Delhi Public School, Jammu

Important questions

Revision Sheet

Class: 10th

Subject: Physics

Chapters Covered:

1. **Current Electricity**
2. **Magnetic effects of current**
3. **Sources of energy**
4. **Light- Reflection and Refraction**
5. **The Human eye and the colourful World.**

1. Current Electricity

Q1: State and prove Ohm's law.

Ans:

Ohm's law:-

It states that at constant temperature (or keeping physical conditions constant like temperature, pressure and heat), the current flowing through a conductor is directly proportional to the potential difference across the conductor.

Mathematically,

$I \propto V$ (when temperature is constant)

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

$\Longrightarrow V = IR$,

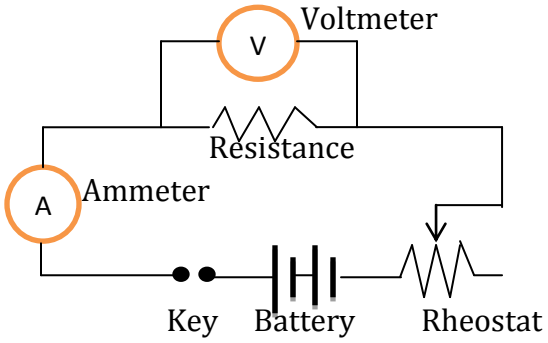
Where R is the resistance of the conductor.

Proof or verification:

To prove the Ohms law experimentally, first we make the following connections.

In the given circuit diagram, we connect Battery, key, ammeter, resistance, Rheostat in series and then connect voltmeter in parallel with resistance.

Circuit Diagram:

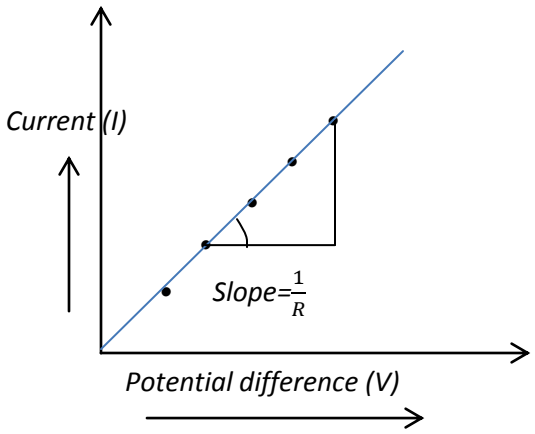


First we close the key so that current flows in the circuit and after that adjust the rheostat so that minimum current flows in the circuit.

After setting minimum current increase the value of current by adjusting Rheostat and measure current shown by ammeter and also measure corresponding value of potential difference from voltmeter. Similar way, take five to six values of current and potential difference and draw a graph between potential V (taken along x-axis) and current I (taken along y-axis).

Ammeter reading (A)	**Voltmeter reading(V)**	**Resistance $R=\frac{V}{I}$**

I_1	V_1	$R_1 = \frac{V_1}{I_1}$
I_2	V_2	$R_2 = \frac{V_2}{I_2}$
I_3	V_3	$R_3 = \frac{V_3}{I_3}$
I_4	V_4	$R_4 = \frac{V_4}{I_4}$
I_5	V_5	$R_5 = \frac{V_5}{I_5}$



We observed a straight line graph between potential V and current I.

This straight line graph shows that the ratio $\frac{V}{I}$ is constant i.e. $R_1 = R_2 = R_3 = R_4 = R_5 = R$, hence R is constant for a given conductor and this indicates that the current flowing through the resistor is directly proportional to the potential difference.

This is what Ohm's law and verified experimentally.

Also from this graph we can easily find the resistance from the slope, i.e.

Resistance $R = \frac{1}{\text{Slope of straight line}}$

When we plot graph between current I and voltage V then,

Resistance R = slope of straight line.

Conclusion of Ohms law is that if the potential difference across a conductor is doubled, then current also gets doubled.

Q2: Define (a) Charge (b) Current and (c) Potential difference. Also give their SI units.

