Answers to Physics

1. Ohm's Law:

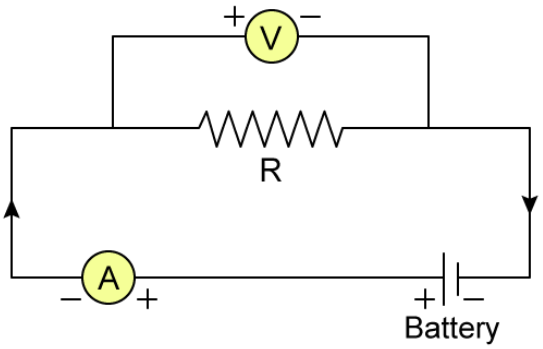
At constant temperature, current flowing through a conductor is directly proportional to the potential difference across its ends.

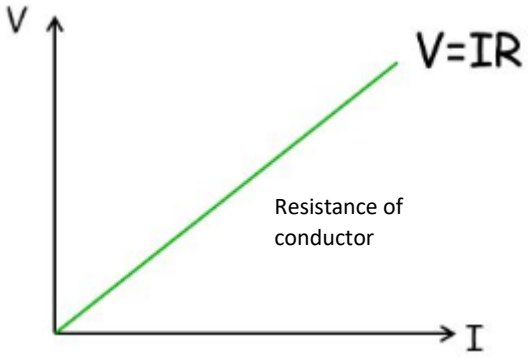
$I \alpha V$ (at constant temp)

$V \alpha I$

$V = R.I$

⇨ **R = V/I**





2. Potential Difference:

Potential difference in an electric circuit is defined as the amount of work done in moving unit charge from one place to another.

$$\text{Potential difference} = \frac{\text{Work Done}}{\text{Quantity of charge transferred}}$$

⇨ **V = W/Q** => SI Unit: 1 V = 1 J/1 C

Electric Current:

Flow of charge through a conductor per unit time is called electric current.

⇨ **I = Q/t** => SI Unit: 1 A = 1 C/1 s

Resistance:

The property of conductor which opposes the flow of charge through a conductor.

⇨ **R = V/I** => SI Unit: 1 Ω = 1 V/1 A

Electric Power:

Electrical work done per unit time is called electric power.

⇨ **P = W/t** => SI Unit: 1 Watt = 1 Joule/ 1 second

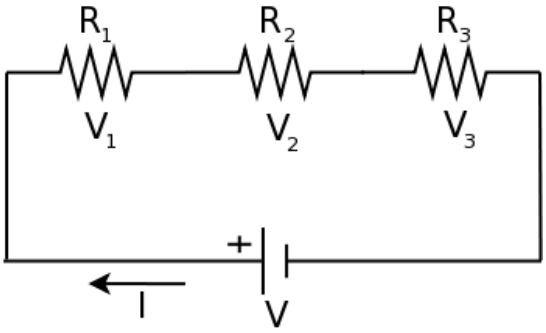
Resistivity:

It is the resistance of a conductor of this material of unit length and unit cross-sectional area.

⇨ **$\rho = R * A / l$** => SI Unit: Ω m

3. Derivation of Combination of Resistances:

Series:



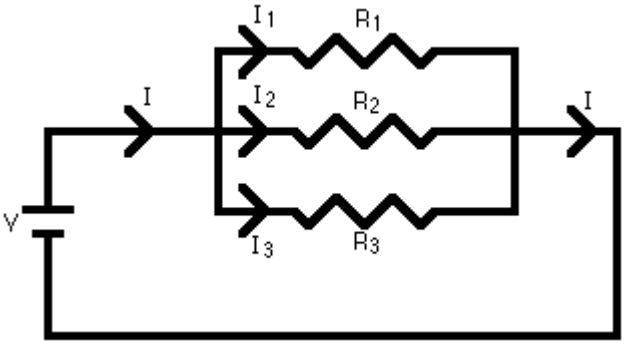
$V = V_1 + V_2 + V_3$ and current remains same

=> But, $V = I*R$, $V_1 = I*R_1$, $V_2 = I*R_2$, $V_3 = I*R_3$

=> $I*R = I*R_1 + I*R_2 + I*R_3$ => $I*R = I*(R_1 + R_2 + R_3)$

⇨ **$R = R_1 + R_2 + R_3$**

Parallel:



Potential difference across each resistor remains the same.

