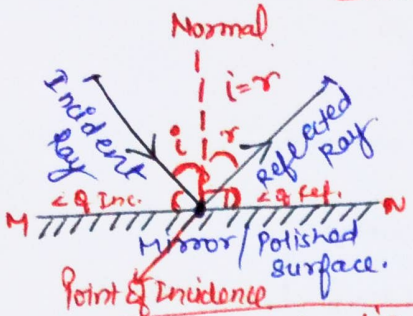
LIGHT -1 Physics 10th



The Phenomenon of bouncing back of ray of light falling on polished surface is known as **Reflection of light.**

Laws of Reflection

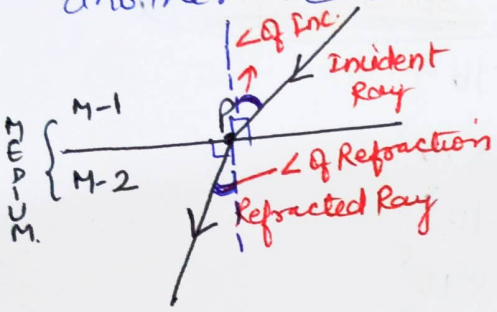
1. Angle of incidence = Angle of Reflection.
2. The incident, Reflected & Normal Ray all lie on same Plane.

Types of Reflection

- On plane surface
- On rough surface.

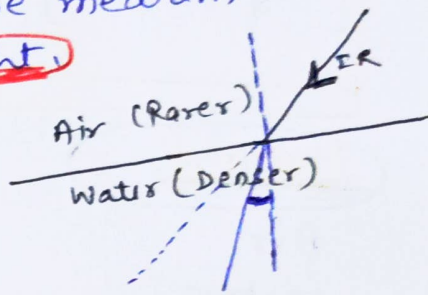
[Light travel in straight direction = Rectilinear Propagation]

The Phenomenon of bending of light from one medium to another medium is called **Refraction of light.**



Bending Tendency

1. When light enter through Rarer to Denser then bend toward Normal
2. Denser to Rearer then bend away from Normal, (DAR) (Dense Away Rearer)



Laws of Refraction

1. Incident Ray, Refracted Ray & Normal they all lie on same Plane.
2. Snell's law $\frac{\sin(i)}{\sin(r)}$ = constant [The ratio of Sin i & Sin R is always constant for given pair of Media]

Reflaction

1. The rays of light before and after reflection, travel in the same medium.
2. In Reflection, the angle of incidence and angle of Reflection are equal
3. In Reflection, there is no change in the speed & wavelength of light
4. There is no dispersion of light.

Refraction

In refraction of light, the rays travel from one medium to another medium

In it, when rays travel obliquely from one medium to another, the angle of incidence & angle of Refraction are not equal.

In it there occurs a change in the speed & wavelength of light.

In it generally dispersion of light occurs.

Lateral Inversion It is the phenomenon where the left & right side of an object appears reversed in an image formed by a Plane surface mirror. eg: Ambulance

d) Refractive index of diamond is 2.42, what is the meaning of this statement?

light speed in vaccum = 3×10^8 m/s

Density = $\frac{\text{Mass}}{\text{volume}}$.

Optical density greater → light speed lower,

Speed of light is lower in diamond as optical density is higher in diamond. light travel slowly in diamond.

Higher density → Higher bending towards Normal.

{Refractive Index of Medium} $n = \frac{c}{v}$ (speed of light in a vacuum) (299,792 Km/sec.) / (speed of light in medium) (< 299,792 Km/sec)

Refractive Index

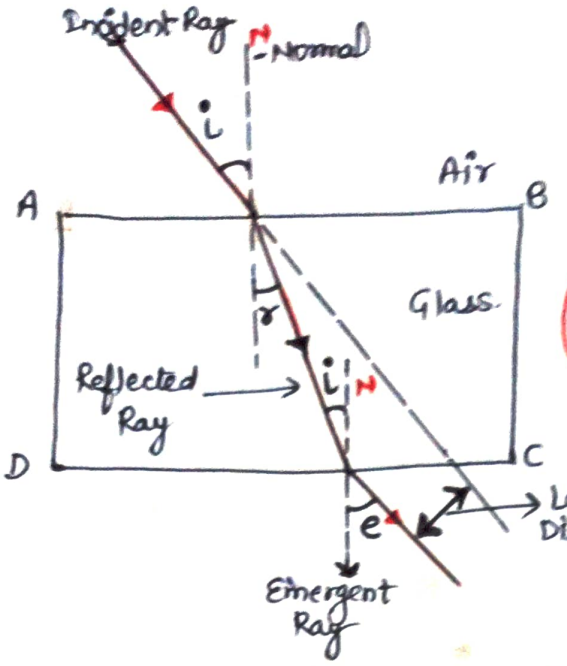
Material	Refractive Index	Speed of light
Air	1.00	3×10^8
Water	1.33	2.3×10^8
Perspex	1.49	2×10^8
Glass	1.50	2.0×10^8
Diamond.	2.42	1.2×10^8.

Absolute Refractive Index

1. It is the ratio of the speed of light in a vaccum to its speed in given medium.
2. Symbol usually denoted by n
3. $n = \frac{c}{v}$ c is speed of light in vaccum & v is speed of light in medium.
4. Reference medium is always vaccum.
5. Always greater than or equal to 1 since light travel fastest in vaccum.
6. Used in optical density of a signle medium.
7. Fundamental is how light bend or refract when entering a medium from a vaccum.

Relative Refractive Index

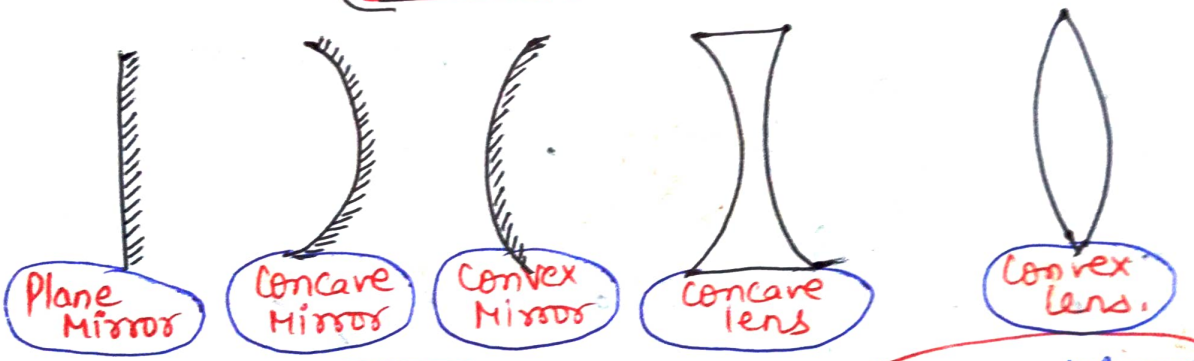
1. Ratio of the speed of light in one medium to another medium.
2. Denoted as $n_{1,2}$ or n_{rel}
3. $n_1 = \frac{v_2}{v_1}$, where v_1 & v_2 are speed of light in two medium.
4. Reference is not fixed & can vary depending on comparison.
5. Can be greater than or less than 1, depending on relative speed of light in two media
6. Used to describe the transition of light between two specific media.
7. Significance - crucial for understanding light refraction at the boundary between two media.



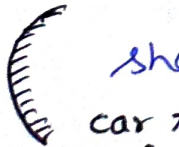
Refraction through a rectangular glass slab

1. When light passed from air into glass, it bends toward the normal.
2. The angle of refraction for the first interface is equal to angle of incidence for second interface.
3. The final angle of emergence is equal to the angle of incidence.
4. The emergent ray is parallel to the incident ray.
5. There is lateral displacement in the path of light.

LENS & MIRROR



Convex Mirror

1. Convex mirror is a spherical mirror whose reflecting surface is away from the centre of the sphere of which the mirror is apart
2. The focus lies behind the mirror
3. Convex mirror is known as diverging mirror.
4. always formed real, Inverted & Diminished image.
5. 

Shape of convex,
car rear view side mirror
Parking mirror.

Concave Mirror

Concave mirror is a spherical mirror whose reflecting surface is toward the centre of the sphere of which the mirror is apart.

The focus lies infront of the mirror

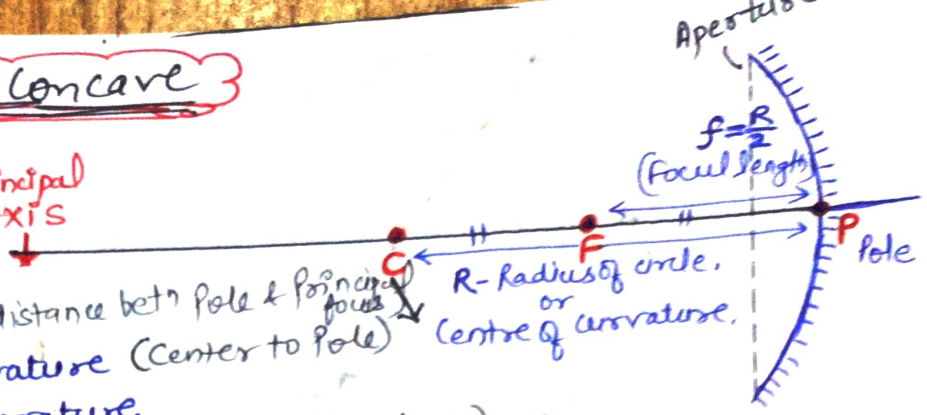
Concave mirror is known as a converging mirror.