Ans:

(a) Charge:- It is the property of the matter which gives rise to electric and magnetic forces.

Mathematically,

$Q = \pm ne = It$

It's SI unit is coulombs.

(b) Current:- It is defined as the quantity of electric charge flowing through a conductor in one second.

Mathematically,

$I(\text{current}) = \frac{Q(\text{charge})}{t(\text{time})}$

Its SI unit is ampere (A) and another unit is coulomb per second (Cs^{-1})

(c) Potential difference:- It is defined as the amount of work done in bringing one unit positive charge from one point to another point.

Mathematically,

$\Delta V = V_B - V_A = \frac{W_B}{q} - \frac{W_A}{q}$

Its SI unit is volt (V) and another unit is joule per coulomb.

Q3: Define resistance. Also give its SI unit, properties and factors.

Ans:

Resistance:- It is the property of a conductor by virtue of which it opposes the flow of electric current through it is called resistance.

Mathematically,

$R = \rho \frac{l}{A}$, where ρ the specific resistance or resistivity of the conductor is, l is the length of the conductor, A is the area of cross-section of the conductor.

Cause:- The basic cause of resistance is collision between electrons and with positive ions present in the metallic conductor by stop and go process.

Properties of resistance:

☛it is a scalar physical quantity and acts as passive component.

☛its SI unit is ohm and denoted by the Greek letter Ω (omega)

Factors affecting resistance:-

Resistance of given conductor depends upon the following factors:

(a) $R \propto l$i.e. resistance is directly proportional to the length of the conductor, it means greater the length, greater the resistance offered by the conductor.

(b) $R \propto \frac{1}{A}$i.e. resistance is inversely proportional to the area of cross section of the conductor, it means greater the area of cross-section, smaller the resistance offered by the conductor. Due to this reason thin wire has higher resistance while thick wires have lower resistance.

(c) $R \propto T$i.e. resistance is directly proportional to the rise in temperature, it means that greater the temperature, greater will be the resistance of the conductor, but the resistance of alloys changes very little with rise in temperature and for semiconductors resistance decreases with rise in temperature.

(d) Resistance depends upon the nature of the material. For e.g. alloys like Nichrome, constantan have higher resistance so used for making heating elements while metals like copper, silver, aluminium have low value of resistance.

Q4: Define electric energy and electric power and their SI units. Also give relation between them.

Ans:-

Electric energy:- It is defined as the capacity of the flowing electricity to do work is called electric energy.

Mathematically,

$E=W=VIt=I^2Rt$

Its SI unit is joules or J and other unit is Watt-second (W-s)

So 1J=1Ws

1J:- One joule is the amount of energy consumed or dissipated when an electric appliance of one watt rating is used for one second.

Its commercial unit is kilo-watt hour

1kWh:- One kilowatt hour is the amount of energy consumed or dissipated when an electric appliance of one kilowatt rating is used for one hour.

1 unit=1kWh $= 3.6 \times 10^6$J

Electric power:- It is defined as the electric work done per second.

Mathematically,

$P=W/t=VI=I^2R = \frac{V^2}{R}$

Its SI unit is watt (W) and other unit is Js^{-1}.

1W:- Power consumed is said to be one watt when one joule of work is to be done for one second.

Relation between electric energy and electric power:-

Electric energy=electric power× time

Or E=P× t

Or $P = \frac{E}{t}$

Q5: Explain the heating effect of current and also give its applications.

Ans: As we know that the conductors in the circuit offer some resistance so we use joules heating effect to calculate the amount of work done in carrying charge q through a potential difference V.

Mathematically,

W=V(It)

And this is the energy spent in overcoming the resistance offered by the conductor and whole of this energy is converted into heat.

