wood 2) furniture 3) brick 4) glass

7. Smoke is the example of
1) homogeneous medium 2) Heterogeneous medium
3) both (1) and (2) 4) neither (1) nor (2)

8. Tube light is the example of
1) point source of light 2) extended source of light
3) both (1) and (2) 4) neither (1) nor (2)

JEE MAINS

Single Correct Choice Type:

1. Light is
1) visible and also makes objects visible on which it falls
2) invisible but makes objects visible on which it falls
3) invisible but becomes visible when it falls on an object
4) sometimes visible and sometimes invisible but it always makes objects visible on which it falls

2. A single straight line drawn from a point source, is called a
1) ray 2)bunch 3) both (1) and (2) 4) Neither (1) nor (2)

3. By definition, A material through which light energy passes wholly (or) partially is called
1) Luminous body 2) Transparent medium
3) Non luminous body 4) Optical medium

4. A ray of Light travels in
1) Straight lines 2) Curved lines
3) Sometimes in straight lines sometimes in curved lines 4) Can't say

5. By definition,A collection of number of rays of light is called

1) beam 2)Ray 3) Light 4) None

6. Light energy consist of tiny packets of energy are called

1) Electrons 2) Photons 3) Protons 4) Neutrons

7. By definition,An optical medium, which has different composition throughout is called

1) Homogeneous medium 2) Heterogeneous medium

3) both (1) and (2) 4) neither (1) nor (2)

8. A medium which allows most of the light energy pass through it is called

1) Transparent medium 2) Translucent medium

3) Opaque medium 4) all of these

9. A medium which allows partially the light energy to pass through it is called

1) Transparent medium 2) Translucent medium

3) Opaque medium 4) None of these

10. A point source of light will always produce a

1) parallel beam 2) convergent beam

3) divergent beam 4) all of these

11. When the rays of light originating from a point, travel in various directions, then the collection of such rays is called

1) Parallel beam 2) ray of light

3) Divergent beam 4) Convergent beam

12. When the rays of light coming from differnt directions, meet at a point then the collection of such rays is called

1) Parallel beam 2) ray of light

3) Divergent beam 4) Convergent beam

13. Choose the odd one out:

1) muddy water 2) fog 3) smoke 4) distilled water

14. Bodies which do not allow the light energy to pass through them are called

1) Transparent bodies 2) Translucent bodies

3) Opaque bodies 4) all of these

15. Choose the odd one out

1) stars 2) sun 3)glow warm 4) chair

JEE ADVANCED

Multi Correct Choice Type:

16. Which of the following is homogeneous medium

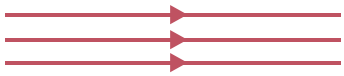
1) Vaccum 2) Clear air 3) Distilled water 4)Pure alcohol

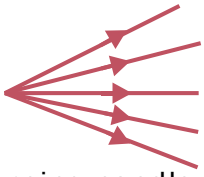
Comprehension Type:

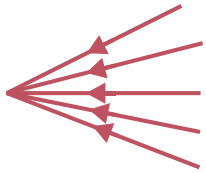
Light produced by source travels in all directions

17. Which of the following figure represents ray of light

1) 

2) 

3) 

4) 

18. Burning candle is an example of

1) point source of light 2) Extended source of light

3) Some times point source, some times extended source

4) Neither point source nor extended source.

19. The example for point source of light

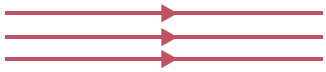
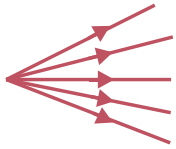
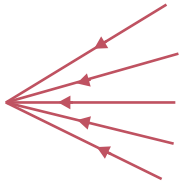
1) Candle 2) bulb 3) pin hole 4) tube light

Integer Answer Type:

20. The speed of light in air is_____$\times 10^8$m/s

Matrix Match Type:

21.

Column-I	Column-II
a) Ray of light	1) 
b) Parallel beam of light	2) 
c) Divergent beam of light	3) 
d) Convergent beam of light	4)

Statement Type:

22. *Statement I :* Moon and wood are non-luminous bodies

Statement II : Non-luminous bodies don't emit energy by themselves,but reflect the light energy falling on them

1) Both Statements I and II are correct.
2) Both Statements I and II are incorrect.
3) Statement - I is correct, Statement - II is incorrect.
4) Statement - I is incorrect, Statement - II is correct.

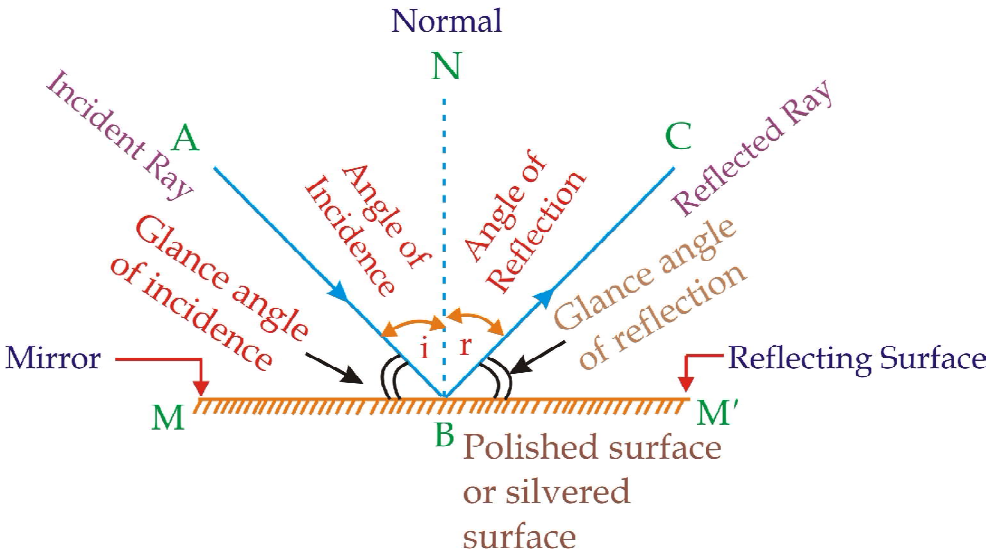
LIGHT — SYNOPSIS-2

Reflection of light: When a beam of light is incident on a surface, a part of it is returned back into the same medium. The part of light which is returned back into the same medium is called the reflected light.

The remaining part of light is absorbed if the surface on which the incident light strikes is opaque or it is partly transmitted and partly absorbed if the surface is transparent.

Reflection: The return of light into the same medium after striking a surface is called reflection.

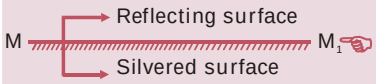
Reflection of light is the process which enables us to see different objects around us. Luminous bodies are directly seen, but non luminous objects are seen only because they reflect the light incident on them which on entering into our eyes, make them visible.

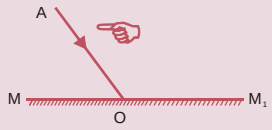
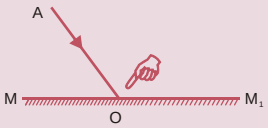
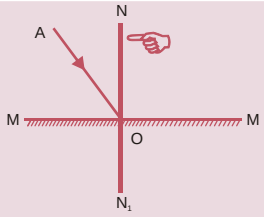
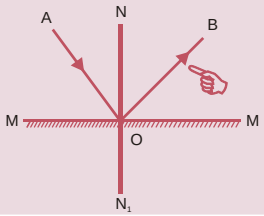
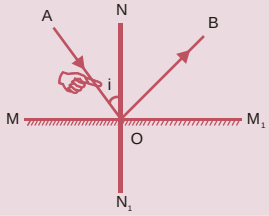
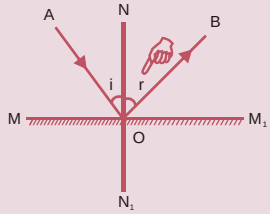


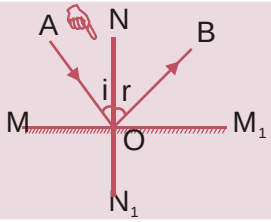
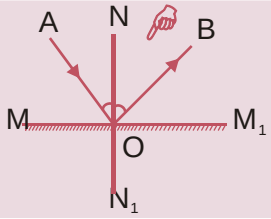
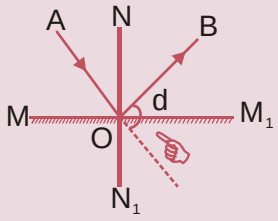
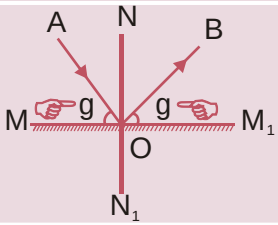
Note: Reflection is possible in case of plane mirror.

A plane mirror is a plane glass plate which is silvered at its one surface. The other surface is then reflecting surface of the plane mirror.

Terms related to Reflection of Light :

Term	Figure	Representation	Definition
Mirror		MM_1	A highly polished surface which reflects almost whole of the light incident upon it is called a mirror. It has two surface - a reflecting surface and a silver surface

Term	Figure	Representation	Definition
Incident ray		AO	The light ray striking the reflecting surface is called the incident ray
Point of incident		O	The point at which the incident ray strikes the reflecting surface is called the point of incidence
Normal		NN_1	The perpendicular draw to the surface at the point of incidence is called the normal
Reflected ray		OB	The light ray coming back to the same medium after reflection is called reflected ray
Angle of incidence		i	The angle, which the incident ray makes with the normal at the point of incidence, is called the angle of incidence.
Angle of reflection		r	The angle, which the reflected ray makes with the normal at the point of incidence, is called the angle of reflection.