Form different type of Image depend on the position of object.



Shape of concave
shaving mirror, Dental Mirror, Makeup

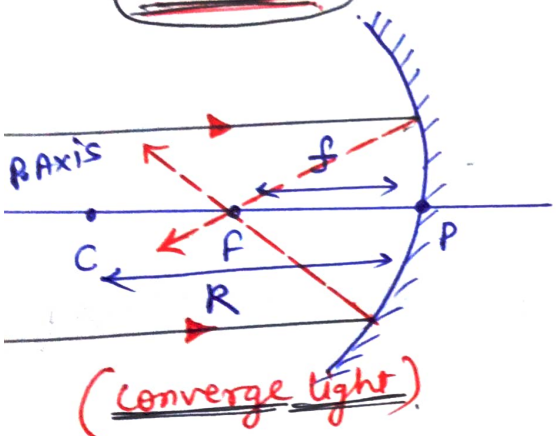
Important Rays on Concave



$2f = R$

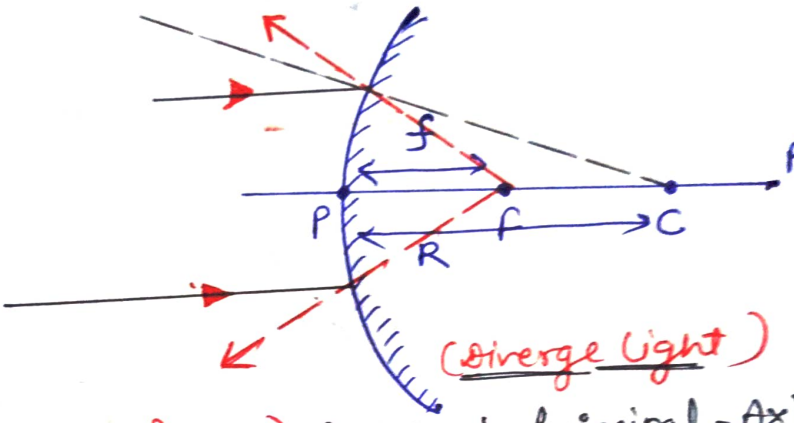
$f \rightarrow$ focal length. (distance bet^n Pole & Principal focus)
$R \rightarrow$ Radius of curvature (Center to Pole)
$C \rightarrow$ center of curvature
$P \rightarrow$ Pole (Mid point of refecting surface)
$F \rightarrow$ Principal of focus. (Mid point of center & Pole)

Concave



(converge light)

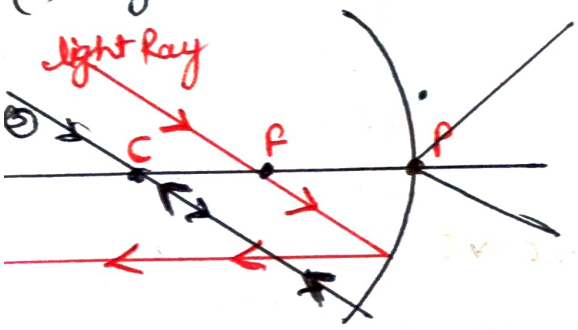
Convex

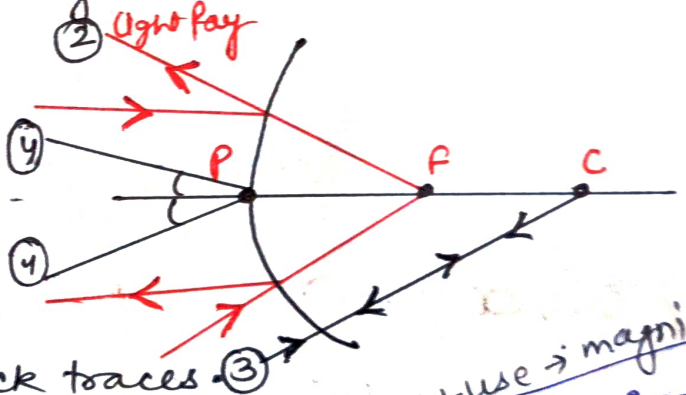


(Diverge Light)

(1) Parallel light Image drawn on focus.) Parallel to Principal - Axis

(2) Light Passes to focus → always Parallel to Principal Axis.





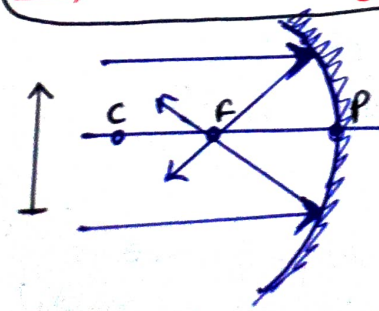
(3) Light Passes at C Back traces

(4) Light Passes at P Pole $\angle i = ir$.

dentist use → magnify image.
Shaving mirror / Makeup
Solar furnance
Headlight of vehicle.

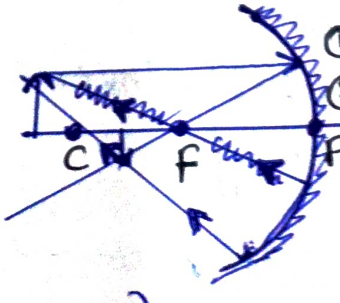
Image formation : Concave Mirror

object at Infinity - 1



Nature of image
1. At Focus (f)
2. Highly diminished
3. Real image
4. Inverted image.

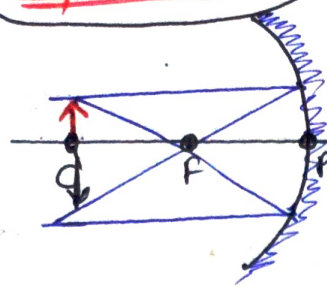
object beyond C - 2



Nature of Image
1. Bet^n C & f
2. Diminished
3. Real Image
4. Inverted Image.

(Virtual is always erect)

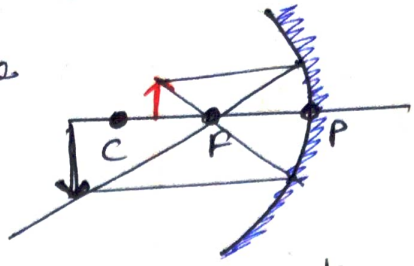
Object at C – 3



Nature of image

1. At C
2. Same Size
3. Real
4. Inverted

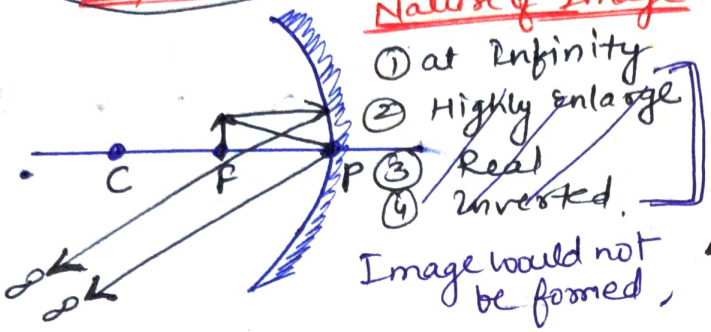
Object bet^n C & F – 4



Nature of image

1. Beyond C
2. Enlarge
3. Real & Inverted.

Object at f – 5

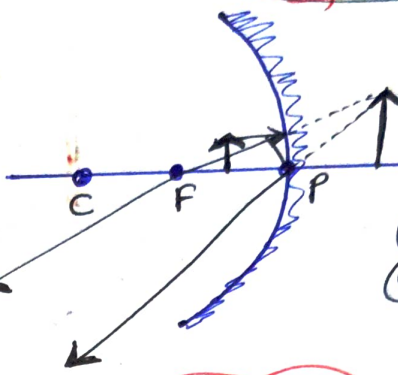


Nature of Image

1. at Infinity
2. Highly enlarge
3. Real
4. Inverted.