Therefore,

Heat produced $H = W = VIt$ joules

But acc to Ohms law, $V = IR$

$\Longrightarrow H = (IR)It = I^2Rt$joules

Applications of heating effects of current:-

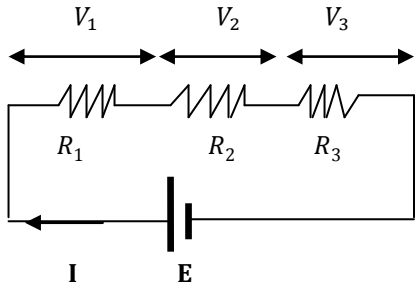
(1) It is due to heating effect we use heating coils or heating elements made of high resistance wires such as nichrome in various electrical appliances like water heaters, electric iron, geysers and toasters etc.
(2) It is due to heating effect we use bulbs for lightening using tungsten as heating filament.
(3) It is due to heating effect we use fuse wires made of alloy of tin and lead to prevent the damage of costlier electric appliances.

Q6: Calculate equivalent resistance in (a) series and (b) parallel combination.

Ans:

Resistance in series: -

Two or more resistances are said to be in series if same current passes through them, when some potential difference is applied across the combination and we proceed along same path.



Since by Ohms law,

V = IR

and E= $V_1 + V_2 + V_3$ ----------1 , where E=IR_S

⇨$V_1 = IR_1, V_2 = IR_2$ and$V_3 = IR_3$

now substituting in 1st we have

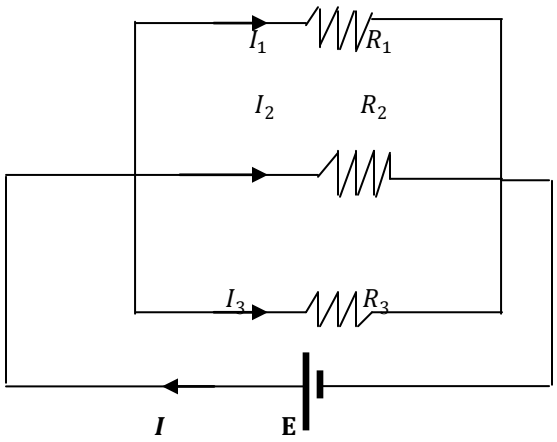
$IR_s = IR_1 + IR_2 + IR_3$

⇨$I(R_S) = I(R_1 + R_2 + R_3)$

⇨$R_S = (R_1 + R_2 + R_3)$

Resistance in parallel combination: -

Two or more resistances are said to be in parallel, if the potential difference across each resistance is same but different currents and we proceed along different paths.



Since by Ohms law V = IR and

$I = I_1 + I_2 + I_3$ ----------1 , where $I = \frac{E}{R_P}$ and

$I_1 = \frac{E}{R_1}$,$I_2 = \frac{E}{R_2}$and $I_3 = \frac{E}{R_3}$, now substituting all in equation 1st, we have

$\frac{E}{R_p} = \frac{E}{R_1} + \frac{E}{R_2} + \frac{E}{R_3} = E\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right)$

$\Rightarrow \frac{1}{R_p} = \left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right)$

2. Magnetic effects of current

Q1: Define magnetic field and give its properties.

Ans:

Magnetic field:

It is a region or space around a magnet where its influence can be felt is called magnetic field.

Properties of magnetic field lines:

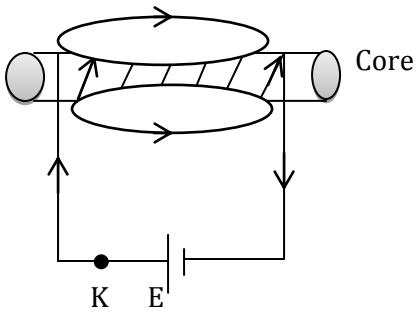
1. Magnetic field lines starts at the North Pole and end at the South Pole outside the magnet and south to North Pole inside the magnet.
2. These field lines are always in the form of closed and continuous curves.
3. Magnetic field lines do not intersect each other, because there cannot be two directions of the magnetic field at any one point.
4. The degree of closeness of the field lines indicates the strength of field.
5. Magnetic field lines are closest near the poles of a magnet and become wider as we move away from the pole.
6. The tangent drawn at any point gives the direction of magnetic field.