Term	Figure	Representation	Definition
Plane of incidence		Plane ACNO	The plane containing the incident ray and the normal is called the plane of incidence
Plane of reflection		Plane BDNO	The plane containing reflected ray and the normal is called the plane of reflection.
Angle of deviation		d	In the absence of the mirror, the ray AO would have gone along the straight line path AOE. But, the presence of mirror makes the ray to deviate through an angle ∠EOB. This angle is called angle of deviation. Thus, the angle through which a ray deviates from its normal path is known as angle of deviation.
Glancing angle		g	The angle made by the incident ray or the reflected ray with the mirror is known as glancing angle g) g_i-Glancing angle of incidence g_r-Glancing angle of reflection $g_i = 90 - I$ and $g_r = 90 - r$

Regular and irregular reflection:

Regular Reflection: Reflection of light is of two kinds depending on the nature of the reflecting surface–regular reflection and diffused or irregular reflection. When the reflecting surface is very well polished and smooth, the light that falls on it is regularly reflected. This phenomenon is known as regular reflection.

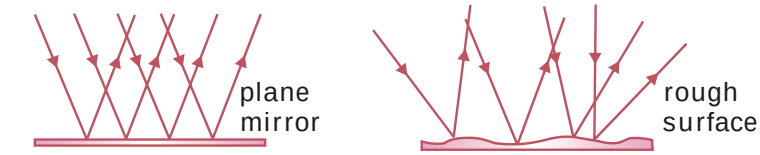
Note: Regular reflection takes place on highly polished on smooth surfaces

Ex: Plane mirror

Irregular Reflection: If the reflecting surface is irregular, the rays of light that fall on it are scattered in all directions. This is called irregular or diffused reflection.

Note: Irregular reflection takes place on rough surfaces

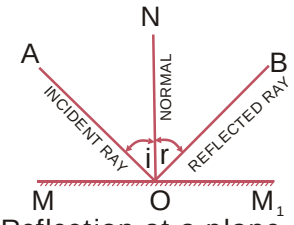
Ex: Wall, wood, paper, cinema screen, ground glass etc.



a. Regular reflection b. Irregular reflection

Two types of reflection

Laws of Reflection: The reflection at a surface obeys the following two laws, which are called the laws of reflection.



Reflection at a plane surface

1. The angle of incidence 'i' is equal to the angle of reflection r (i.e. $\angle i = \angle r$). In figure $\angle AON = \angle BON$.

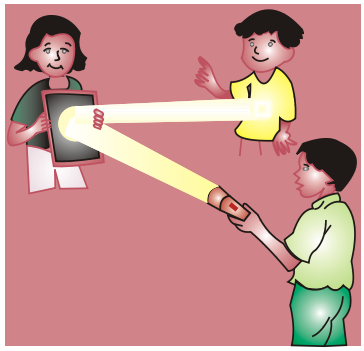
   For a ray incident normally on a surface, $\angle i = 0^0$, therefore $\angle r = 0^0$. Thus, a ray of light incident normally on a surface is reflected back along the same path.

2. The incident ray, the reflected ray and the normal at the point of incidence, lie on the same plane.

ACTIVITY

Request one of your friends to hold a mirror in his/her hand at one corner of a dark room. You stand at another corner with a torch in your hand. Switch on the torch and direct its light beam onto the mirror which your friend is holding.

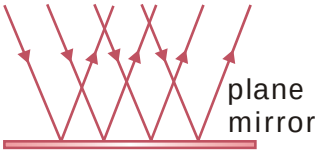
Your can see a patch of light on the other side. Adjust the direction of the torch so that one patch of light falls on another friend standing in the room. What do you conclude from this activity? Do you agree that a mirror changes the direction of light that falls on it ? This activity also suggests that light travelling along straight lines are reflected from a mirror.

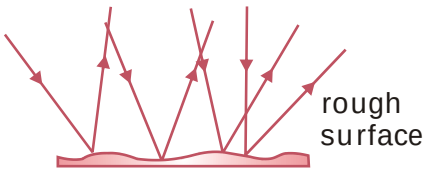


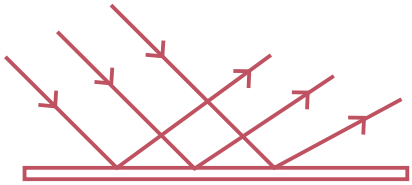
LIGHT WORKSHEET- 2

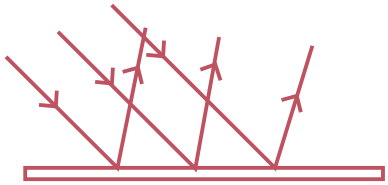
CUQ

1. The point at which the incident ray strikes the reflecting surface is called
   1) Point of incident 2) reflected ray
   3) angle of reflection 4) plane of incidence
2. If angle of incidence = 45° the angle of reflection is_____
   1) 90^0 2) 0^0 3) 45^0 4) 135^0
3. The plane containing the incident ray and the normal is called
   1) Point of incident 2) reflected ray
   3) angle of reflection 4) plane of incidence
4. When a light ray incidence on a refleting surface along the normal , then the angle of reflection is
   1) 90^0 2) 0^0 3) 60^0 4) 180^0
5. The plane containing the reflected ray and the normal is called
   1) Plane of reflection 2) reflected ray
   3) angle of reflection 4) plane of incidence
6. When a light ray incidence on a refleting surface along the normal , then the sum of angles of incidence and reflection is
   1) 0^0 2) 90^0 3) 120^0 4) 360^0
7. Which of the following best represents regular reflection?

1) 

2) 

3) 

4) 

8. A smooth polished surface from which regular reflection can take place.
   1) Mirror 2) Lens 3) Wall 4) Wood
9. The light ray striking the reflecting surface is called
   1) Incident ray 2) Reflected ray 3) Normal 4) All the above
10. The perpendicular drawn to the surface at the point of incident.
   1) Incident ray 2) Reflected ray 3) Normal 4) All the above
11. The light ray coming back to the same medium after reflection is called
   1) Incident ray 2) Reflected ray 3) Normal 4) All of these
12. The angle, which the incident ray makes with the normal at the point of inci dence is called
   1) Angle of incidence 2) Angle of Reflection
   3) Angle of deviation 4) Glancing angle

13. The angle, which the reflected ray makes with the normal at the point of inci dence, is called
    1) Angle of incidence 2) Glancing angle
    3) Angle of deviation 4) Angle of reflection
14. The angle made by the incident ray with the mirror is known as
    1) Angle of incidence 2) Glancing angle
    3) Angle of deviation 4) Angle of reflection
15. The angle made by the reflected ray with the mirror is known as
    1) Angle of incidence 2) Angle of Reflection
    3) Glancing angle 4) None of these

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Single Correct Choice Type:

1. The phenomenon in which light that strikes a surface and is thrown back into the same medium is called
   1) reflection of light 2) Polarisation 3) Refraction 4) None
2. If the angle between the mirror and the incident ray is 40^0, the angle of reflection (r) is
   1) 40^0 2) 80^0 3) 50^0 4) 100^0
3. If the angle between the incident ray and the reflected ray is 100^0, the angle of reflection is
   1) 100^0 2) 50^0 3) 80^0 4) 40^0
4. If angle of incidence is 20^0 then angle of reflection is
   1) 10^0 2) 20^0 3) 30^0 4) 40^0
5. If angle of incidence is 20^0 then glancing angle is
   1) 60^0 2) 70^0 3) 80^0 4) 90^0
6. If angle between mirror and incidence ray is 30^0 then the angle between reflected ray and mirror is
   1) 30^0 2) 40^0 3) 50^0 4) 60^0
7. The angle between mirror and reflected ray 60^0 then angle between incidence ray and reflected ray is
   1) 40^0 2) 30^0 3) 20^0 4) 60^0
8. The angle of incidence is 40^0 the angle of reflection is
   1) 40^0 2) 30^0 3) 20^0 4) 10^0
9. The angle made by the mirror with reflected ray is 40^0 then what is the angle of incidence
   1) 50^0 2) 100^0 3) 40^0 4) 30^0

10. Angle of incidence = 0 then glancing angle is

1) 90^0 2) 100^0 3) 45^0 4) 30^0

11. Choose the correct statement

1) Angle of incident is always equal to glancing angle
2) Angle of incidence is always equal to angle of reflection
3) Incident ray, reflected ray and normal all lie in different planes
4) All the above

12. In which the following regualr reflection takes place

1) Wall 2) Wood 3) paper 4) Plane mirror

13. The angle of incidence is 15^0 and the angle of reflection is

1) 10 2) 15^0 3) 25^0 4) 75^0

14. In the following, irregular reflection takes place

1)Wall 2)Wood 3)Paper 4)All of these

15. The ratio of incident angle to the reflected angle is

1)3:2 2)1:2 3)2:3 4)1:1

JEE ADVANCED

Multi Correct Choice Type:

16. Choose the correct statement(s) related to law reflection of light

1) The angle of incidence is equal to the angle of reflection
2) The incident ray,the reflected ray and the normal at the point of incidence,lie on the same plane
3) The angle of incidence is not equal to the angle of reflection
4) The incident ray,the reflected ray and the normal at the point of incidence,does not lie on the same plane

17. The angle of incidence at which angle of incidence and angle of reflection are equal

1) 0^0 2) 30^0 3) 40^0 4) 15^0

18. If angle of incidence is 40^0 then

1) Angle of reflection is 50^0 2) Angle if reflection 40^0

3) glancing angle 50^0 4) glancing angle 40^0

Reasoning Type:

19. Statement I : Regular reflection occurs when a beam of light falls on a smooth and polished surface

Statement II : Irregular reflection occurs when a beam of light falls on a rough surface.