Image would not be formed,

Object Between F & P – 6

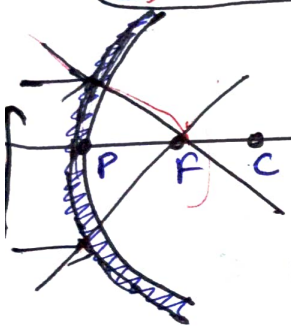


Nature of Image

1. Behind the Mirror
2. Enlarge.
3. Virtual image
4. Erect image.

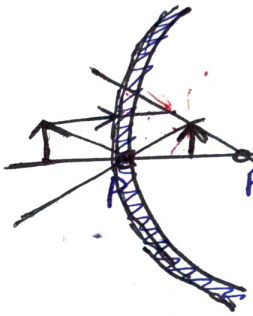
Image formation at Convex Mirror

Object at Infinity – 1



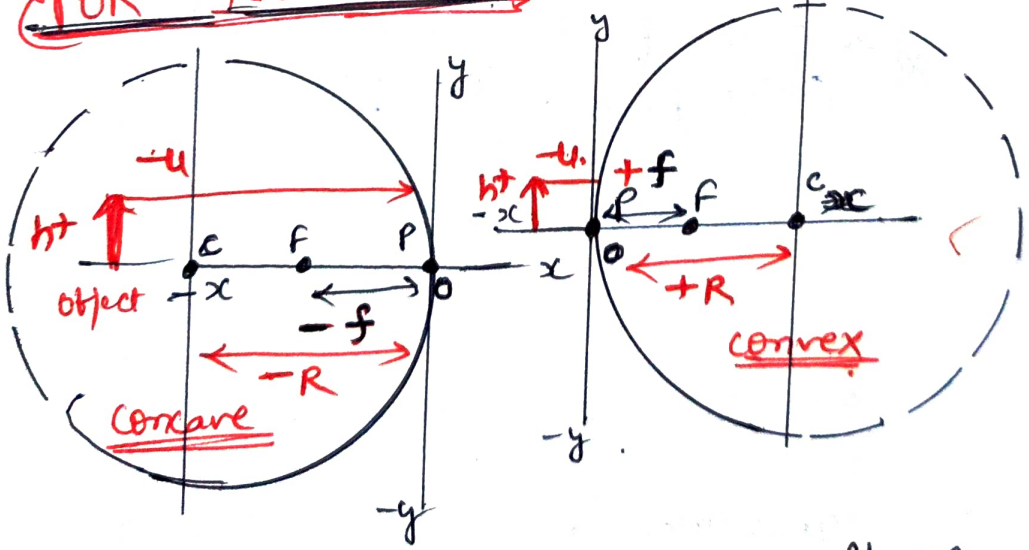
1. At F
2. Highly diminished
3. Virtual & Erect.

2 – Object at finite distance (∞–P)



1. B/W P & F
2. Diminished
3. virtual
4. Erect.

FOR NUMERICAL



u is always -ve

h is always +ve

u = -ve

h = +ve

P is original of Cartesian Plane

Mirror formula

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

Magnification formula

$$m = \frac{-v}{u}$$

$$m = \frac{h_{image}}{h_{object}} = \frac{h_i}{h_o}$$

Nature of image

$0 < m < 1$: Diminished

$m = 1$: Same size

$m > 1$: Enlarge / Magnified

$m \nearrow +$: Erect + virtual

$m \searrow -$: Inverted + Real

eg: of $m = -2.5$

The image is 2.5 times enlarge & it is real & Inverted. (Bet C & F) -4

Q An object is placed at distance of 10 cm from a converging mirror of focal length 5 cm find nature & position? (Converging → Concave)

$u = -10$ cm

$f = -5$ cm.

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$$\frac{1}{-5} = \frac{1}{v} - \frac{1}{10}$$

$$\frac{1}{10} - \frac{1}{5} = \frac{1}{v} \quad = -\frac{1}{10} = \frac{1}{v}. \quad v = -10 \text{ cm}.$$

$$m = \frac{-v}{u} = \frac{-(-10)}{-10} = -1$$

$m = -1$: Real & Inverted, Same Size., Object at C

Q An object is placed at a distance of 15cm from a diverging mirror of focal length 6 cm. find nature & Position? (Diverging → Convex)

$u = -15$cm

$f = 6$cm.

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$$\frac{1}{6} = \frac{1}{v} - \frac{1}{15}$$

$$\frac{1}{15} + \frac{1}{6} = \frac{1}{v} \qquad \frac{2+5}{30} = \frac{7}{30} = \frac{1}{v}$$

$7v = 30$

$v = 30/7$ 4.28 cm.

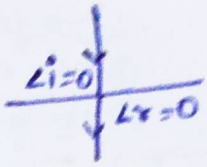
$$m = \frac{-v}{u} = \frac{-30}{7} \div -15$$

$$= \frac{30}{7} \times \frac{1}{15} = \frac{2}{7} = .28.$$

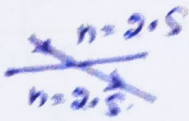
$m = .28$ virtual Erect / Diminished.

When refraction not occur

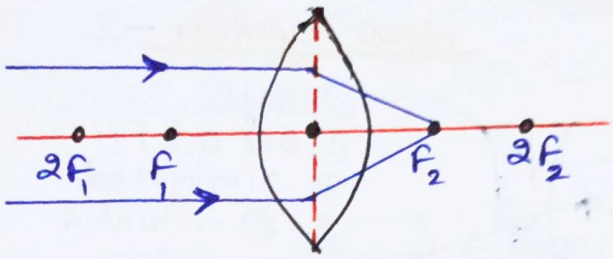
① when light fally Normally. ⊥

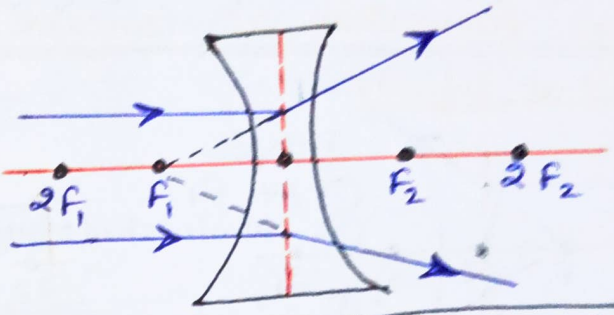


② when both media have optical Density.



Refraction through spherical lens:



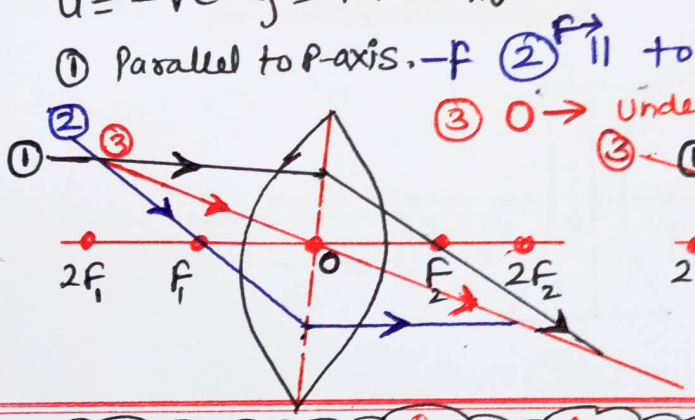


Convex / converging lens

u = −ve f = +ve h0 = +ve

① Parallel to P-axis. – f ② ~~f~~ → ∥ to P axis

③ O → Undeviated.



Concave / diverging lens.

u = −ve f = −ve h0 = +ve

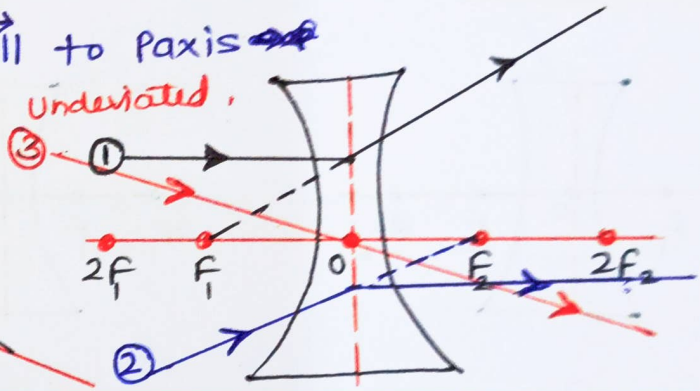


Image formation : Convex lens

Object at Infinity – 1

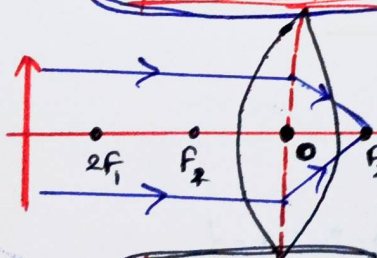


Image
① At F2
② Highly diminished
③ Real / Inverted.

Object beyond 2F1 – 2

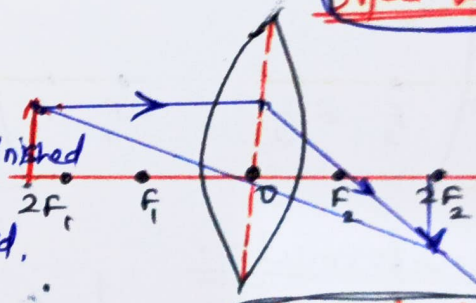


Image
① B/W F2 & 2F2
② Diminished
③ Real / Inverted.

Object at 2F1 – 3

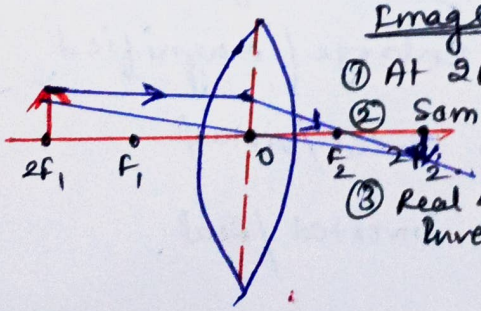


Image
① At 2F2
② Same size
③ Real & Inverted.