$I = I_1 + I_2 + I_3$

=> $V/R = V/R_1 + V/R_2 + V/R_3$

=> $V/R = V*(1/R_1 + 1/R_2 + 1/R_3)$

=> **$1/R = 1/R_1 + 1/R_2 + 1/R_3$**

Advantages of Parallel Distribution over Series:

- Each appliance can work independently.
- Each appliance gets the voltage of 220 V.
- If one appliance gets damaged, then working of others is not affected.
- Each appliance draws current according to their required value.

4. Joule's Law of Heating:

If current passes through a high resistance conductor, after some time the wire becomes hot. This is called Joule's law of heating.

⇨ **$H = I^2*R*t$**

Application:

- It is used in heating appliances.
- It is used in electric bulb.

5. Continuous flow of current is maintained by connecting terminals of a conductor with battery.

6. Laws of Refraction of Light:

i. The incident ray, refracted ray and the normal all lie in the same plane at the point of incidence.

ii. The ratio of sine of angle of incidence to the sine of angle of refraction is always constant for a given pair of media and this constant is called refractive index.

⇨ $n = \sin i / \sin r$

7. Practice of ray diagram from NCERT book

8. Difference between real image and virtual image:

REAL IMAGE	VIRTUAL IMAGE
i. When two or more reflected or refracted rays actually meet at a point	When two or more reflected or refracted rays do not actually meet but appear to meet at a point
ii. Can be obtained on the screen	Cannot be obtained on the screen
iii. Inverted	Erect

9. Power of Lens:

The degree of convergence or divergence of light rays falling on a lens.

OR

Power of lens is the reciprocal to the focal length of lens in meter.

⇨ $P = 1/f\ (m)$ => SI Unit is Dioptre

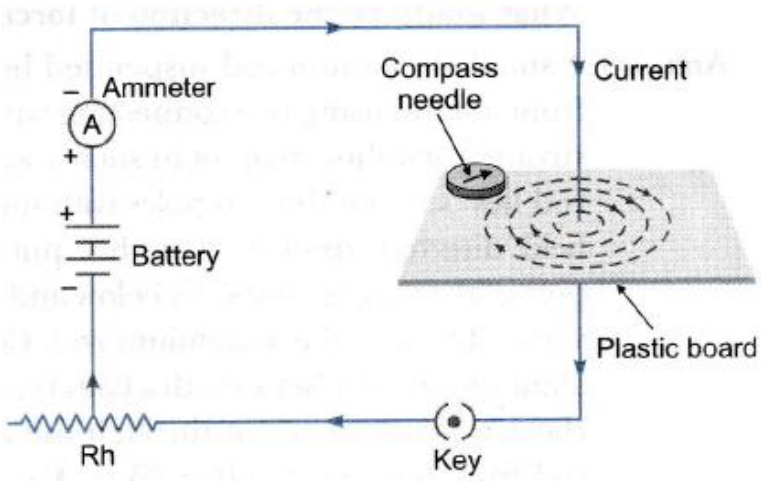
10. Uses of Concave Mirror:

- It is used in solar heating devices to concentrate solar energy at one point.
- It is used in head light of vehicle to get powerful parallel beam of light.
- It is used by dentist to see magnified image of teeth.
- It is used by ENT doctor.

Uses of Convex Mirror:

- It is used as a rear-view mirror due to following reasons:
    - It always forms virtual and erect image.
    - Size of image is smaller, so it covers wide field of view.
- It is used in street light to diverge light over a larger area.