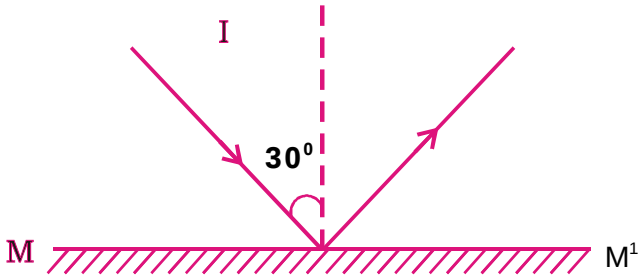
1) Both Statements I and II are correct.
2) Both Statements I and II are incorrect.
3) Statement - I is correct, Statement - II is incorrect.
4) Statement - I is incorrect, Statement - II is correct.

20. Statement I : Angle of incidence = Angle of reflection

Statement II : Incident ray, reflected ray and normal at the point of incidence lie in the same palne.

1) Both Statements I and II are correct.
2) Both Statements I and II are incorrect.
3) Statement - I is correct, Statement - II is incorrect.
4) Statement - I is incorrect, Statement - II is correct.

Comprehension Type:



Angle of incidence is equal to angle of reflection

21. Angle of reflection =

1) 30 2) 60^0 3) 120 4) 90^0

22. Angle of incidence + Angle of reflection =

1) 60^0 2) 30^0 3) 120^0 4) 90^0

23. Glancing angle =

1) 60^0 2) 30^0 3) 120^0 4) 90^0

Matrix Match Type:

24.

Column-I	Column-II
a) Regular reflection	1) Angle between normal and incident ray
b) Irregular reflection	2) polished smooth surfaces
c) Angle of incidence	3) Angle through which a ray deviates from its normal path
d) Angle of reflection	4) rough surfaces
	5) angle between normal and reflected ray

Integer Answer Type:

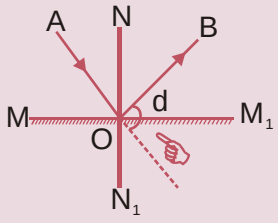
25. If the angle of incidence is 20^0, then the angle of reflection is _____

26. In which of the following regular reflection takes place

1) Still water 2) Oil 3)Highly polised metals 4)Furniture

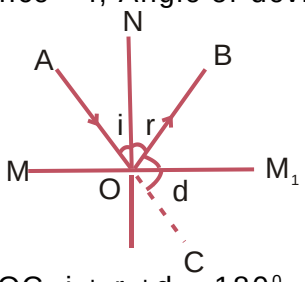
LIGHT SYNOPSIS-3

Angle of deviation

Angle of deviation		d	In the absence of the mirror, the ray AO would have gone along the straight line path AOE. But, the presence of mirror makes the ray to deviate through an angle ∠EOB. This angle is called angle of deviation. Thus, the angle through which a ray deviates from its normal path is known as angle of deviation.

Formula for the angle of deviation due to reflection:

In the figure angle of incidence = i; Angle of deviation = d =?



Consider the straight line AOC, $i + r + d = 180^0$

i.e the sum of angle of incidence, angle of reflection and angle of deviation is 180^0

$\Rightarrow d = 180 - (i + r) = 180 - (i + i)$ $(\therefore i=r) = 180 - 2i$

Therefore, for an angle of incidence i, the angle of deviation is equal to

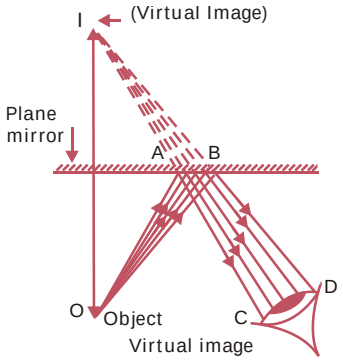
$180 - 2i = \pi - 2i$, $d = 2g$

Note: The deviation produced by n reflections from two plane mirrors inclined at an angle θ is given by $D = n(180 - \theta) = 360 - 2\theta$, where n is even.

Image: When the rays of light, diverging from a point, after reflection or refraction, either actually meet at some other point, or appear to meet at some other point, then that point is called image of the object.

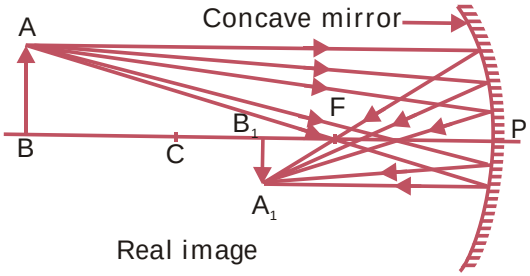
Types of images:

a) Virtual Image: When the rays of light, diverging from a point, after reflection or refraction, appear to diverge from another point, then the image so formed is called virtual image.



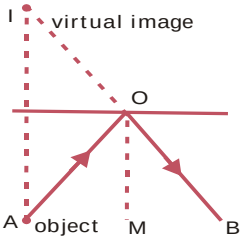
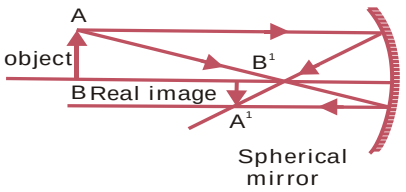
virtual images are always erect upright. The path of the rays forming a virtual image is shown by dotted lines.

b) Real Image: When the rays of light, diverging from a point, after reflection or refraction actually converge at some other point then that point is real image of the object.



Real images are always inverted (upside down). Real images and the path of the rays which form them are shown by continuous lines.

Distinction between real image and virtual image:

S. No.	Virtual Image	Real Image
1.	The rays of light after reflection or refraction appear to meet at some other point.	The rays of light after reflection or refraction actually meet at some other point.
2.	It cannot be taken on screen	It can be taken on screen
3.	It is always erect	It is always inverted
4.	Image of our face in a plane mirror	Image formed on a cinema screen
5.		

COOL PHYSICS FACT

One way mirrors are used a lot in spy movies, but are thy really one - way? Try to devise a glass or a glass coating so that room scenes will pass in only one direction. If this is impossible then how do the so - called one - way mirrors work?

Most one-way mirrors depend on one side (say the room in a which a criminal is being questioned) being more brightly it than the other side (where a viewer is). Some of the light incident on the glass from the criminal's side is reflected by the front and back surfaces of the glass. If the other side is relatively dark, then the criminal sees only the reflected mirror. The viewer, on the other hand, receives ample light transmitted through the glass and can clearly see the criminal. The mirror effect is enhanced if the viewer's side of the glass is coated with a very thin layer of metal that would increase the amount of reflected light to the criminal but still allow enough light for the viewer.

Characteristics of an image formed by a plane mirror:

1. The image is formed behind the mirror and has the same size as the object
2. The image is laterally inverted.
3. The image is as far behind the mirror as the object is in front of it.
4. The image is virtual. It cannot be received on a screen.
5. The image is erect.

Effect of Rotation of Mirror on Reflected Ray:

If a plane mirror is rotated through an angle θ, the reflected ray is rotated through an angle 2θ.

LIGHT_WORKSHEET-3

CUQ 1. The angle through which a ray deviates from its normal path is known as

1. Angle of incidence
2. Angle of reflection
3. Glancing angle
4. Angle of deviation

2. Formula for the angle of deviation due to reflection is equal to _____

1) 180^0–2i 2) 180^0+2i 3) 180^0–i 4) 90^0–2i

3. When the rays of light diverging from a point, after reflection or refraction, either actually meet at some other point, or appear to meet at someother point, then that point is called

1. object 2. image 3. Both 1 and 2 4. Neither 1 or 2

4. When the rays of light, diverging from a point, after reflection or refraction appear to diverge from another point, then the image so formed is called____

1. object 2. real image 3. virtual image 4. None of these

5. Image of our face in a plane mirror is

1. Virtual image 2. real image 3. object 4. All of these

6. Virtual images_____

1. Cannot be taken on screen
2. can be taken on screen
3. Impossible
4. All inverted always

7. Virtual images_____

1. All inverted always
2. can be taken on screen
3. Are Impossible
4. Are always erect upright

8. When the rays of light, diverging from a point, after reflection or refraction actually converge at some other point then that point is

1. Virtual image 2. Real image 3. Object 4. None of these

9. Real images_____

1. Can not be taken on screen
2. can be taken on screen
3 Are always virtual
4. Are impossible

10. Real images_____

1. Can not be taken on screen
2. Are always virtual
3. Are always inverted
4. None of these

11. Which of the following is the characteristic of an image formed by plane mirror
    1. The image is laterally inverted 2. The image is real
    3. The image is inverted 4. magnified size
12. Which of the following is not a characteristic of image formed by plane mirror
    1. Same size as the object 2. The image is virtual
    3. The image is inverted 4. The image can not be taken on a screen
13. If a plane mirror is rotated through an angle Q, the reflected ray is rotated through an angle
    1. Q 2. Q/2 3. 2Q 4. 3Q
14. The angle at which glancing angle of incidence and angle of reflection are same
    1. 90^0 2. 45^0 3. 20^0 4. 15^0