Object B/n 2F1 & F1 – 4

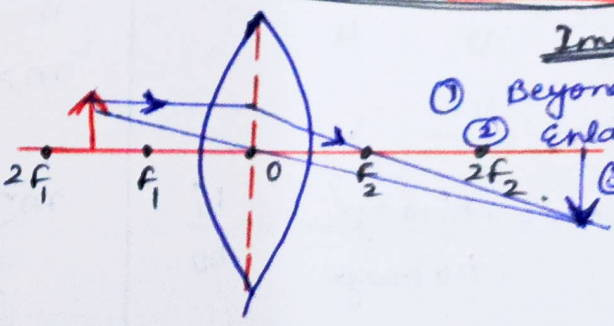


Image
① Beyond 2F2
② Enlarged
③ Real & Inverted.

Object at F1 — 5

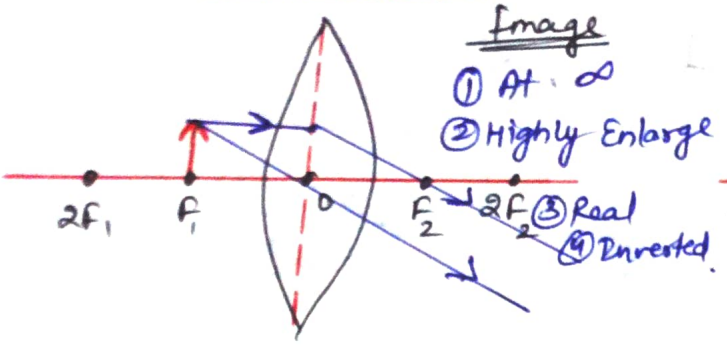


Image
① At ∞
② Highly Enlarge
③ Real
④ Inverted

Object B/n F1 & O — 6

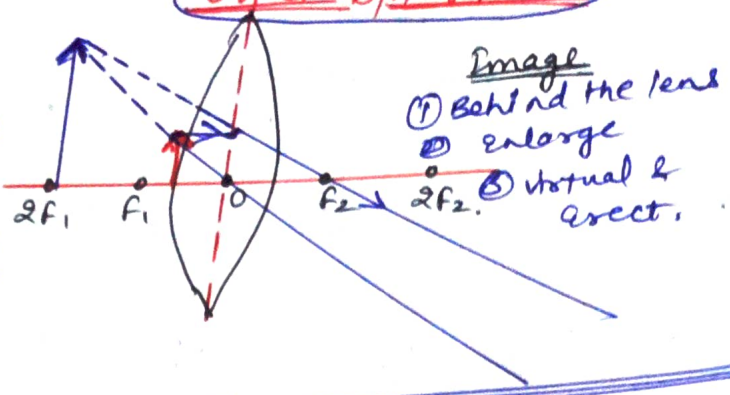


Image
① Behind the lens
② Enlarge
③ Virtual & Erect.

Image formation at Concave lens

Object at Infinity — 1

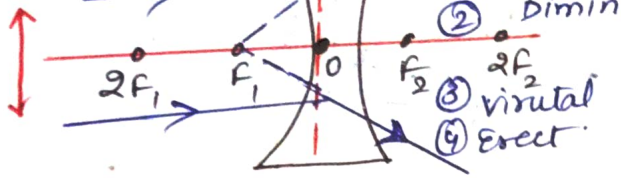


Image
① At F1
② Diminished Highly
③ Virtual
④ Erect

Object beyond 2F1 — 2

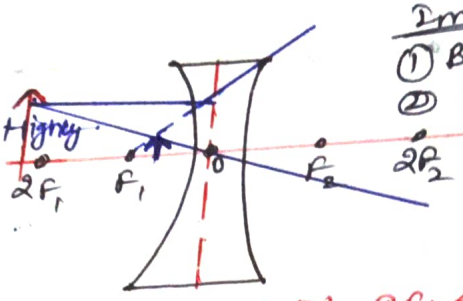
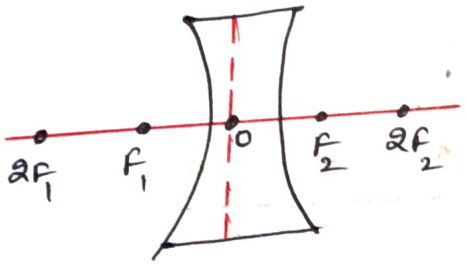
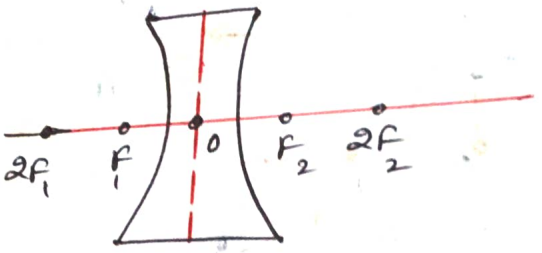


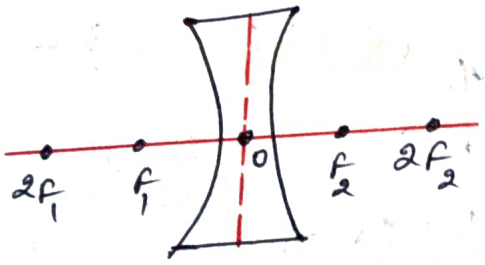
Image
① Bet O & F1
② Diminished
③ Virtual & Erect.

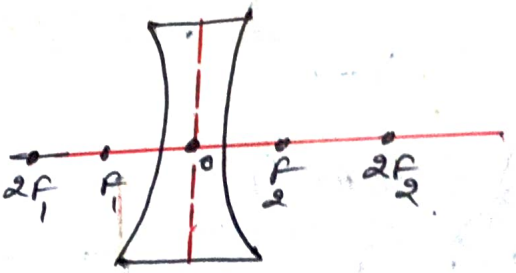
Object at 2F1 — 3



Object B/n 2F1 & F1 — 4







Concave lens formula.

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

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

$$m = \frac{\text{hi image}}{\text{ho image}} = \frac{hi}{ho}.$$

$0 < m < 1$: Diminished
$m = 1$: Same size
$m > 1$: Enlarge / Magnified

$m \begin{cases} + : \text{Erect/virtual} \\ - : \text{Inverted/Real.} \end{cases}$

Characteristics of a image formed by a plane mirror.

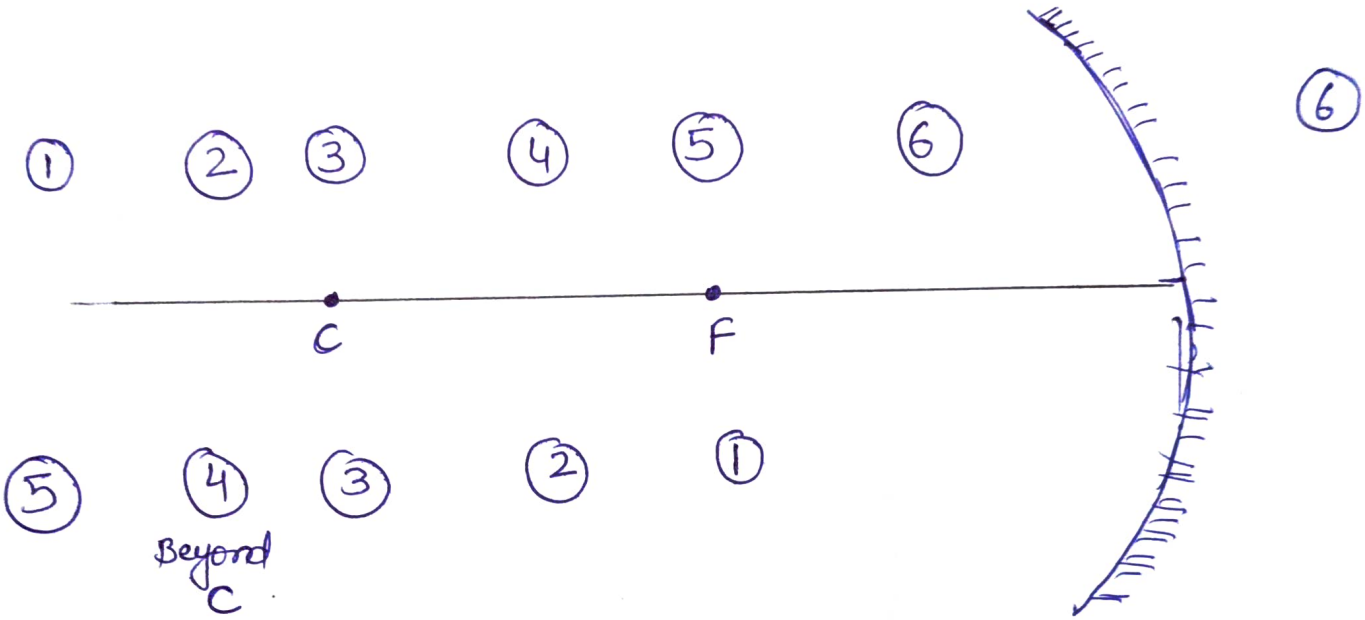
Plane mirror is a smooth & polished surface that reflect light uniformly.

(1) image obtained is virtual
(2) Image is laterally inverted
(3) image is erect
(4) size of image is same as size of object
(5) Distance betn image & mirror / mirror & object is same.

