PHYSICS

I. LIGHT: REFLECTION AND REFRACTION

1. A smooth highly polished surface from which regular reflection can take place is called mirror

2. **Laws of reflection of light:**

   i. The angle of incidence is equal to the angle of reflection

   ii. The incident ray, the normal to the mirror at the point of incidence and the reflected ray, all lie in the same plane.

3. A spherical mirror whose reflecting surface is curved inwards, that is, faces towards the center of the sphere is called a concave mirror.

4. A spherical mirror whose reflecting surface is curved outwards, is called a convex mirror.

5. The midpoint of a spherical mirror is called pole.

6. The center of the sphere of which the spherical mirror is a part, is called center of curvature

7. An imaginary line passing through the pole and center of curvature of a spherical mirror is called principal axis

8. Principal focus is a point on principal axis, where a beam of light, parallel to principal axis after reflection either actually meets or appear to diverge.

9. The linear distance between pole and principal focus is called focal length.

10. The linear distance between pole and center of curvature is called radius of curvature.

11. Concave mirrors are commonly used in torches, search-lights and vehicles headlights to get powerful parallel beam of light.

12. Concave mirrors are often used as shaving mirrors to see a large image of the face

13. The dentists use concave mirrors to see large image of the teeth of patients.

14. Large concave mirrors are used to concentrate sunlight to produce heat in solar furnaces.

15. Convex mirrors are commonly used as rear-view (wing) mirrors in vehicles.

16. Convex mirrors always give an virtual, erect and diminished image.

17. . **Image formation by a concave mirror for different positions of the object:**

Position of the object	Position of the image	Size of the image	Nature of the image
At infinity	At the focus F	Highly diminished, point-sized	Real and inverted
Beyond C	Between F and C	Diminished	Real and inverted
At C	At C	Same size	Real and inverted
Between C and F	Beyond C	Enlarged	Real and inverted
At F	At infinity	Highly enlarged	Real and inverted
Between P and F	Behind the mirror	Enlarged	Virtual and erect

18. **Image formation by a convex mirror for different positions of the object:**

Position of the object	Position of the image	Size of the image	Nature of the image
At infinity	At the focus F, behind the mirror	Highly diminished, point-sized	Virtual and erect
Between infinity and pole P of the mirror	Between P and F, behind the mirror	Diminished	Virtual and erect

19. **Sign Convention for Reflection by Spherical Mirrors:**

i. The object is always placed to the left of the mirror. This implies that the light from the object falls on the mirror from the left-hand side.

ii. All distances parallel to the principal axis are measured from the pole of the mirror.

iii. All the distances measured to the right of the origin (along + x-axis) are taken as positive while those measured to the left of the origin (along – x-axis) are taken as negative.

iv. Distances measured perpendicular to and above the principal axis (along + y-axis) are taken as positive.

v. Distances measured perpendicular to and below the principal axis (along –y-axis) are taken as negative.

20. **Mirror Formula:** $\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$

21. i. Magnification produced by a spherical mirror gives the relative extent to which the image of an object is magnified with respect to the object size.

$$m=\frac{(\text{Height of the image (h'}))}{(\text{Height of the object (h}))}$$

ii. The magnification m is also related to the object distance (u) and image distance (v). It can be expressed as:

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

22. If the light rays are travelling from one medium to another they change their direction at the boundary between two mediums.

Cause: It is due to the change of speed of light in different medium that the light rays are refracted.

23. **Laws of Refraction Of Light:**

i. The incident ray, the refracted ray and the normal to the interface of two transparent media at the point of incidence, all lie in the same plane.

ii. The ratio of sine of angle of incidence to the sine of angle of refraction is a constant, for the light of a given colour and for the given pair of media. This law is also known as Snell's law of refraction.

If i is the angle of incidence and r is the angle of refraction, then,

$$\frac{\sin i}{\sin r}=\text{constant}$$

This constant value is called the *refractive index* of the second medium with respect to the first. i.e. $\frac{\sin i}{\sin r}=\frac{n_2}{n_1}$

24. **Refractive Index:**

i. Absolute Refractive Index: Absolute refractive index is the ratio of the speed of light in vacuum to the speed of light in the medium.

The value of absolute refractive index is greater than unity.

$$n_m = \frac{\text{(Speed of light in air)}}{\text{(Speed of light in the medium)}} = \frac{c}{v}$$

Where $c = 3 \times 10^8$ m/s.

ii. Relative Refractive Index: Relative refractive index is the ratio of the speed of light in the medium 1 to the speed of light in medium 2.

The value of absolute refractive index may be greater than or less than unity.