Q2: Define solenoid. Explain the formation of magnetic field lines due to solenoid.

Ans:

Solenoid: -

It is a long straight cylindrical coil having large number of close circular turns of insulated copper wire wrapped over an insulated core material.



Anticlockwise Clockwise

In case of solenoid when key is closed, then current 'I' flows which produces magnetic field lines similar that of a bar magnet.

When current enters from left end it produces North Pole at left side and when current leaves the right end it produces South Pole at right side.

The magnetic field lines inside the solenoid are in the form of parallel straight lines.

The polarity of ends of current carrying solenoid depends upon the direction of current flowing and is given by clock rule.

For anticlockwise direction of current, North Pole develops and for clockwise direction of current, South Pole develops when seen from front side.

The strength of the magnetic field lines depends upon;

(a) Strength of current 'I' flowing through it.

(b) Number of turns 'n' of the solenoid.

(c) Nature of core material.

Q3: Define electromagnetic induction and Flemings right hand rule.

Ans: Electromagetic induction: It is the phenomenon of producing electric current in a conductor by moving it perpendicular to a magnetic field or vice-versa.

The current produced by this process is called **induced current.**

Fleming's Right hand rule: It states that if we stretch the forefinger, the central finger and the thumb of the right hand such that they are mutually perpendicular to each other, then fore-finger shows the direction of the magnetic field, thumb shows the direction of motion of conductor and the central finger gives the direction of the induced current.

3. Sources of energy

Q1: Define source of energy. Give the characteristics of a good fuel.

Ans:- Any substance which can produce adequate amount of useful energy at a steady rate over a long period of time is called a source of energy.

Characteristics of good fuel are:

1. It should be easily available and economical.
2. It should have high calorific value.
3. It should leave no residue.
4. It should be easily stored and transported.
5. It should have moderate ignition temperature.

Q2: What are conventional and non-conventional sources of energy? Give two examples for each.

Ans: Conventional source of energy are those which had been used for long due to their easy availability.

For example: fossil fuels, hydropower, biogas etc.
Non-conventional sources of energy are those which are not easily available and needs modern methods to harness.
For example: geothermal energy, OTE (ocean thermal energy), nuclear energy etc.
Q3: What is hydro energy and wind energy. Give the limitations of harnessing hydro energy and wind energy.
Ans: Hydro energy is the energy produced due to kinetic energy of flowing water or the potential energy of water stored at height.
Limitations:

1. The fast flowing Water Rivers is not found everywhere.
2. It cannot be produced everywhere.

Wind energy is the energy produced due to kinetic energy of flowing air or wind.
Limitations:

1. It needs wind velocity of 16km/h or greater.
2. It is harnessed near coastal areas.

Q4: What is OTE? How it is harnessed?
Ans:- OTE: Ocean thermal energy.
It is harnessed when the temperature difference between land and different layers of ocean is 20°C or more upto 1km distance.
Q5: Give difference between nuclear fission and fusion reaction.
Ans: The differences are:

Nuclear fission	Nuclear fusion
In this heavy nucleus breaks into two or more lighter nuclei.	In this lighter nuclei combines to form a heavier nucleus.
It can take place at all temperatures.	It takes at very high temperatures of $10^7 K$
Its products are generally radioactive	Its products are generally not radioactive.

4.Light-Reflection and Refraction of light.

Q1: What are the uses of concave and convex mirror's?
Ans: **Uses of concave mirror:**

1. As reflector, concave mirrors are used as reflectors in the head lights of cars, search light etc.
2. In hospitals and clinics, concave mirrors are used by dentists as dentists mirror to focus light on the tooth to be examined.
3. As shaving mirrors and makeup mirror; concave mirrors are used to see the enlarged and erect images.
4. As solar heating devices, concave parabolic mirrors are used as radiation collector.