(*) Real → Inverted ↓ (उल्टी)
(*) virtual → ERECT. ↑ (सीधी)

Focal length of plane mirror is ∞ infinite.

Image formation at concave mirror



Phy-2. Magnetic effect of current

Magnet → Is an object which attract pieces of iron. Steel etc toward itself.

eg:- Bar magnet 

Horseshoe magnet 

, Magnetic Needle. S—N

Ferromagnetic → Fe, Nikket (Ni), Cobalt (Co)
(lores magnet.)

PROPERTIES

1. Magnet always exist as dipole

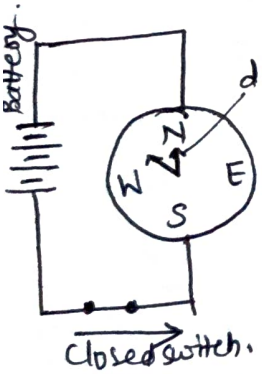
2. when magnet is freely suspended it always aligns to North-South direction.

[Earth core have molten ions (charged particles) in molten state whenever charge particle moves magnetic field is generated] Hence earth have its own magnetic field.

3. Like poles always repen & opposite poles always attracts.
4. Two poles can never be seperated. Magnet never have monopole.

Oersted's Experiment





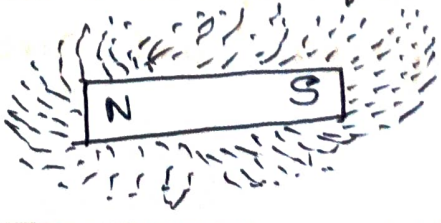
1. current ↑ deflection ↑
2. Change in current direct ⇒ change in deflection direction.

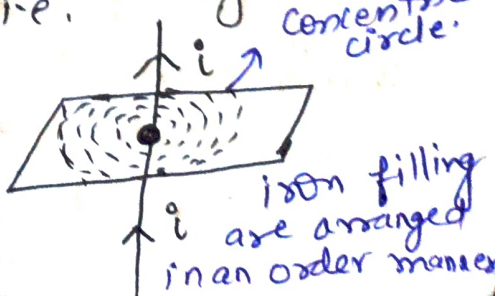
$$\theta \propto i$$

Conclusion → Electricity & Magnetism are inter related.

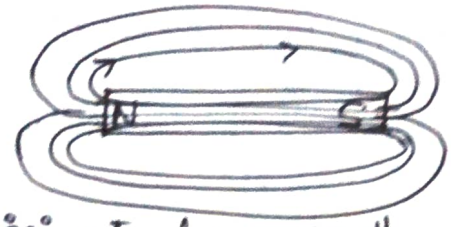
Magnetic field lines

1. Magnet always develop certain area around it i.e. magnetic field. where it effect can be felt





(2) Magnetic field is studies by drawing imaginary lines called magnetic lines of forces.



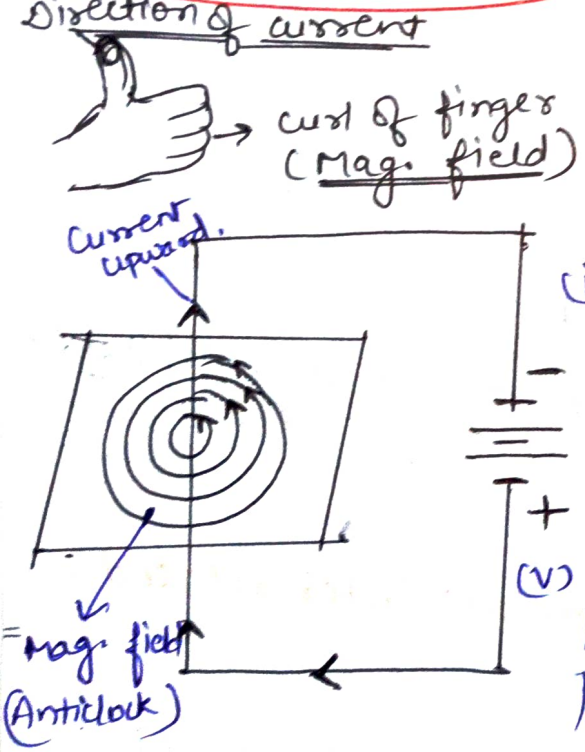
always toward south from North.

★ CHARCTERSTICS

(3) (i) Always originate from North & terminate at south.
(ii) Field lines are always closed curves.
(iii) fild lines are crowded Near poles. This shows strength of pole magnet.
(iv) Two fild line never cross each other as the two direction at a single point of intersection can not occur.

MAXWELL'S HAND RULE OR COBRA RULE

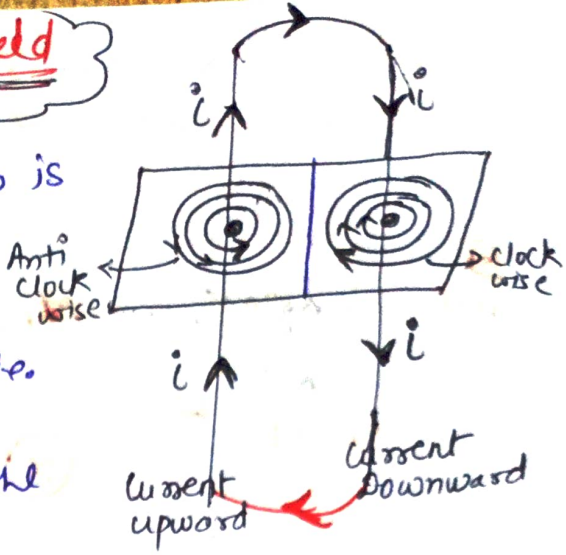
Used to Know the Direction of fild.



(i) M. lines are concentric circle.
(ii) Direction of magnet lines reverse as we reverse the direction of current
(iii) When current flow upward = Direction of M. Lines Anticlockwise.
(iv) When current flow downward = Direct of M. lines clockwise.
(v) M. Field Procedce is directly proportionate to current & inversly proportionate to distance from conductor.

You grasp the conductor in your right hand such that thumb point in direction of current Then the direction in which your finger curl gives us direction of M. field.

Circular loop produced by M. field



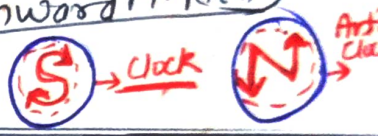
(1) M. fild produced around circular loop is also circular. As we more away from loop. Concentric circle Become Big.

(2) At the centre, the M. Lines are parallel ie. cancel eath other.

(3) The part where the M. Line entering the coil facing us that is considered as South pole & other is North Pole.

(4) current flowing clockwise → South Pole | M. Field → Inward
current flowing Anticlockwise → North Pole | M. Fild → Outward

[from North → M. Field outward & South → Inward M. field)

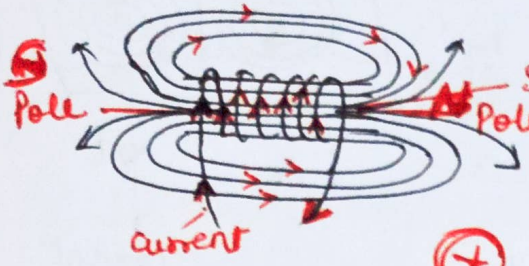


CHARACTERISTICS OF Circular loop

- The magnetic lines are circular at the point from where current enters or leave the coil.
- Within the space enclosed by coil the field lines are in same direction.
- Near the center of the coil the magnetic lines are almost parallel to each other.
- At the centre of the coil the plane of magnetic fild lines are at right angle to the plane of circular coil.
- Magnetic field produced is directly proportional to current & inversly proportional to distance from conductor.

SOLENOID

Long coil containg large no. of turns of copper wire.



- When solenoid is connected to a Battery & current is passed through it. It produce M. field which is similar to Mag. field produced around bar magnet.
- One side of solenoid act as **N** and other side act as **S** Pole.

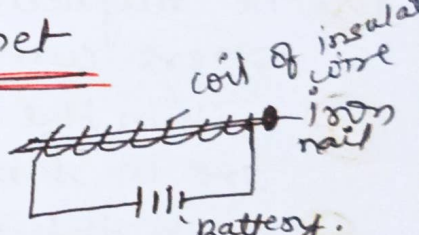
* [Electric form of Bar Magnet] → Solenoid

Solenoid behave same as Bar magnet.

Strength of magnetic field can be changed by :-

- Increasing amount of current
- Increase no. of turns of copper wire
- Decrease gap between turns of copper wire
- nature of medium inside the core of solenoid.

Factor affecting strength of electromagnet



- No. of turns in coil
- Current flowing in coil
- Length of gap between poles.