JEE MAINS

Single Correct Choice Type:

1. Reflected ray rotated through 40^0 if the mirror rotate through (for a given incident ray)
    1) 20^0 2) 50^0 3) 0^0 4) 15^0
2. If the mirror is rotated through 5^0, then the reflected ray will rotate through for a given incident ray is
    1) 10^0 2) 50^0 3) 0^0 4) 15^0
3. Reflected ray rotated through 20^0 if the mirror rotate through (for a given incident ray)
    1) 20^0 2) 50^0 3) 10^0 4) 15^0
4. If the mirror is rotated through 30^0, then the reflected ray will rotate through for a given incident ray is
    1) 10^0 2) 60^0 3) 0^0 4) 15^0
5. A ray of light is incident on a plane mirror at angle of 60°, then the angle of deviation is_____.
    1) 60° 2) 30° 3) 50° 4) 90°
6. A ray of light is incident on a plane mirror at angle of 30°, then the angle of deviation is_____.
    1) 60° 2) 120° 3) 90° 4) 180°
7. A ray of light is incident on a plane at angle of 40^0, then angle of deviation is_____.
    1. 50^0 2. 100^0 3. 90^0 4. 20^0
8. If the angle of reflection is 30^0 then angle of deviation of incident ray is_____.
    1. 50 2. 30^0 3. 60^0 4. 120^0
9. If the angle of incident is 19^0 then angle of deviation is
    1. 132^0 2. 122^0 3. 142^0 4. 152^0

10. If the angle of deviation is 10^0 for than angle of incidence.
    1. 80 2. 85 3. 90 4. 95
11. If the plane mirror is rotated by an angle 15 the reflected ray is rotated through
    1. 20^0 2. 30^0 3. 40^0 4. 50^0
12. Reflected ray is rotated through 12^0 if the mirror rotated through_____.
    1. 10^0 2. 8^0 3. 6^0 4. 3^0
13. The angle of reflection for an incident ray is 30^0 then angle of deviation is
    1. 30^0 2. 40^0 3. 60^0 4. 70^0
14. If the glancing angle for incident ray is 12^0 then angle of deviation is
    1. 24 2. 36 3. 12^0 4. 20^0
15. If the object is placed at a distance 10cm then Image distance is
    1. 12 cm 2. 20cm 3. 40 cm 4. 10 cm

WORKSHEET-1 KEY

CUQ: 1) 3 2) 3 3) 3 4) 1 5) 3 6) 4 7) 2 8) 2

JEE MAINS AND ADVANCED:

1) 2 2) 1 3) 4 4) 1 5) 1 6) 2 7) 2 8) 1
9) 2 10) 1 11) 3 12) 4 13) 4 14) 3 15) 4 16) 1,2,3,4 17) 1 18) 2 19) 3 20) 3 21) a-4;b-1;c-2;d-3 22) 1

WORKSHEET-2 KEY

CUQ: 1) 1 2) 3 3) 4 4) 2 5) 1 6) 1 7) 1 8) 1
9) 1 10) 3 11) 2 12) 1 13) 4 14) 2 15) 3

JEE MAINS AND ADVANCED:

1) 1 2) 3 3) 2 4) 2 5) 2 6) 1 7) 4 8) 1
9) 1 10) 1 11) 2 12) 4 13) 2 14) 4 15) 4 16) 1,2
17) 1,2,3,4 18) 2,3 19) 1 20) 1 21) 1 22) 1 23) 1
24) a-2;b-4;c-1;d-5 25) 20 26) 1,2,3

WORKSHEET-3 KEY

CUQ: 1) 4 2) 1 3) 2 4) 3 5) 1 6) 1 7) 4 8) 2
9) 2 10) 3 11) 1 12) 3 13) 3 14) 2

JEE MAINS AND ADVANCED:

1) 1 2) 1 3) 3 4) 2 5) 1 6) 2 7) 2 8) 4
9) 3 10) 2 11) 2 12) 3 13) 3 14) 1

UNITS AND DIMENSIONS

CONTENTS :

UNITS AND DIMENSIONS

KNOW YOUR SCIENTIST

Pierre Vernier
(19 August 1580)

Pierre Vernier (19 August 1580)

Pierre Vernier (19 August 1580 at Ornans, Franche-Comté, Spanish Habsburgs (now France) – 14 September 1637 same location) was a French mathematician and instrument inventor. He was inventor and eponym of the vernier scale used in measuring devices.

He was born in Ornans, France, in 1580, he was taught science by his father. He later became captain and castellan of the castle at Ornans, for the King of Spain. He was also later councillor and director general of moneys in the County of Burgundy.

SYNOPSIS - 1

INTRODUCTION TO PHYSICS

Observe the following **events** which we come across in our daily life:

- How the water entered into coconut even though it had a hard shell ?
- How can a large ship which can float in water, but a small stone can not float ?
- We see Lightning first and then we hear a thunder. Similarly in Television we here sound first then we see picture why ?
- How rain comes ?
- Who is catching the Earth for it to rotate ?
- How does a flower turns into fruit ?
- How can a bird can fly ? Why Human beings can not fly ?
- What is there beyond Sun ?
- How can Sun gives us Light and Heat ?
- Why Stars appear so small ?
- Why can' t Animals speak with Human beings ?

There are so many other numerous Questions and Problems which are need to be Answered and to be Solved. The Answers for the above Phenomena is possible only through the study of **PHYSICS**.

Physics is the study of laws of nature.

Introduction to Measurement

Measurements have an important role not only in physics but also in every branch of science and everywhere in our day-to-day life. Measurement should be made for knowing about the physical quantity. For example,

Imagine that you take a piece of cloth to a tailor for stitching a shirt.

What will the tailor do ?

He will first find **'how much'** quantity of cloth is required to prepare a shirt for you.

To know how much quantity required is called measuring**.** The act of measuring the quantity required is called **measurement**.

In the above example, the quantity measured by the tailor using a tape is **length. Quantity**

Quantity means size, amount, magnitude or simply stated as the answer for 'how much?' or 'how many?'

Physical Quantity: The quantities which are measurable are called physical quantities.

Ex : Length, mass, time, speed, etc.

Note : Love, sadness, hatred, affection are not physical quantities because you cannot measure them.

The information about a physical quantity, by description of its external properties like colour, taste etc. is incomplete with out knowing its temperature, size (dimensions), which depends on measurement. i.e., with out measurements it is impossible to know about the external properties of any object. So, it becomes necessary to measure it.Thus Measurement is thus the comparison of an unknown quantity with a known constant quantity.

This constant quantity which is used to measure the standard physical quantity is called **unit**. Unit is a standard to measure the physical quantity.

Measurement of the physical quantity

Measurement of the physical quantity involves two steps.

Step 1: Choose the standard value as a unit of measurement (unit)

Step 2: Find how many times that unit is contained in the given physical quantity (Numerical Value)

i.e., A measurement consists of two parts, the numerical value and the unit.

Ex : Length of the table = 5 metre. Here length is the physical quantity

5 is the numerical value and metre is the unit.

$\therefore$ Physical quantity = numerical value × unit

Note : The number of times a standard quantity is present in a given physical quantity is called **Numerical value** of physical quantity.

Unit : In the early days, people used to measure length with the help of various parts of a body, such as handspan, footspan , arm or cubit etc.,

Look at a boy measuring the length of a table:

Here, the boy is measuring the length of the table using handspan and the length was found to be **8 handspans.**

We can also say that **handspan** is present 8 times during the measurement of length of the table.This **handspan** (a part of the body) which is used to measure the length was called a **unit**.

ACTIVITY *Ask four students to measure the length of your text book by using palm and note the values. Let them compare the values and find that the values vary as their palms are of different sizes. This indicates that hand measurements like, span, cubit and fathom differ from person to person. But measurement should be the same whoever and wherever it is measured.*

Standard Unit: Imagine now boy's father is measuring the length of the table using his handspan.

Length of the table measured by his father is found to be **6 handspans** whereas length of the table measured by the boy was **8 handspans.**

So, using **handspan** as a **unit,** length found by the boy and his father is not same.

Hence, we need a **unit** which gives same length when used by the boy or his father or infact any one, and this unit is called **standard unit**.

For example, Meter is the standard by which we can measure length, Second is the standard by which we can measure time etc.,

Note: Magnitude of a physical quantity is constant (does not change with choice of unit)

Magnitude Physical Quantity(P) = Numerical value(N) × Unit(U)

i.e., P = constant $\Rightarrow$ NU = constant $\Rightarrow$ $N \propto \frac{1}{U}$ (as p is constant) $\Rightarrow$ $N_1U_1 = N_2U_2$

Example : Height of a girl is 1.2m= 120 cm

in 1.2m the unit is m and the numerical value is 1.2.

in 120 cm the unit is cm and numerical value is 120.

"Think it Over!"

gm/cm³ and kg /m³ are the units of density and 1gm/cm³ =1000 kg/m³. Is the above relation Violating the rule $N_1U_1=N_2U_2$?

System of Units : The scientists all over the world have developed basic set of standard units for measuring various quantities. This set is also known as system of units and named as Standard **I**nternational **S**ystem of Units or **SI system.** At present the system adopted by all the scientists in the world is SI. Some other units still in use are

(i) F.P.S system (**F**oot, **P**ound,**S**econd)

(ii) C.G.S. system (**C**entimetre, **G**ram, **S**econd)

(iii) M.K.S. system (**M**etre, **K**ilogram, **S**econd)

System	Fundamental Physical Quantities		
	Length	Mass	Time
FPS	Foot (ft)	Pound(*lb*)	Second (s)
CGS	Centimeter (cm)	Gram (g)	Second (s)
MKS	Metre (m)	Kilogram(kg)	Second (s)

Conventions for writing the symbols of units :

1. The symbol for a unit which is not named in the honour of some scientist is written in lower letter.

   Ex: The symbol for metre is 'm' for kilogram is 'kg' and for second as 's'.