11. Shape of Magnetic Field produced by Straight Current Carrying Conductor:

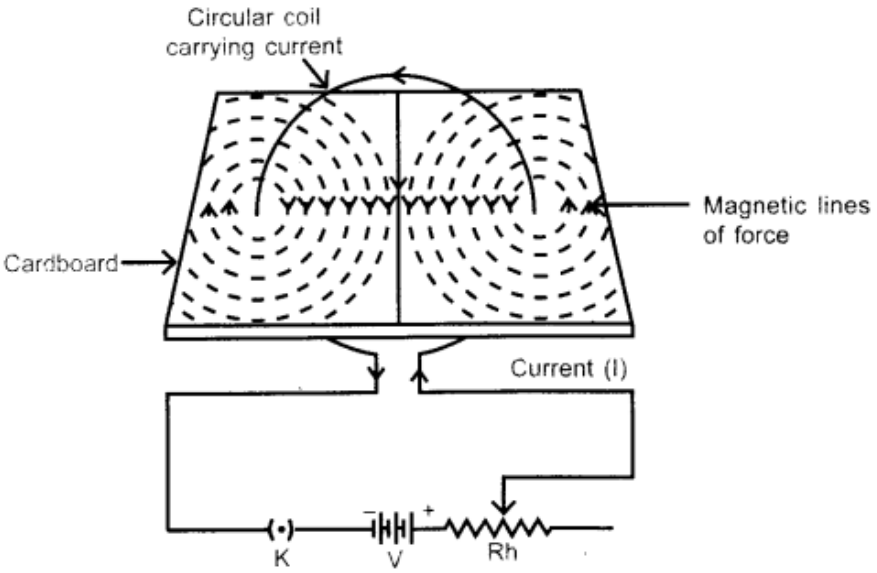


Factors:

B α I

B α 1/distance of point from wire

Shape of Magnetic Field produced by Current Carrying Circular Loop:



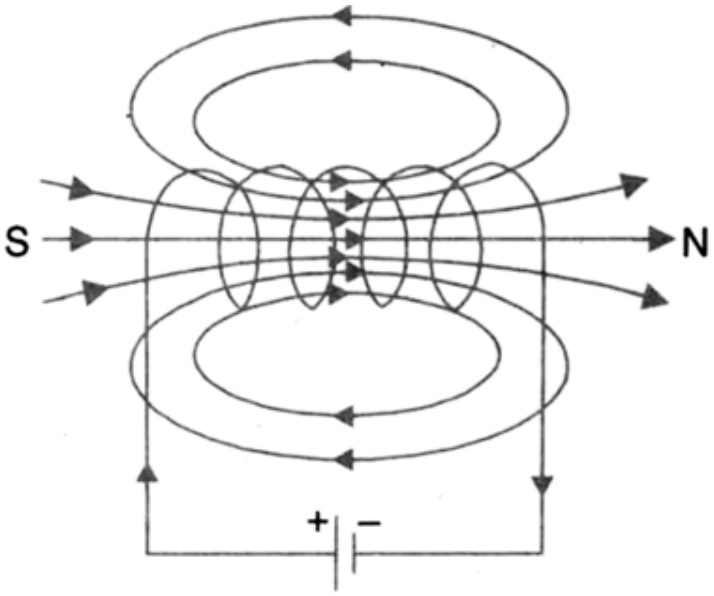
Factors:

B α I

B α n

B α 1/ r

Current Carrying Solenoid:



Factors:

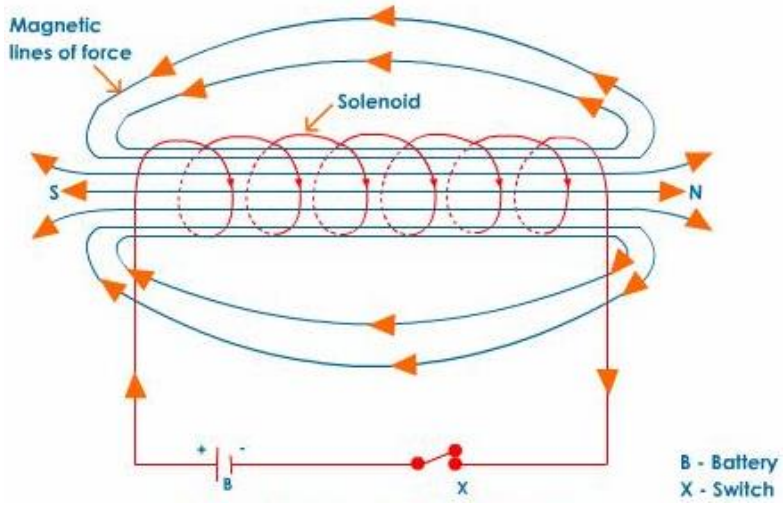
$B \alpha I$

$B \alpha n$

$B \alpha 1/l$

12. Electromagnet:

It works on the principle of magnetic effect of current. It behaves like temporary magnet. It consists of many close turns of copper wire wound on a soft iron rod.