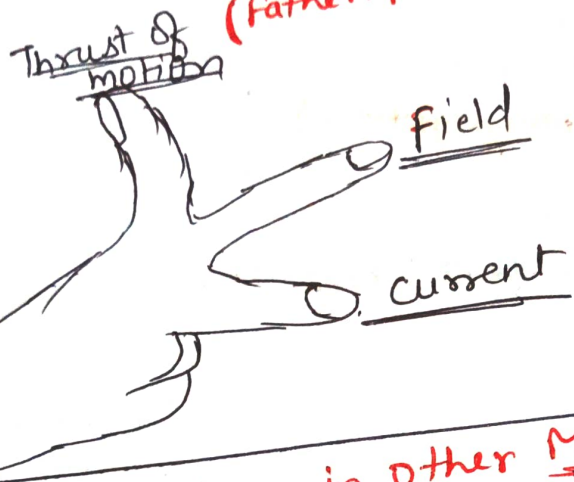
~~Steel is not used for making electromagnet as it does not loose its magnetism even if current is switched off.~~

* Permanent mag → Hard iron, Nicket, Cobalt.
* Electromagnet → Soft iron, → Used in toys.

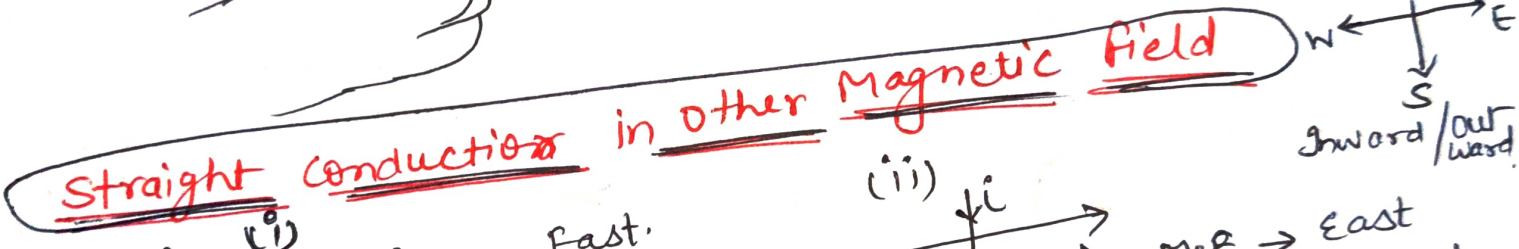
Permanent	Electromagnet
• It is permanent magnet.	• It is temporary loose magnet when current remove.
• Strength is fixed.	• Strength can be changed.
• Produce weak mag. force	• Produce strong magnetic force.
• Cannot be immediatly Demagnetise	• Can be demagnetise immediatly
• get damage with rough use	• not Damage with rough use.

Fleming's Left Hand Rule

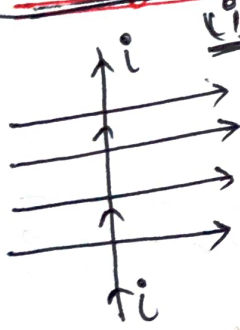
Stretch your fore finger, center finger & thumb mutually perpendicular to each other such that fore finger point in the direction of m. field, center finger indicated ~~of~~ current & thumb give us direction of force of motion.



Straight conductor in other Magnetic Field

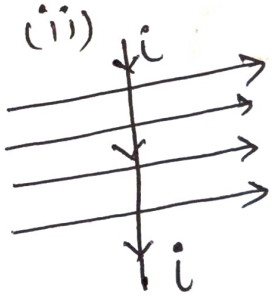


(i)



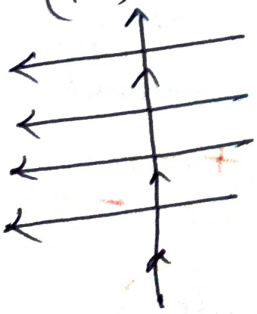
M.f – East.
Current – North
Force – Inward

(ii)



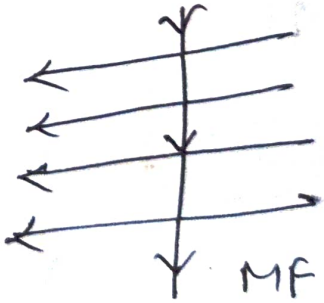
M.F → East
current → South
Force → outward.

(iii)



Mf – west
current – North.
force – outward.

(iv)

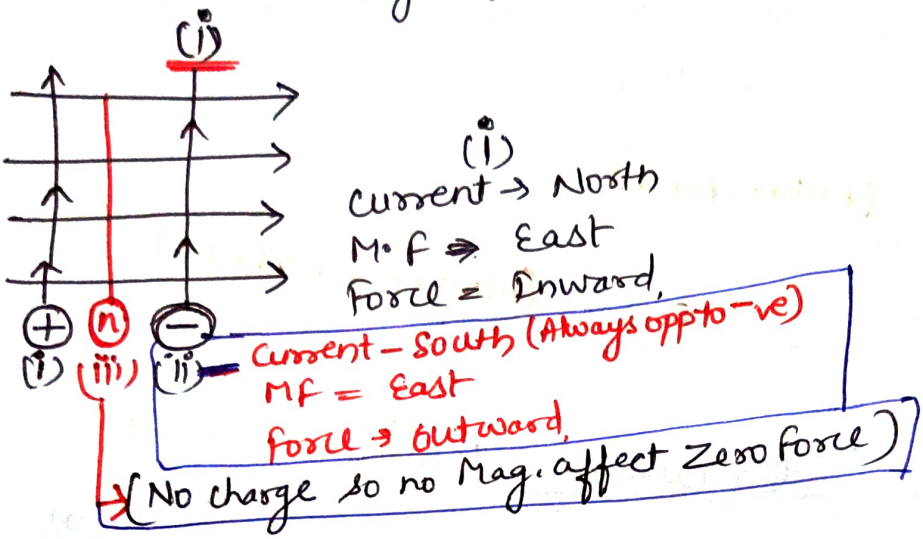


Mf – West
current – south.
force – Inward.

* Charge projected In other Magnetic field

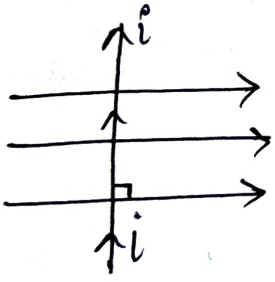
(1) + Proton
(2) − Electron
(3) 0 Neutron.
(4) Alpha (α^{++})
(5) Beta (β^-)
(6) Gamma (γ^0)
(7) Cat +
(8) An −
(9) Atom

Current is + entity. (I) +ve particle is current



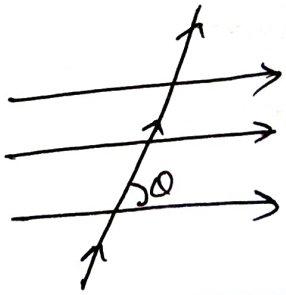
* changing orientation of straight conductor,

wire at 90° Right ⊾



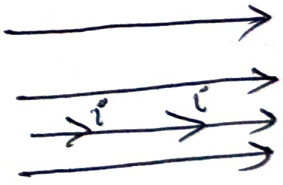
F = Max.

Wire at acute ∠ >=0 <90°



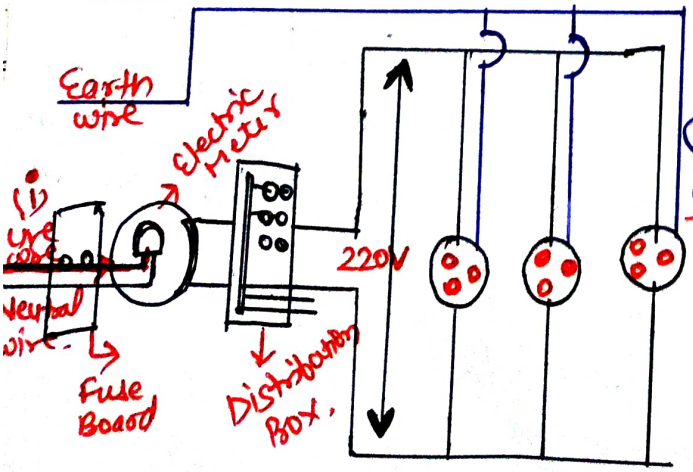
Force >0 <Max.

wire at 0° / 180°



Force = zero

Domestic Electric Circuit



Green → Earth wire
Red → Live wire (+ve)
Black → Neutral wire. (−ve)

2 Type Circuit

15 A
(Higher Power)
Fridge, AC Gyser

5 A
(Lower Power)
TV, Bulb, fan.

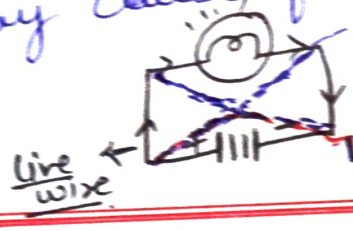
Overloading

Of an electric circuit mean when current flows in a circuit become more than the capacity of component in the circuit to resist the current. When too much current passes an electric overload occurs through electric wires, which may cause fire to break.

Short-Circuiting

A short circuit is an electrical circuit that allows a current to travel along an unintended path with very low electrical resistance. This result in an excessive current flowing through the circuit, which may cause fire to break.

(unintended / undesired)



overloading current is infinite.

* (e) − to +
* Current + to −

Electricity Physics - 10.

(STUDY OF CHARGE is Electricity.)

Static

Study of charge at rest

eg:- Glass rod rubbed on silk cloth.

Glass rod +
Silk − } static charge.

Current Electricity

Study of charge in motion.

(e) − to + flow.