2. The symbol for a unit which is named in the honour of some scientist is written with initial capital letter.

   Ex: The symbol for unit of force (newton) is N.

   The symbol for unit of temperature (Celsius) is °C.

   The symbol for unit of work (joule) is J.

   The symbol for unit of power (watt) is W.

3. Full name of the unit named in the honour of scientist is written with lower initial letter.

   Ex: The full name for the unit of force is newton and not Newton.

   The full name for the unit of power is watt and not Watt.

4. Negative powers are used for compound units obtained by dividing one unit with another unit.

   Ex: The unit of speed is m/s. It is expressed as ms^{-1}.

5. A unit in short form is never written in plural.

   Ex: 30 kilogram in short form is written as 30kg and not 30kgs.

WORKSHEET - 1

CUQ 1. The act of measuring the required quantity is called_____.

1) Instrument 2) Measurement 3) Quantity 4) devise

2. The quantity which is measurable is called a

1) Physical quantity 2) standard quantity

3) Natural quantity 4) General quantity

3. The number of times a standard quantity is present in a given physical quantity is called

1)Numerical quantity 2) Unit

3)Physical quantity 4) General quantity

4. A constant quantity used for comparison during the measurement of unknown quantity is called

1) material quantity 2) standard quantity

3) natural quantity 4) General quantity

5. Which of the following is an example of physical quantity ?

1) weakness 2) mass 3) sadness 4) affection

6. A standard in a given physical quantity, which is used to measure it is called

1) unit 2) cubit 3) quantity 4) numerical value

7. Physical quantity = Numerical value × _____.

1) Number 2) standard unit

3) Value 4) Quantity

8. The numerical value of physical quantity (N) is related to the unit of the quantity (U) as

1) $N \propto U$ 2) $N \propto \frac{1}{U}$ 3) $N \propto U^2$ 4) $N \propto \frac{1}{U^2}$

9. If U_1, U_2 are the units of physical quantities and N_1, N_2 are their numerical value then

1) $\frac{N_1}{N_2} = \frac{U_1}{U_2}$ 2) $\frac{N_1}{N_2} = \frac{U_2}{U_1}$ 3) $\frac{N_1}{N_2} = \sqrt{\frac{U_2}{U_1}}$ 4) $\left(\frac{N_1}{N_2}\right)^2 = \frac{U_1}{U_2}$

10. A system used to measure mass, length and time is

1) GPS system 2) MLT system 3) MIC system 4) CGS system

JEE MAINS

1. To measure any physical quantity _____is required.
   1) Time 2) Mass 3) Unit 4) Length
2. The unit of length in FPS system is
   1) Foot 2) Centimeter 3) Metre 4) All of these
3. The unit of mass in F.P.S system is
   1) second 2) pound 3) meter 4) centimeter
4. The unit of length in C.G.S system is
   1) second 2) pound 3) centimeter 4) meter
5. The unit of mass in M.K.S system is
   1) kilogram 2) second 3) centimeter 4) meter
6. Which among the following is the international system of units ?
   1) S.I. 2) F.P.S 3) C.G.S 4) M.K.S
7. Unit of mass in C.G.S system is
   1) gram 2) kilogram 3) centigram 4) milligram
8. The unit of length in M.K.S system is
   1) Foot 2) Centimeter 3) Handspan 4)Metre
9. The fundamental unit which is common in C.G.S and S.I System is
   1) meter 2) second 3) gram 4) centimeter
10. The symbol for unit of length in C.G.S system is
    1) centimeter 2) C.M 3) cm 4) Cm
11. The symbol for unit of length in M.K.S system is
    1) Meter 2) m 3) M 4) mr
12. The symbol for unit of mass in F.P.S system is
    1)p 2)pd 3) lb 4)po
13. The symbol for unit of time in M.K.S system is
    1)t 2)s 3)T 4)S
14. The symbol of unit of force is
    1) N 2) newton 3) F 4) n
15. The symbol for unit of work is
    1) S 2) K 3) J 4) I

JEE ADVANCED

Multi Correct Choice Type:

16. Which of the following quantities are measurable physical quantities?
    1) length 2) mass 3) time 4) speed

Statement Type:

17. *Statement - I :* 4 kilogram can be written as 4 kg.
    Statement - II : The symbol of unit should not be written in plural form.
    1) Both statements I and II are correct and II is correct explanation of I.
    2) Both statements I and II are not correct and II is correct explanation of I.
    3) Statement I is correct and statement II is incorrect.
    4) Statement I is correct and statement II is correct.

Comprehension Type:

Unit is a standard which is used for the measurement of a physical quantity.

18. In C.G.S. system the unit of volume is (volume = length × breadth × height)
    1) m^2 2) cm^3 3) kg^2 4) s^2
19. 60 kilogram in short form is written as
    1) 60 kgs 2) 60 kg 3) 60KG 4) 60KI
20. In which physical quantity, unit is same in all systems?
    1) length 2) mass 3) time 4) temperature

Comprehension Type: The unit of a physical quantity can be known if we know the measuring formual of that physical quantity.

21. Speed is numerically length divided by time, then it's unit is
    1) ms 2) s/m 3) ms^{-1} 4) $m^{-1}s^{-1}$
22. If work is the product of force and length, then it's unit can be written as
    1) Nm^{-1} 2) nM 3) Nm 4) NM
23. The unit of power in M.K.S system is (if power = $\frac{\text{Force} \times \text{length}}{\text{time}}$)
    1) Nms 2) $Nm^{-1}s^{-1}$ 3) $\frac{nm}{s}$ 4) Nms^{-1}

Matrix Match Type:

24.

Column-I	Column-II
a) unit of length in F.P.S	p) gram
b) unit of mass in C.G.S	q) foot
c) unit of time	r) metre
d) unit of length in S.I	s) pound
	t) second

25.

Column-I	Column-II
a) length	p) metre
b) mass	q) second
c) time	r) kilogram
d) system of unit	s) F.P.S
	t) C.G.S

Integer Answer Type:

26. Amount of work done is 9 joule, here _____ stands for Numerical value.

SYNOPSIS - 2

Based upon the nature of dependence and independence, physical quantities are classified into two types:

1) Fundamental physical quantities 2) Derived physical quantities

Fundamental quantities : The physical quantities which are independent of other physical quantities are called fundamental physical quantities.

Ex : Length, mass and time etc.,

Fundamental units : Fundamental units are the units for measuring fundamental quantities. These are independent of other units. These are also called basic units.

Ex: metre, kilogram and second etc.,

Fundamental quantities and units in S.I system:

Fundamental Quantity	S.I. unit	Symbol
Length	Metre	m
Mass	Kilogram	kg
Time	Second	s
Strength of electric current	ampere	A
Thermodynamic temperature	Kelvin	K
Amount of substance	Mole	mol
Luminous Intensity	Candela	cd

Supplementary quantity	Unit	Symbol
Plane Angle	radian	rad
Solid Angle	steradian	sr

Derived quantities : The physical quantities which are dependent on fundamental quantities are called derived quantities.

Ex : Area, volume, density, speed etc.

Derived Units: Units of derived physical quantities are called derived units.

Ex: The unit of speed is expressed by dividing the unit of distance by unit of time.

Hence speed is a derived quantity and the unit of speed =m/s.

SI units of some derived physical quantities are as follows:

Derived Physical Quantities	Derived Units
Area	m^2
Volume	m^3
Speed	ms^{-1}
Force	$kgms^{-2}$ or newton (N)
Energy	kgm^2s^{-2} or joule (J)

NOBEL LAUREATE IN PHYSICS - 1901

WILHELM CONRAD RONTGEN (1845 - 1923)
Munich University, Munich, Germany
"in recognition of the extraordinary services he has rendered by the discovery of the remarkable rays subsequently named after him"

WORKSHEET - 2

CUQ

1. The physical quantities which are independent of other physical quantities are called
   1) Fundamental quantities 2) Derived quantities
   3) Fundamental units 4) Derived units
2. Which of the following are fundamental quantities?
   1) kilogram 2) second 3) acceleration 4) Time
3. The units used for measuring the fundamental quantities are called
   1) Fundamental quantities 2) Derived quantities
   3) Fundamental units 4) Derived units
4. The S.I unit of length is
   1) centimetre 2) metre 3) foot 4) gram
5. The symbol used for unit of time is
   1) T 2) t 3) s 4) ti
6. The unit of plane angle is
   1) radian 2) steradian 3) candela 4) mole

7. The unit of mass in S.I. system is_____.
   1)gram 2) second 3) kilogram 4) foot
8. The unit of strength of electric current in S.I. system is_____.
   1)kelvin 2) mole 3) candela 4) ampere
9. The unit of amount of substance in S.I. system is_____.
   1)mole 2) candela 3)ampere 4) kelvin
10. The unit of luminuous intensity in S.I. system is_____.
   1)kelvin 2) mole 3) ampere 4) candela

JEE MAINS

Single Correct Choice Type:

1. Which of the following is a fundamental quantity?
   1) volume 2) length 3) area 4) force
2. Which of the following is a fundamental quantity?
   1) weight 2) quantity of substance
   3) density 4) area
3. Which of the following is a fundamental quantity?
   1) weight 2) volume 3) density 4) temperature
4. Length is a fundamental quantity in SI system, because
   1) it is independent of all other quantities
   2) it is in the set of fundamental quantities of SI
   3) it can't be a derived quantity in any system
   4) it is a fundamental quantity in all the systems
5. The symbol of unit of strength of electric current is
   1) m 2) kg 3) i 4) A
6. The symbol of unit of thermodynamic temperature is
   1) m 2) kg 3) K 4) θ
7. The symbol of unit of luminous intensity is
   1) cd 2) kg 3) K 4) A
8. The symbol of unit of amount of substance is
   1) mole 2) Cd 3) mol 4) A
9. Which of the following is a derived quantity?
   1) depth 2) height 3) volume 4) mass
10. The unit of speed is a
   1) Fundamental unit 2) Derived unit
   3) Neither fundamental not derived 4) Both fundamental and derived

11. Unit of area is a
    1) Derived unit
    2) Fundamental unit
    3) Fundamental and derived
    4) Fundamental or derived

12. Volume is a _____ quantity.
    1) fundamental 2) derived 3) natural 4) numerical

13. The derived unit of area is
    1) m 2) m^2 3) m^3 4) m/s

14. Derived unit of volume is
    1) m 2) m^2 3) m^3 4) m^4

15. Derived units are the units of
    1) derived physical quantities
    2) fundamental physical quantities
    3) single quantities
    4) secondary quantities

JEE ADVANCED

Multi Correct Choice Type:

16. Choose the correct statement:
    1) Number of fundamental quantities are limited
    2) In M.K.S System there are 3 fundamental quantities
    3) Number of fundamental quantities are unlimited
    4) Units of fundamental quantities in M.K.S is same as in SI

Statement Type:

17. *Statement I :* Fundamental units are the units for measuring fundamental quantities.

    Statement II : Metre is the standard unit of length.

    1) Both statements I and II are correct.
    2) Both statements I and II are incorrect.
    3) Statement I is correct and statement II is incorrect.
    4) Statement I is incorrect and statement II is correct.

Comprehension Type:

Unit is a standard which is used for the measurement of physical quantities. Fundamental units are the units for measuring fundamental quantities and derived units are the units for measuring derived quantities.

18. Which of the following is a derived quantity?
    1) height 2) depth 3) mass 4) volume

19. If density = mass/volume, then which of the following quantities are used to derive the quantity density ?
    1) Mass only 2) time,Mass 3) length,Area 4) Mass,length

20. Which of the following is a fundamental quantity?
    1) area 2) volume 3) density 4) radius

All derived quantities are derived from fundamental physical quantities.

21. If Speed = distance/ time then speed is derived from
    1) Length & Angle 2) Time & Angle 3) Time & Mass 4) Length & time

22. Force is derived from (Hint : force = (mass × length) / time)
    1) length & time 2) mass & length
    3) mass, length and time 4) mass & time

23. Volume is derived from
    1) length & time 2) mass & length
    3) mass, length and time 4) length

Matrix Match Type:

24.

Column-I	Column-II
a) Derived unit	p) Height
b) Fundamental unit	q) Thickness
c) Derived quantity	r) Area
d) Fundamental quantity	s) m^3
	t) Kilogram

25.

Column-I	Column-II
a) length	p) ampere
b) time	q) second
c) plane angle	r) centimeter
d) strength of electric current	s) metre
	t) radian

SYNOPSIS - 3

The distance between Amritsar and New Delhi is 470,000 metre. But it is far more convenient to say that the distance between Amritsar and New Delhi is 470 kilometre. Here the word kilo stands for one thousand and represented with a letter k. i.e., 1 kilometre = 1000 metre or **1km = 1000 m**

Kilo is used to replace 1000 and is called **Prefix.** 10^3 is called the **multiple.**

Submultiple of metre: Some lengths are much smaller than a metre.

For example, the length of a pencil is 0.15 metre.It is far more convenient to say that the length of a pencil is 15 centimetre.

Here, centi stands for 0.01 and represented with a letter **c**.

$0.01\ m = \frac{1}{100}\ m = 10^{-2}\ m = 1\ cm$

Centi is used to replace 0.01 and is called **Prefix.** 10^{-2} is called **sub multiple.**

Multiple and sub multiple factors

S.No	Multiplication factor	Prefix	Symbol
1.	10	deca	da
2.	10^2	Hecta	h
3.	10^3	Kilo	K
4.	10^6	Mega	M
5.	10^9	Giga	G
6.	10^{12}	Tera	T
7.	10^{15}	Peta	P
8.	10^{18}	Exa	E
9.	10^{21}	Zetta	Z
10.	10^{24}	Yotta	Y
11.	10^{-1}	Deci	d
12.	10^{-2}	Centi	c
13.	10^{-3}	Milli	m
14.	10^{-6}	Micro	μ
15.	10^{-9}	Nano	n
16.	10^{-12}	Pico	p
17.	10^{-15}	Femto	f
18.	10^{-18}	Atto	a
19.	10^{-21}	Zepto	z
20.	10^{-24}	Yetto	y

2. The gap between two points is measured by length.
In S.I. system, the length is measured in unit metre (m).

3. **Multiples of metre**

i) decametre (dam) = 10^1 m = 10 m

ii) hectometre (hm) = 10^2 m = 100 m

iii) kilometre (km) : One kilometre is the one thousand multiple of a metre.

1 km = 10^3 m = 1000 m

Practical units of length :

i) Astronomical unit (A.U) : It is the mean distance of the earth from the sun.

1 astronomical unit = 1.496×10^{11} m

ii) Light year (ly) : The distance travelled by the light in one year.

1 light year = speed of light × 1 year

= 300000 × 1 year km = 300000 × 365 × 24 × 60 × 60 km

= 9.46×10^{12} km = 9.46×10^{15} m

iii) Parallactic second (or Parsec) : It is the biggest unit of distance.

One parsec is 3.26 times the light year. i.e.,

1 parsec = 3.26 light year = 3.26 × (9.46×10^{15} m) = 3.08×10^{16} m

4. **Submultiples of metre**

i) decimetre (dm) : One decimetre is one tenth part of a metre

$$1 \text{ dm} = \frac{1}{10} \text{ m} = 10^{-1} \text{ m} = 10 \text{ cm}$$

ii) centimetre (cm) : One centimetre is one hundredth part of a metre.

$$1 \text{ cm} = \frac{1}{100} \text{ m} = 10^{-2} \text{ m} = 1 \text{ cm}$$

iii) millimetre (mm) : One millimetre is one thousandth part of a metre.

$$1 \text{ mm} = \frac{1}{1000} \text{ m} = 10^{-3} \text{ m} = 0.1 \text{ cm}$$

iv) micrometre (μm): It is one millionth (10^{-6}) part of a metre.

(micron) 1 μm = 10^{-6} m = 10^{-4} cm

v) Nanometre (nm) : It is 10^{-9} th part of a metre. 1 nm = 10^{-9} m = 10^{-7} cm

vi) Picometre (pm) = 10^{-12} m = 10^{-10} cm

vii) Angstrom (A°) : It is 10^{-10} th part of a metre.

1 A° = 10^{-10} m = 10^{-8} cm = 10^{-1} nm ∴ 1 μm = 1000 A° and 1 nm = 10 A°

viii) Fermi (f) or Femto metre : It is 10^{-15} th part of a metre

It is the smallest unit of distance. 1 fermi = 10^{-15} m

6. **Multiples of Kilogram**

i) 1 Quintal (qt) = 100 kg ii) 1 Metric tonne = 1000 kg = 10 quintal

7. **Submultiple of kilogram**

i) Hectogram (hg) = 10^{-1} kg = 100 g ii) Decagram (dag) = 10^{-2} kg = 10 g

iii)Gram (g) : One gram is one thousandths part of a kilogram. 1 g = 10^{-3} kg

iv) Milligram (mg) = 10^{-6} kg = 10^{-3} g v) Microgram (μg) = 10^{-9} kg = 10^{-6} g

vi) Atomic mass unit (a.m.u) : The smallest unit of mass is a.m.u.

1 a.m.u = 1.66×10^{-27} kg

Some **practical units of time** in various branches of physics (These are not SI units)

☞ 1 Shake	=	10^{-8} s
☞ 1 Minute	=	60 s
☞ 1 Hour	=	60 minute = 3600 s
☞ 1 mean solar day	=	1 × 24 hour
	=	1 × 24 × 60 minute
	=	86400 s

☞ Month	=	30 days (April, June, September and November)
	=	31 days (January, March, May, July, August, October December)
	=	28 days (February)
	=	29 days (February in a leap year)
☞ Lunar Month	=	4 weeks = 27.3 days (approximately)
☞ Year	=	365.25 days

LAUGH & LEARN

When an third grader was asked to cite Newton's first law, she said, "Bodies in motion remain in motion, and bodies at rest stay in bed unless their mothers call them to get up."
Einstein's favorite limerick was:
There was an old lady called Wright who could travel much faster than light.
She departed one day in a relative way and returned on the previous night.