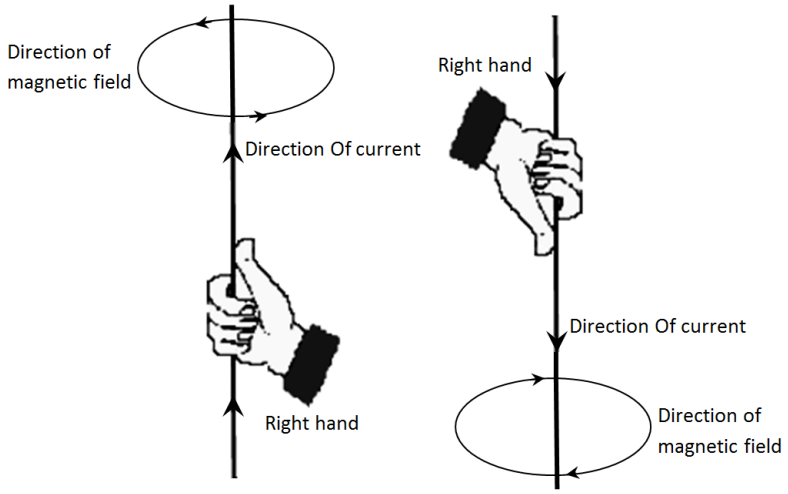


We never use steel rod for making an electromagnet because it becomes permanent magnet, does not loose magnetism, if current is switched off.

13. Maxwell's Right Hand Thumb Rule:

To determine the direction of magnetic field.

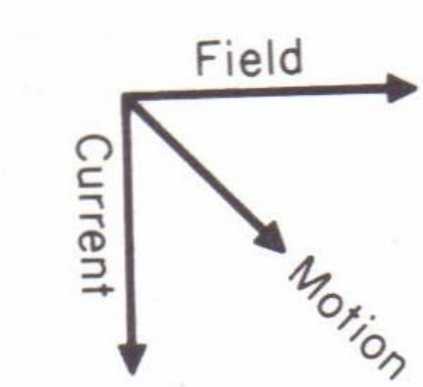
According to this rule, suppose you are holding a straight current carrying conductor in your right hand in such a way that thumb points the direction of current and fingers which encircle the conductor, indicates the direction of magnetic field.



Fleming's Left Hand Rule:

To determine the direction of force on a current carrying conductor placed in a magnetic field.

According to this rule, hold the thumb, the fore finger and the center finger of left hand in such a way that all these are at right angles to one another. Fore finger indicates the direction of magnetic field, center finger indicates the direction of current then in which direction, thumb points indicate the direction of force.



14. **Electric Motor: (Diagram from NCERT book)**

Principle: Based on electromagnetism, when electric current is passed through a rectangular coil which is placed between two poles of a permanent magnet, then force acts on the coil, due to this coil rotates continuously.

15. **Generator:**

Principle: Based on electromagnetic induction, when rectangular coil is placed between two poles and is rotated, then current is induced.

16. **Electric Fuse –** It is a safety device having short length thin wire made up of copper plated with tin, low melting point,it breaks circuit if current exceeds from safe value. It is always connected in <u>series.</u>
    Short circuiting -When plastic insulation of line wire and neutral wire get damaged,then both wire touch each other.The touching of line wire and neutral wire together is called short circuiting.
    The combination produces low resistance so current becomes high ,causes high temperature and electric fire is caused.
    Earthing – Many electric appliances of daily use have a metallic body. If the insulation of any these appliances melts and makes contact with the metallic case, then the person on touching receive an electric shock. To avoid such problem, the metal casing of the electric appliance is earthed. Since the earth doesn't offer any resistance, the current flows to the earth through the earth wire.