Conductors are material which allows the current to pass through them.

eg:- Gold, Iron, Copper.

Insulator are materials which do not allow the current to pass through them.

eg:- Plastic, wood, etc.

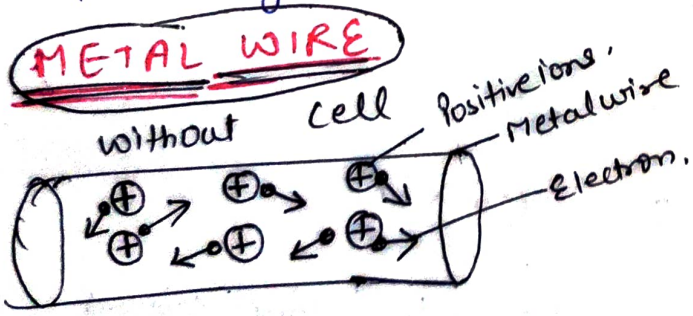
Is water conductor or insulator ?

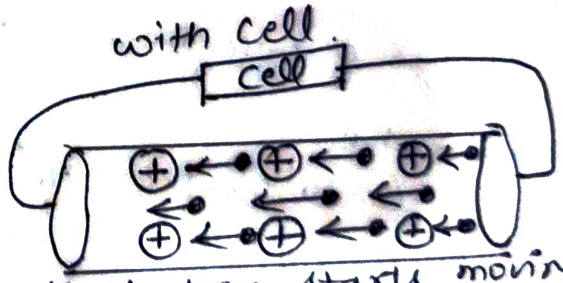
Pure water is insulator.
Impure water is conductor. } water can be insulator or conductor.

Why iron scale not react static charge ?

Because iron is good conductor so its outer layer loose the charges. They must posses free charge carrier.

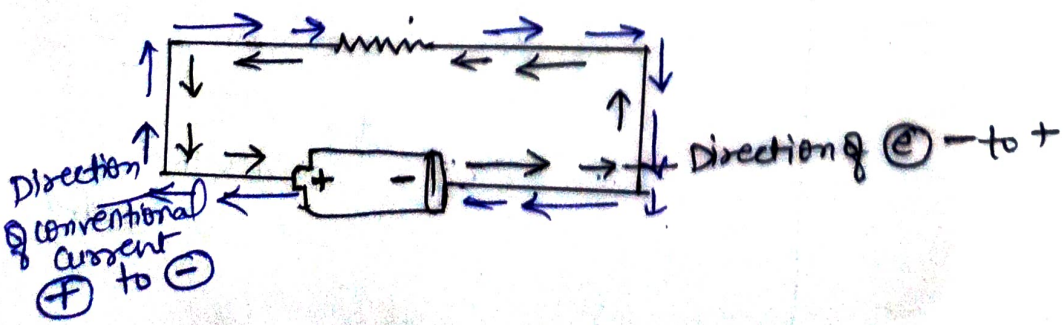
METAL WIRE





(with cell electron starts moving in one direction cause electric charge)

Direction of conventional current



Electric charge

+ve

−ve

Like charge Repel ⊕ ⊕ → ⊕ ⊕

Unlike charge attract ⊕ ⊖ ← ⊖

Electron carry Negative charge (-1.6×10^{-19})

Positive charge $(+1.6 \times 10^{-19})$

Symbol = Q SI Unit = C Coulomb

Electric current

$I = \frac{Q}{t}$ → Q → electric charge, t → time

SI-Unit- Ampere. (I → Electric current)

1 Ambere when 1 coulomb of charge flows in circuit for 1 sec the current is said to be 1 ampere.

1 Coulomb when 1 Ampere of current flows in circuit for 1 sec. the amount of charge circulated is of 1 coulomb.

Q A current of 150 mA flows through a circuit for 2 min. Find the charge that flows through a circuit.

Given $I = A$

$I = .15\ A$.

$I = \frac{Q}{t}$

$mA = 10^{-3} A$.

$t = 2 \text{ min.} = 2 \times 60 = 120 \text{ sec.}$

$.15 = \frac{Q}{120} \Rightarrow Q = .150 \times 120$

$= 18$ coulomb.

Q (n) No. of electron $= 6 \times 10^{16}$.

(t) Time $= 20$ sec.

(e) charge of 1 electron $= -1.6 \times 10^{-19}$.

$Q = ne$

$= 6 \times 10^{16} \times -1.6 \times 10^{+19}$.

9.6×10^{-3}

$I = \frac{Q}{t} =$

$I = \frac{9.6 \times 10^{-3}}{20}$

4.8×10^{-4}. ~~Ampere~~ coulomb

Q $Q = 500C$

$t = 6 \text{ min } 40 \text{ sec} = 400 \text{ sec.}$

$I = \frac{Q}{t}$

$= \frac{500}{400} = 1.25\ A$

Q $Q = 800C$

$I = 8.0\ mA = 8.0 \times 10^{-3} A$

$T = ?$

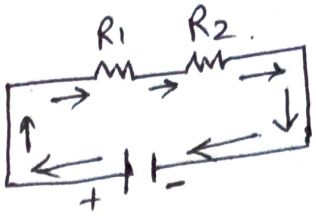
$I = \frac{Q}{T}$ $8.0 \times 10^{-3} = \frac{800}{t}$

$t = \frac{800}{8.0 \times 10^{-3}}$

$= 10^{-5}$ sec.

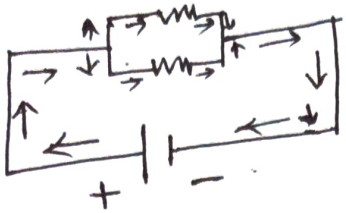
Electric Current

Series connection



I (current) Remain same.

Parallel



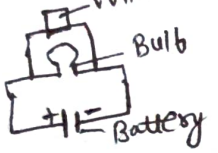
I = Divide = $I_1 + I_2$.

Ammeter

(Used to find current value)



Always added in series connection. with the conductor through which current is flowing & is to be measured.



POTENTIAL ENERGY

→ eg:- water tank always on top.

Measuring Device = Voltmeter → voltmeter always connected in Parallel connection.

$$\text{Electric Potential (V)} = \frac{\text{Work done (W)}}{\text{charge (Q)}}$$

SI unit of Potential is volt. (Named after Alessandro Volta)

Potential of a body is said to be one volt if one joule of work is done in charging it with one coulomb of positive charge.

$$\therefore 1V = \frac{1J}{1C} = 1JC^{-1}$$

Electric Potential is scalar Quantity.

Q An electric bulb draws a current of .2A when the voltage is 220 volt. Cal. amount of elec charge. in 1 hrs.

Current (I) = .2A

Voltage (V) = 220 volts

(Q) electric charge = ?

Time = 1hrs = 60×60 = 3600 secs.

$Q = I \times t = \frac{2}{10} \times 3600 = 720$ coulomb.

Q. How much work is done in moving a charge of 2C across point have potential difference 12V?

Potential diff. (V) = 12 V,

~~p va = degree~~ Q = 2 C

W = ?

$$V = \frac{W}{Q} = 12 = \frac{W}{2} = W = 24 \text{ Joule}.$$

Q How much energy is given to each coulomb of charge passing through a 6V battery?

charge moved (Q) = 1C

Potential (V) = 6V

W = ?

$V = \frac{W}{Q} \Rightarrow 6 = \frac{W}{Q} \Rightarrow 6 = \frac{W}{1} \Rightarrow W = 6$ Joule

* **Galvanometer** used to measure smaller currents.
  - It can measure sensitive currents.
  - It can also show direction of flowing current.



symbol.

OHM'S LAW (George Simon Ohm, 1827)

Relation Btn Current Passing & Potential diff.

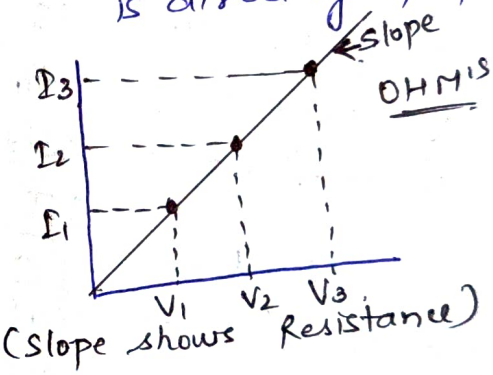
(current depends on potential. current increases as per voltage)

$V \propto I$

$V\uparrow - I\uparrow$ → so long as the circuit remains the same, the Potential diffence is directly proposittional to the current.

$V = IR$

(where R = Resistance)



(slope shows Resistance)

$R = \frac{V}{I}$, $I = \frac{V}{R}$, $V = IR$

Q The potential diff. betn two terminals of an electric heater is 75V when its draws a current of 5A from the source. what current will the heater draw, if the potential diff is increased to 150 V.?

$V = \frac{I}{R}$

$V_1 = 75$ V, $I_1 = 5$A, $V_2 = 120$ V, $I_2 = ?$

$R = \frac{V_1}{I_1} = \frac{75}{5} = 15\ \Omega$

$I_2 = \frac{V_2}{R} = \frac{150\ V}{15\Omega} = 10$ A.

The current flowing in heater = 8 A.