Uses of convex mirror:

1. Convex mirrors are used as drivers mirror to cover large view behind the vehicle.
2. Convex mirrors are used as reflectors for street light.
3. Convex mirrors are used in shopping malls, shops and in stores to form large rear view of objects.
4. Convex mirrors are used as vigilance mirrors at airports and at custom departments.

Q2: Define refraction of light. Also give laws of refraction.
Ans: *It is defined as the bending of a ray of light as it passes from one medium to another medium.*

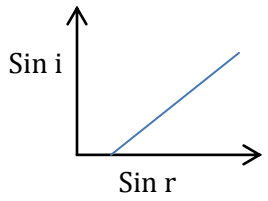
Laws of refraction:

There are two laws of refraction:
Law 1st: It states that the ratio of sine of angle of incidence to the sine of angle of refraction for a particular pair of media is constant.
This law is also called **Snell's law.**

The constant is called refractive index of the material or media through which light refracts.
Mathematically,

$$\frac{sin\angle i}{sin\angle r} = constant = n = \mu$$

Its value depends upon the temperature and the wavelength of light used.
This law is also called Snell's law after the name of its discoverer **Willebrord Snell.**



When we draw a graph between the different sine values of angle of incidence and their corresponding sine values of angle of refraction, we obtain a straight line.
This shows that $\sin i \propto \sin r$
or $\frac{sin\angle i}{sin\angle r} = constant = n = \mu$
where n or μ is a constant, called refractive index.
Law 2nd: It states that the incident ray, the refracted ray and the normal all lies in the same plane.
Q3: Define refractive index. What are the factors affecting refractive index?
Ans: It is the ability of a transparent medium to bend light as it enters the medium.
It is defined as the ratio of velocity of light in vacuum to the velocity of light in a given medium.
It is a pure number and has no units.
Factors affecting refractive index:
Refractive index of a transparent material depends upon the following two factors:

1. Temperature as $velocity\ v \propto \sqrt{T}$ and $\mu \propto \frac{1}{v}$
2. Wavelength of light used, $n = \mu = \frac{1}{\lambda^2}$ (acc to Cauchy's relation)

Q4:(a) Define power of lens and define 1 dioptre.
(b) What are the uses of concave and convex lenses?
Ans: (a) *It is defined as the measure of its degree of convergence or divergence. Or It is defined as the reciprocal of focal length of a lens.*
Mathematically,
$P = \frac{1}{f(m)} D = \frac{100}{f(cm)}$D
The power of lens is measured in dioptres and denoted by bold letter **D.**
Dioptremeter measures the power of lens.
1 D: Power of lens is said to be one dioptre if its focal length is 1m.
(b) **Uses of concave lens:**

1. It is used mainly in spectacles for correction of Myopia or short-sightedness.
2. It is used to diverge incident light.

Uses of convex lens:

1. It is used as magnifying glass.
2. It is used in theatre spotlight.
3. It is used in spectacles for correction of long-sightedness or Hypermetropia.

5. The Human eye and the colourful World.

Q1: Define Power of accommodation and Least distance of distinct vision.

Ans: **Accommodation:-** *it is the ability of eye to observe distinctly the objects situated at widely different distances from the eye.*

Least distance of distinct vision:-*it is the closest distance for which lens focus light on the retina and equal to 25cm.*

Q2: Explain the defects of vision (a) Hypermetropia and (b) Myopia with their cause and cure.

Ans:

Hypermetropia (far or long sightedness):-

It is that defect of human eye by which the eye can see clearly the far-off objects but cannot see nearby objects clearly.

In this defect the parallel rays are focused at point O beyond the retina and thus the near point in hypermetropic eye shifts from F to F'.

Cause:-

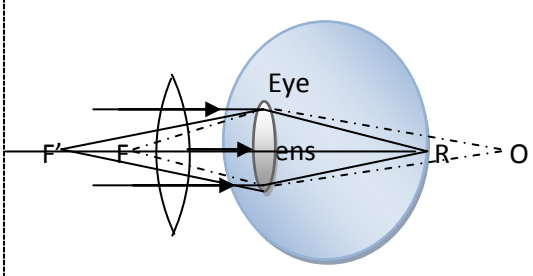
There are two basic causes:

(a) First one is the decrease or contraction in the size of eye-ball i.e the distance of retina from the eye lens has decreases.