17. **Human Eye: (Diagram from NCERT)**

Working: Light rays coming from the object to be seen enter the eye through corner and fall on the eye lens through the pupil of the eye. The eye lens being convex, forms a real inverted image of the object on the retina. As soon as the image is formed on the retina, light sensitive cells get activated and generate electrical signals which are sent to the brain via optic nerve. The brain processes this information and we perceive objects as they are.

18. **Myopia (Short-sightedness): (Diagram from NCERT)**

In this defect, person is able to see nearby things but unable to see distant objects.

Causes:

- Eye-ball size increases
- Curvature of lens increases
- Eye lens becomes thick
- Focal length decreases and converging power increases

Correction: It is corrected by using concave lens.

Hypermetropia (Long-sightedness): (Diagram from NCERT)

In this defect, person is able to see distant objects but unable to see nearby things.

Causes:

- Eye-ball size decreases
- Eye lens becomes thin
- Focal length increases
- Low converging power

Correction: It is corrected by using convex lens.

Presbyopia: (Diagram from NCERT)

In this defect, an old person is unable to read and write comfortably without spectacles.

Causes:

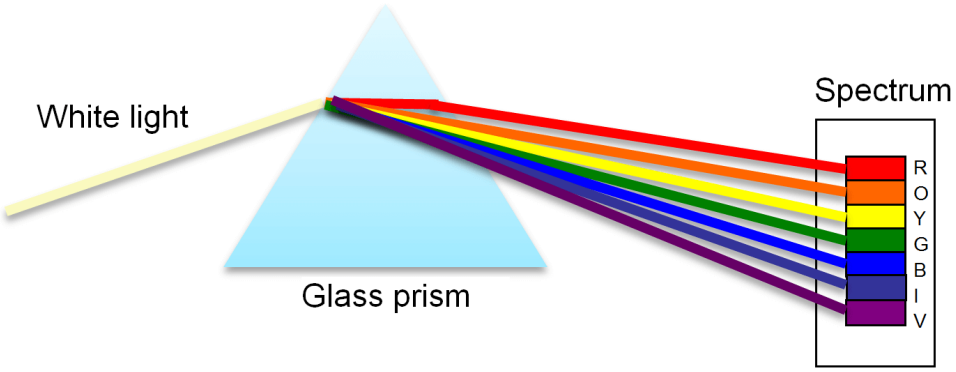
- Weakening of the working of ciliary muscles
- Diminishing the flexibility of eye lens

Correction: It is corrected by using bi-focal lens in which upper half is concave lens and lower half is convex lens.

19. **Ray diagram of refraction through glass slab and glass prism from NCERT**

20. **Dispersion of Light:**

Splitting of white light into its constituent colors when passes through a glass prism.



Causes of Dispersion of Light:

White light is a mixture of seven colors and all colors have their own wave length and deviate through different angles of refraction.

21. **Atmospheric Refraction:**

Bending of light on passing through earth's atmosphere.

i. Advance sunlight and delayed sunset due to atmospheric refraction. The sun appears to rise above horizon, two minutes before, it actually is above horizon.

ii. Stars twinkle but planets don't. This is also due to atmospheric refraction. The star light reaching our eyes increases and decreases continuously. When the star light reaching our eyes increases, the star looks bright and when the star light reaching our eyes decreases, star looks dim.

Planets appear bigger and can be considered to be made up of a number of point sources of light, changing atmosphere is unable to cause variation in this light.

iii. Stars seem higher than they actually are due to atmospheric refraction, because the light coming from stars bending every time towards normal. On producing the final refracted ray backwards, apparent star position is higher than actual star position.

iv. Clear sky appears blue in color due to Rayleigh elastic scattering of light. As the size of the scatterers is less than the wave length of incident light, so it is valid. Wave length of blue light is nearly half than the red light, so scattering of blue light will be 16 times greater than red, so sky appears blue in color.

v. Sun appears red at the time of sunrise and sunset. It is also based on scattering of light. At the time of sunrise and sunset, sun is near the horizon. The rays from the sun have to travel a much longer distance before reaching to the observer's eye so scattering pf blue color is more and goes beyond our vision. So, in our vision, least scattered light is left behind that's why sun appears red at the time of sunrise and sunset.

vi. Danger signals are red. In terms of Rayleigh elastic scattering, red light has longer wave length so it is least scattered by fog particles and can be seen from longer distance.