Q The potential difference between the terminals of an electric heater is 60V when it draws a current of 4A from the source. what current will heater draw if the potential difference is increased to 120V?

$V_1 = 60V, \quad I_1 = 4A \quad V_2 = 120, \quad I_2 = ?$

$$R = \frac{V_1}{I_1} = \frac{60}{4} = 15\,\Omega$$

$$\text{Current } I_2 = \frac{V_2}{R} = \frac{120}{15} = 8\,A.$$

the current flowing in heater will be 8A.

Resistance (R) It is the property of conductor to resist the flow of charges through it. SI unit is Ohm (Ω) Measuring device = Ohmmeter.

symbol



Resistance of conductor depends on:

$R \propto L$ (1) length of conductor (Increase length Increase Resistance)

$R \propto \frac{1}{A}$ (2) Area of conductor (Thicker conductor lesser Resistance)

$R \propto \frac{L}{A}$ Hence (3) Material of conductor

↳ Copper is used to good conductor of electricity ↓ low resistivity.

$R \propto Temp.$ (4) Temperature (High temp High Resistance)

$L \uparrow \Rightarrow \updownarrow R$

$A \uparrow \Rightarrow \downarrow R$

$$R \propto \frac{L}{A}$$

ρ = Rho → Resistivity.

$$\rho = \frac{RA}{L} \quad \Omega - m^2 \quad \Omega - m$$

$\rho = \Omega m$ Unit

Resistance

(i) Ability of Conductor to oppose current

(ii) It depends on length & Area of Cross section

Resistivity

Ability of Material of Conductor to oppose current.

It does not depend on length & Area of cross section.

COMBINATION OF RESISTANCE

$V = IR$ ohm law

Resistance in series.

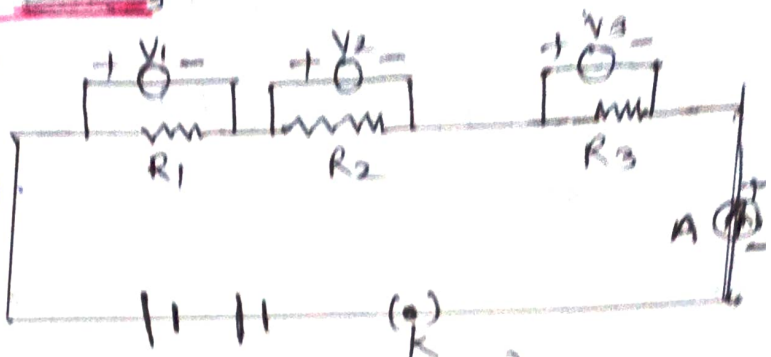
$V = V_1 + V_2 + V_3$

$IR_S = IR_1 + IR_2 + IR_3$

$I R_S = I(R_1 + R_2 + R_3)$

Series $R_S = R_1 + R_2 + R_3$.

(I is always same in series) (Voltage divide in series).



Resistance in Parallel $(V = IR)$ ohm law

$I = \frac{V}{R}$

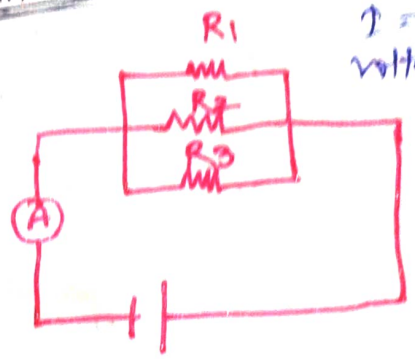
We know

$I = I_1 + I_2 + I_m$

$\frac{V}{R_p} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$

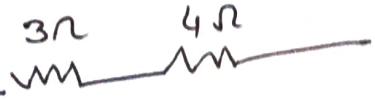
$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

Parallel $\frac{1}{R_{net}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \cdots$



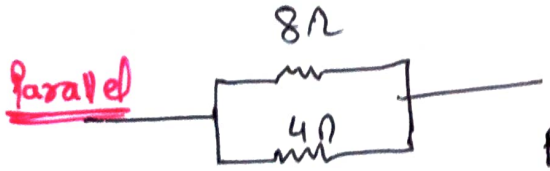
I = divide
voltage = same.

eg:- Series



$R_{net} = 3 + 4 = 7\Omega$

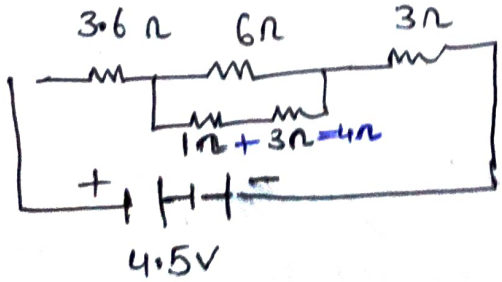
Parallel



$\frac{1}{R_{net}} = \frac{1}{8} + \frac{1}{4} = \frac{1+2}{8} = \frac{3}{8}\Omega$

$R_{net} = \frac{8}{3}\Omega$

Q1



Find current flowing

Ohms law

$V = IR$, $I = \frac{V}{R}$.

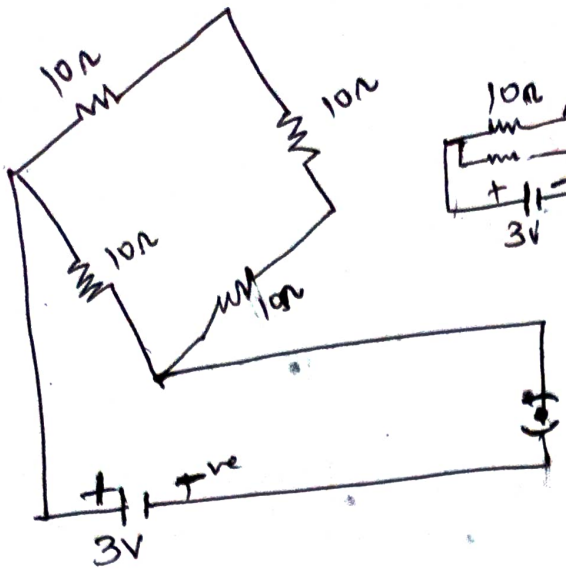
$\frac{1}{R_{net}} = \frac{1}{6} + \frac{1}{4} = \frac{2+3}{12} = \frac{5}{12} = \frac{12}{5} = 2.4\Omega$

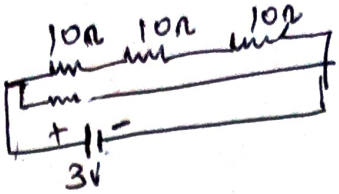
$R_{net} = 3.6 + 2.4 + 3$

$= 9\Omega$ Ans

$I = \frac{V}{R}$ $\quad I = \frac{4.5}{9.0} = .\frac{1}{2} = .5$ Ampere

Q





Series = 30Ω

$\frac{1}{30} + \frac{1}{10} = \frac{1+3}{30} = \frac{4}{30}$

$\frac{30}{4} \quad \frac{15}{2} = R = 7.5\Omega$

$I = \frac{V}{R} = \frac{3}{7.5} = \frac{30}{75} \quad \frac{6}{15}$ • 4Ampere

Heat Generated

Heating effect of Electric current.

$H = I^2RT$] V=IR, IR I T, VI I

$H = VIT$] I=V/R, V x V/R x t

$H = \frac{V^2t}{R}$

Joule Law of Heating

Heat generated in the conductor is directly proportional to

(i) square of current
(ii) Resistance
(iii) Time for which current is passed.

depends

$H = I^2Rt$ ★ so Heat → Resistance

(Resistance) $R = \rho \frac{L}{A}$

Electric bulb

→ Tungston (Current → Resistance → Heat → Glow)

(Tungston is used as its melting point is very high)

Why it is in spiral?

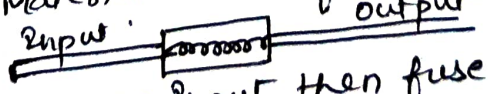
$H = I^2RT$

$H \propto R$ & $R = \rho \frac{L}{A}$

(More length More Resistance) To make wire length High for Resistance spiral shape is used.

Electric fuse

→ Material used in fuse have low Melting point.



If High voltage Input then fuse material melt & output interrupt.

Electric Iron

Power } Work done per unit time. SI unit W (watt).

$$V = \frac{W}{q} = W = \frac{Vq}{t}$$

$$P = \frac{W}{q}, \quad P = VI \qquad W = I^2Rt \qquad W = \frac{V^2}{R}.$$

* 1 Hp = 746 W
* 1 kp = 1000 W.

Q An electric refrigerator 500 W operates 6 hrs/day. what is cost of energy to operate it for 30 days at 4.5₹ per kW.

$P = 500\,W.$
$T = 180\,hrs.$

$$P = \frac{W}{t} = W = Pt$$

$= 500 \times 180 = 90,000$ Watt.

$W = 900$ Jule. $\times 4.5$

Cost = ~~480~~ 50 ₹ Ans

$= 405$ ₹ Ans

SYMBOLS

1 Connecting wire

2 A wire Joint

3 Cell

4 Battery

5 Ammeter

6 voltmeter

7 Galvanometer

8 Elect. bulb

9 Resistance

10 open switch

11 closed switch.