(b) Second cause is the increase in the focal length eye lens.

Method to cure:-

This defect can be cured by using spectacles with **convex lens** of suitable focal length or by using suitable convex contact lenses.



In this parallel rays from infinity after refraction through concave lens should appear to come from F i.e from the far point of the defective eye.

As lens formula is given as $\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$

Let 'x' be the distance of near point F' for Hypermetropic eye, d be the least distance of distinct vision and 'f' be the focal length of convex lens, then for convex lens

$u = d \; and \; v = -x$

$\Rightarrow \frac{1}{-x}-\frac{1}{d}=\frac{1}{f}$

$\Rightarrow f = \frac{-xd}{d-x}=\frac{xd}{x-d}$, here x> d so $f \; is \; positive$.

Hence focal length of convex lens used should be positive.

Myopia (near or short sightedness):-

It is that defect of human eye by which the eye can see clearly nearby objects but cannot see far off objects clearly.

In this defect the parallel rays are focused at point O in front of the retina and F is the far-off point for such defect.

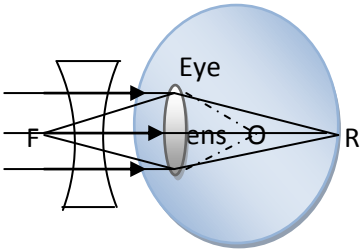
Cause:- there are two basic causes:

(c) First one is the increase in the size of eye-ball i.e the distance of retina from the eye lens has increased.

(d) Second cause is the decrease in the focal length eye lens.

Method to cure:-

This defect can be cured by using spectacles with **concave lens** of suitable focal length or by using suitable concave contact lenses.



In this parallel rays from infinity after refraction through concave lens should appear to come from F i.e from the far point of the defective eye.

As lens formula is given as $\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$

Let 'x' be the distance of far point for myopic eye and 'f' be the focal length of concave lens, then for concave lens $u=\infty \; and \; v=-x$

$\Rightarrow \frac{1}{-x}-\frac{1}{\infty}=\frac{1}{f}$

$\Rightarrow f=-x$, hence focal length of concave lens used should be equal to the distance of far-off point of the eye.

Q3: Define Scattering of light and Tyndall effect.

Ans:

Scattering of light:

It is the phenomenon of absorption of light energy by particles comparable to the wavelength of the light and then scattering light energy by these particles in all directions.

The scattering of light by colloidal solution was described by **Tyndall in 1871.**

Tyndall effect:

It is the phenomenon of scattering of light by the particles in a colloid.

The extent of scattering and the colour of the scattered light depend on two basic factors:

1. The size of the particle and
2. The wavelength of light used.

For example smaller size particles scatter light of shorter wavelength, such as blue colour while large size particles scatter light of longer wavelength, such as red light.

Q4: Explain why clear sky appears blue and sun appears red at sunshine and sunset and white at noon?

Ans:

Clear sky appears blue:

Reason: As the earth's atmosphere consist of gases and many different kind of particulate matter, such as smoke, small water droplets and suspended particles of fine dust, which when comes in the path of sunlight absorbs light energy and scatter light mainly of blue colour and hence sky appears blue to an observer.

Sun appears red at sunshine and sunset and white at noon:

Reason: As during sunrise and sunset, Sun is closer to the horizon and the sunlight near the horizon passes through denser layers of the air and covers larger distance before reaching our eyes. Due to this most of the light gets scattered and the light that reaches our eyes is of longer wavelength mainly orange and red. Hence sun appears red at the sunset and sunrise. On the other hand at noon time, the Sun is overhead and sunlight passes through the rarer layers of the air and covers shorter distance before reaching the observers eye, thus a small amount of blue light get scattered and most of the light of other colors reaches to observer as a result the sun appears white.