WORKSHEET - 3

CUQ

1. 10^{-3} is represented with the prefix
   1) kilo 2) milli 3) mega 4) centi
2. The multiplication factor for micro is
   1) 10^{-3} 2) 10^{3} 3) 10^{-6} 4) 10^{6}
3. Which is not the multiple of meter?
   1) kilometer 2) hectometer 3) millimeter 4) decameter
4. Which of the following is a sub-multiple?
   1) kilo 2) mega 3) nano 4) deca
5. Which of the following is a multiple?
   1) deci 2) centi 3) deca 4) pico
6. Which among the following is a bigger multiple?
   1) Tera 2) Giga 3) mega 4) kilo
7. Light year is the unit of
   1) time 2) mass 3) distance 4) area
8. Prefix 10^{-6} is
   1) kilo 2) milli 3) micro 4)centi
9. Prefix 10^{9} is
   1) mega 2) giga 3) Exa 4)deca
10. 1Mm= _____ m.
    1) 10^{2} 2)10^{3} 3)10^{5} 4)10^{6}

JEE MAINS

1. One meter =_____centi meter.
   1) 10,000 2) 1000 3) 100 4) 10
2. 1 Metric tonne =
   1) 10 kg 2) 100kg 3) 1000kg 4) 10000kg
3. 1 Hour =
   1) 60 s 2) 100s 3) 24s 4) 3600s
4. Among the following the arrangement of multiples in increasing order is
   1) kilo,mega,giga 2) mega,kilo,giga
   3) kilo,giga,mega 4) giga,mega,kilo
5. 1 fermi is equal to
   1) 10^{-15} m 2) 10^{-13} m 3) 10^{-12} m 4) 10^{-10} m
6. Which of the following is the biggest unit of distance?
   1) light year 2) parsec 3) metre 4) kilometre
7. The smallest unit of mass is
   1) atomic mass unit 2) gram
   3) milligram 4) kilogram
8. Which of the following is the sub multiples of kilogram?
   1) gram 2) quintal 3) metric tonne 4) ten quintal
9. Which of the following is the sub-multiple of metre
   1) micrometre 2) nanometre 3) picometre 4) all of these
10. 1 mean solar day =
    1) 1 hour 2) 12 hour 3) 24 hour 4) 48 hour
11. 1 angstrom =
    1) 10^{-10} metre 2) 10^{10} metre 3) 10^{-8} metre 4) 10^{8} metre
12. 1 astronomical unit =
    1) 1.496×10^{11} m 2) 4.196×10^{11} m
    3) 9.146×10^{11} m 4) 6.149×10^{11} m
13. 1kg = _____ μg
    1) 10^{3} 2) 10^{6} 3) 10^{9} 4) 10^{4}
14. 1 μs =_____ms
    1) 10^{-3} 2)10^{3} 3)10^{-6} 4)10^{6}
15. 1Mm= _____mm
    1) 10^{3} 2)10^{6} 3)10^{12} 4)10^{9}

JEE ADVANCED

Multi Correct Choice Type:

16. Which of the following is the sub-multiple of metre?

1) micrometre 2) nano metre 3) decimetre 4) centimetre

Statement Type:

17. *Statement - I :* One kilometre is the one thousand multiple of a metre.

Statement - II : One par sec is 3.26 times the light year.

1) Both statements I and II are correct.

2) Both statements I and II are incorrect.

3) Statement I is correct and statement II is incorrect.

4) Statement I is incorrect and statement II is correct.

Comprehension Type:

Multiples and submultiples are introduced to change the size of the units to fulfill the needs of various branches in physics.

18. Which of the following is multiple of metre?

1) deca metre 2) milli metre 3) centimetre 4) micro metre

19. Which of the following is sub - multiple of metre?

1) deca metre 2) milli metre 3) hecto metre 4) kilo meter

20. Which of the following is sub-multiple of kilogram?

1) deca gram 2) milli gram 3) hecto gram 4) kilo meter

Multiples and submultiples are introduced to change the size of the units to fulfill the needs of various branches in physics.

21. 1 tera metre =

1) 10^2 m 2) 10^{10} m 3) 10^6 m 4) 10^{12} m

22. 1nano metre =

1) 10^{-9} m 2) 10^{-10} m 3) 10^{-3} m 4) 10^9 m

23. 1Exa metre =

1) 10^{12} m 2) 10^{-10} m 3) 10^{-3} m 4) 10^{18} m

Matrix Match Type:

24.

Column-I	Column-II
a) 1Mm=_____m	p) 10^{-6}
b) 1ng = _____mg	q) 10^3
c)1μg =____ picogram	r) 10^6
d) 1 ms =_____s	s) 10^{-3}
	t) 10^9

25.

Column-I	Column-II
a) milli	p) 10^{-6}
b) micro	q) 10^{-12}
c) pico	r) 10^{-15}
d) femto	s) 10^{-3}
	t) 10^{-9}

SYNOPSIS - 4

Measurement of Length

Observe the following:

Here, we are measuring the distance between two points A and B.

This distance between two points is called **Length**.

Standard Unit of Length : According to SI system of units, the standard unit of length is **metre**. In short form it is written as **m**.

Multiples and Sub- multiples of metre

Multiple of metre: The distance between Amritsar and New Delhi is 470,000 metre. But it is far more convenient to say that the distance between Amritsar and New Delhi is 470 kilometre. Here the word kilo stands for one thousand and represented with a letter k. i.e., 1 kilometre = 1000 metre or **1km = 1000 m**

Kilo is used to replace 1000 and is called **Prefix.** 10^3 is called the **multiple.**

Submultiple of metre: Some lengths are much smaller than a metre.

For example, the length of a pencil is 0.15 metre.It is far more convenient to say that the length of a pencil is 15 centimetre.

Here, centi stands for 0.01 and represented with a letter **c**.

$$0.01 \text{ m} = \frac{1}{100} \text{ m} = 10^{-2} \text{ m} = 1 \text{ cm}$$

Centi is used to replace 0.01 and is called **Prefix.** 10^{-2} is called **sub multiple.**

Measuring Instruments of length

Ruler, Tape are some instruments used to measure length.

Conversion of units:

To convert a unit from one system to another, the steps to be followed are:

Step-1 : First convert the given unit into SI unit.

Step-2 : Then, convert it into the desired system of units.

Note : **Conversion is possible only between the units used to measure the same physical quantity.**

Convert the following units of "length" into desired units.

a) Convert 20 cm into meter; **Step 1 :** 20 cm = 20×10^{-2} m= 0.2 m

b) Convert 20 cm into km; **Step 1:** 20 cm = 20×10^{-2}m = 0.2 m

Step 2: 0.2 m = $0.2 \times 10^{-3} \times 10^{3}$ m = 0.2×10^{-3} km

c) Convert 20 cm into μm; **Step 1:** 20 cm = 20×10^{-2}m = 0.2 m

Step 2: 0.2 m = $0.2 \times 10^{6} \times 10^{-6}$ m = 0.2×10^{6} μm

d) Convert 20 cm into nm; **Step 1:** 20 cm = 20×10^{-2} m=0.2 m

Step 2: 0.2 m = $0.2 \times 10^{9} \times 10^{-9}$ m = 0.2×10^{9} nm

Note : 12 inches = 1 foot; 3 feet = 1 yard; 5 ½ yards = 1 pole or rod; 4 pole = 1 chain

80 chain = 1 mile.

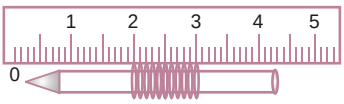
Now, find out 1 inch = _____ mile.

Read the Googly
1Kilogram=_____meter
Ans : Conversion is not possible

ACTIVITY

Measuring the diameter of wire using scale.

Take the wire whose diameter has to be measured. Wind it around the pencil as shown in figure.



See that there is no gap between the turns of wire. Measure the length of coil. For example if the number of rounds wound are 24 and the length of coil is 4.8cm, then the diameter of wire is length of the coil / number of rounds wound

= 4.8/24 = 2mm.

Measurement of Mass: Imagine you have to buy vegetables from the market.

Here, the measuring quantity is **mass**.

The quantity of matter contained in the body is called its mass.

In S.I. system mass is measured in kilogram.

Standard unit of mass: According to SI system of units, the standard unit of mass

is **kilogram**. In shortform it is written as **kg**.

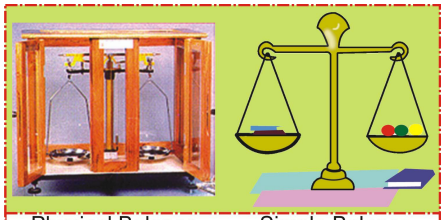
Multiples and Sub multiples of Kilogram

Multiple of kilogram: For stating the mass of heavier bodies a bigger unit is used. It is called **Quintal**. The relation between Quintal and Kilogram is **1Quintal = 100 kilogram**

Sub multiple of kilogram : For stating the mass of bodies less than one kilogram, another unit is used. It is called **gram**. In short form it is written as **g**.

The relation between gram and kilogram is One gram = $\frac{1}{1000}$ kilogram

Measuring Instruments of mass: Simple balance, Physical balance etc., are some instruments used to measure mass.



Physical Balance Simple Balance

Conversions:

Convert the following units of 'mass' into desired units

a) Convert 300 g into kg; **Step 1:** 300 g = 300 × 10^{-3} kg = 0.3 kg

b) Convert 5 mg into kg; **Step 1:** 5 mg = 5 × 10^{-3} g

Step 2: 5 × 10^{-3} × 10^{-3}kg = 5 × 10^{-6} kg

c) Convert 400 kg into mg; **Step 1:** 400 kg = 400 × 10^{6} × 10^{-6} kg = 400 × 10^{6} mg
Now you have enough practice. From now onwards combine the two steps.

d) Convert 5 μg into ton; 5 μg = 5 × 10^{-6} g = 5 × 10^{-9} kg

5 × 10^{-9} kg = 5 × 10^{-9} × 10^{-3} ton = 5 × 10^{-12} ton

e) Convert 10 quintal into ng; 10 quintal = 10 × 10^{2} kg

10 × 10^{2} kg = 10 × 10^{2} × 10^{3} g = 10 × 10^{2} × 10^{3} × 10^{9} ng = 10^{15} ng

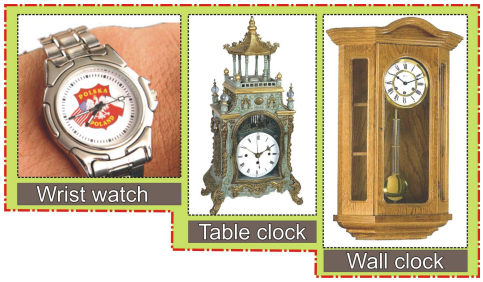
Measurement of Time: Imagine every day, after coming from school, you start playing at 5 PM. Here, the measuring quantity is **Time**.

Standard Unit of Time: According to SI system of units, the standard unit of time is **second**. In short form it is written as **s**.

Other Units of time

1 minute (min) = 60 seconds	1 hour (h) = 60 minutes = 360 seconds
1 day = 24 hours	1 year = $365\frac{1}{4}$ days
1 decade = 10 years	1 century = 10 decades
1 leep year = 366 days	1 millennium = 100 decades = 100 years

Measuring Instruments of Time: Watches and clocks are some instruments used to measure time.



Conversions: Convert the following units of 'time' into desired units.

a) Convert 32 s into ms; $32\ s = 32 \times 10^3 \times 10^{-3}\ s = 32 \times 10^3$ ms.

b) Convert 40 min in to μs;

$40\ min = 40 \times 60\ s = 24 \times 10^2\ s = 24 \times 10^2 \times 10^6 \times 10^{-6}\ s = 24 \times 10^8\ \mu s$

c) Convert 1day into seconds;

$1day = 24hrs = 24 \times 60\,min = 24 \times 60 \times 60s = 86,400s$

WORKSHEET - 4

CUQ 1. The distance between any two points is called

1) mass 2) length 3) velocity 4) weight

2. The standard unit of length is S.I. System is _____

1) kilometre 2) metre 3) centimetre 4) millimetre

3. The prefix kilo is used to replace

1) 100 2) 10 3) 1000 4) $\frac{1}{1000}$

4. Centi is used to replace

1) 0.1 2) 0.01 3) 0.001 4) 10

5. Conversion is possible only between the units used to measure the

1) same physical quantities 2) different physical quantities

3) all physical quantities 4) no physical quantities

6. The quantity of matter contained in the body is called _____

1) weight 2) Length 3) mass 4) time

7. The standard unit of mass is S.I. system is

1) gram 2) milli gram 3) centimetre 4) kilogram

8. 1 quintal=

1) 10 kg 2) 100 kg 3) 1000kg 4) $\frac{1}{1000}$ kg

9. 1 gram=

1) $\frac{1}{1000}kg$ 2) $\frac{1}{100}kg$ 3) 1000 kg 4) 100 kg

10. 1 century = _____ years

1) 10 2) 100 3) 1000 4) 5

JEE MAINS

1. 1 centimetre=_____metre.

1) 1/10 2) 1/100 3) 1/1000 4) 1/10,000

2. 1 millimetre=_____metre.

1) 1/10 2) 1/100 3) 1/1000 4) 1/10000

3. 1 centimetre =_____ millimetre

1) 10 2) 100 3) 1000 4) 10000

4. 1 centimetre =_____kilometre

1) 10 2) 100 3) $\frac{1}{10}$ 4) $\frac{1}{100000}$

5. 1 millimetre =_____centimetre

1) 10 2) 1000 3) $\frac{1}{1000}$ 4) $\frac{1}{10}$

6. 1 millimetre =_____kilometre

1) $\frac{1}{10}$ 2) $\frac{1}{100}$ 3) $\frac{1}{1000000}$ 4) 1000000.

7. 1 km =_____m

1) 100 2) 1000 3) 10 4) 10000

8. 1 nm = _____ A°.

1) 1 2) 1000 3) 100 4) 10

9. 1 nm = _____.

1) 10^{-9} m 2) 10^{-10} m 3) 10^{-7} m 4) 10^{-10} mm

10. 1 μm=-----A^0

1) 10^7 2) 10^4 3) 10^5 4) 10^8

11. 1 kilogram=_____gram.

1) 10 2) 100 3) 1000 4) 10000

12. 1 kilogram = _____milligrams

1) 10 2) 100 3) 10000 4) 1000000

13. 1 gram =_____milligram

1) 10 2) 100 3) 1000 4) 1/1000

14. 1 gram =_____kilogram

1) $\frac{1}{10}$ 2) $\frac{1}{100}$ 3) 1000 4) $\frac{1}{1000}$

15. 1 milligram=_____gram

1) $\frac{1}{10}$ 2) $\frac{1}{100}$ 3) 1000 4) $\frac{1}{1000}$

JEE ADVANCED

Multi Correct Choice Type:

16. 1 metric tonne =

1) 1000 kg 2) 10 quintal 3) 2000 kg 4) 20 quintal

Statement Type:

17. *Statement I :* Negative powers are used for compound units obtained by dividing one unit with another unit.

Statement II : A unit in short form is never written in plural.

1) Both statements I and II are correct.

2) Both statements I and II are incorrect.

3) Statement I is correct and statement II is incorrect.

4) Statement I is incorrect and statement II is correct.

Comprehension Type:

To convert a unit from one system to another, the steps to be followed are:

- first convert the given unit into S.I. unit.
- then, convert it into the desired system of units.

18. 20 cm = _____ km.

1) 1.2×10^{-7} 2) 1.4×10^{-2} 3) 0.2×10^{-3} 4) 0.9×10^{-6}

19. 5 mg = _____ kg.

1) 2×10^{-3} 2) 3×10^{-6} 3) 5×10^{-6} 4) 6×10^{-5}

20. 1 day = _____ sec.

1) 34,600 2) 43,000 3) 56,230 4) 86,400

To convert a unit from one system to another, the steps to be followed are:

First convert the given unit into SI unit.

Then, convert it into the desired system of units.

21. 1 cm/ns =_____ mm/μs .

1) 10^4 2) 10^{-3} 3) 10^6 4) 10^{-6}

22. 1 mg/km=_____μg/mm .

1) 10^3 2) 10^{-3} 3) 10^6 4) 10^{-6}

23. 1 μs/nm =____ms/km.

1) 10^6 2) 10^{-6} 3) 10^9 4) 10^{-9}

Matrix Match Type:

24.

Column-I	Column-II
a) 1mg	p) 10^{-9} g
b) 1 kg	q) 10^6 g
c) 1μg	r) 10^{-6} g
d) 1ng	s) 10^3 g
	t) 10^{-3} g

25.

Column-I	Column-II
a) $10^{-3}m$	p) 1 pico metre
b) $10^{-9}m$	q) 1mm
c) $10^{-12}m$	r) 1nm
d) $10^{-6}m$	s) 10 A^0
	t) 1 μ m

UNITS AND DIMENSIONS_KEY

WORKSHEET - 1

CUQ : 1) 2 2)1 3)1 4)2 5)2 6)1 7)2
8)2 9)2 10)4

JEE MAINS AND ADVANCED: 1) 3 2)1 3)2 4)3 5)1
6)1 7)1 8)4 9)2 10)3 11)2 12)3 13)2
14)1 15)3 16)1,2,3,4 17)1 18)2 19)2 20)3 21)3
22)3 23)4 24)a-q;b-p;c-t;d-r 25)a-p;b-r;c-q;d-s,t 26)9

WORKSHEET - 2

CUQ 1) 1 2)4 3)3 4)2 5)3 6)1 7)3 8)4
9)1 10)4

JEE MAINS AND ADVANCED 1) 2 2)2 3)4 4)1 5)4
6)3 7)1 8)3 9)3 10)2 11)1 12)2 13)2 14)3
15)1 16)(1,2,4) 17)1 18)4 19)4 20)4 21)4 22)3
23)4 24) a-s;b-t;c-r;d-p,q 25)a-r,s;b-q;c-t;d-p

WORKSHEET - 3

CUQ 1)2 2)3 3)3 4)3 5)3 6)1 7)3 8)3
9)2 10)4

JEE MAINS AND ADVANCED 1)3 2)3 3)4 4)1 5)1 6)2
7)1 8)1 9)4 10)3 11)1 12)1 13)3 14)1 15)4
16)1,2,3,4 17)1 18) 1 19)2 20)2 21)4 22) 1 23)4
24) a-r;b-p;c-r;d-s 25) a-s;b-p;c-q;d-r

WORKSHEET - 4

CUQ 1) 2 2) 2 3) 3 4) 2 5) 1 6) 3 7) 4 8) 2
9) 1 10) 2

JEE MAINS AND ADVANCED

1) 2 2) 3 3) 1 4) 4 5) 4 6) 3 7) 2 8) 4
9) 1 10) 2 11) 3 12) 4 13) 3 14) 4 15) 4 16) 1,2
17) 1 18) 3 19) 3 20) 4 21) 1 22) 2 23) 3
24) $a \to t; b \to s; c \to r; d \to p$ 25) $a \to q; b \to r, s; c \to p; d \to t$

NOTES