The refractive index of medium 2 with respect to medium 1 is given by

$$n_{21} = \frac{\text{(Speed of light in medium 1)}}{\text{(Speed of light in medium 2)}} = \frac{v_1}{v_2}$$

25. **Image formation by a convex lens for different positions of the object:**

Position of the object	**Position of the image**	**Size of the image**	**Nature of the image**
At infinity	At the focus F	Highly diminished, point-sized	Real and inverted
Beyond $2F_1$	Between F_2 and $2F_2$	Diminished	Real and inverted
At $2F_1$	At $2F_2$	Same size	Real and inverted
Between F_1 and $2F_1$	Beyond $2F_2$	Enlarged	Real and inverted
At Focus F_1	At infinity	Highly enlarged	Real and inverted
Between $F_1$and optical center O	In front of the lens	Enlarged	Virtual and erect

26. Image formation by a concave lens for different positions of the object:

Position of the object	Position of the image	Size of the image	Nature of the image
At infinity	At focus F_1	Highly diminished, point-sized	Virtual and erect
Between infinity and optical centre O of the lens	Between F_1 and optical centre O	Diminished	Virtual and erect

27. Lens Formula: $\frac{1}{f}=\frac{1}{v}-\frac{1}{u}$; Magnification: $m=\frac{h'}{h}=\frac{v}{u}$

28. The degree of convergence or divergence of light rays achieved by a lens is expressed in terms of its *power*.

The power of a lens is defined as the reciprocal of its focal length. It is represented by the letter P. The power P of a lens of focal length f is given by

(or)

$$P = \frac{1}{f(m)} = \frac{100}{f(cm)}$$

Power is measured in dioptre [D]

II. THE HUMAN EYE AND THE COLOURFUL WORLD

1. The front transparent part of the sclera is called cornea. Light enters the eye through the cornea.
2. A dark muscular tissue and ring-like structure behind the cornea are known as the iris. The colour of iris actually indicates the colour of the eye. The iris also helps regulate or adjust exposure by adjusting the iris.
3. A small opening in the iris is known as a pupil. Its size is controlled by the help of iris. It controls the amount of light that enters into the eye.
4. Behind the pupil, there is a transparent structure called a lens. By the action of ciliary muscles, it changes its shape to focus light on the retina. It becomes thinner to focus distant objects and becomes thicker to focus nearby objects.
5. It is a light-sensitive layer that consists of numerous nerve cells. It converts images formed by the lens into electrical impulses. These electrical impulses are then transmitted to the brain through optic nerves.

7. Cones are the nerve cells that are more sensitive to bright light. They help in detailed central and colour vision.
8. Rods are the optic nerve cells that are more sensitive to dim lights. They help in peripheral vision.
9. At the junction of the optic nerve and retina, there are no sensory nerve cells. So no vision is possible at that point and is known as a blind spot.
10. The ability of the eye lens to adjust its focal length is called accommodation.
11. The minimum distance, at which objects can be seen most distinctly without strain, is called the least distance of distinct vision. It is also called the **near point** of the eye.
12. For a young adult with normal vision, the near point is about 25 cm. The farthest point up to which the eye can see objects clearly is called the **far point** of the eye. It is infinity for a normal eye.
13. A person with myopia can see nearby objects clearly but cannot see distant objects distinctly.
14. Myopia is also known as near-sightedness.
15. **Causes of myopia:**

    (i) Excessive curvature of the eye lens

    (ii) Elongation of the eyeball.
16. Myopia can be corrected by using a *concave lens* of suitable power. For myopic person power is negative (-ve)
17. A person with Hypermetropia can see distant objects clearly but cannot see nearby objects clearly. Hypermetropia is also known as far-sightedness.
18. **Causes of Hypermetropia:**

    i) The focal length of the eye lens is too Long

    ii) The eyeball has become too small.
19. Hypermetropia can be corrected by using a convex lens of appropriate power. For hypermetropic person power is positive (+ ve)
20. Presbyopia is that defect of vision due to which an old age person cannot see the nearby objects clearly due to loss of power of accommodation of the eye.

21. **Causes of presbyopia:** It arises due to the gradual weakening of the ciliary muscles and diminishing flexibility of the eye lens.
22. Presbyopia can be corrected by using bifocal lenses.
23. **Recombination of white light:** Newton found that when an inverted prism is placed in the path of dispersed light then after passing through the prism, they recombine to form white light.
24. 'Dispersion of Light' can be defined as the splitting of white light when it passes through a glass prism into its constituent spectrum of colors (i.e. violet, indigo, blue, green, yellow, orange and red).
25. Angle of deviation (ä) is the angle between emergent ray and incident ray.
26. Scattering of light means to throw light in various random directions. Light is scattered when it falls on various types of suspended particles in its path.
27. The twinkling of a star is due to atmospheric refraction of star light.
28. The sun visible to us about 2 minutes before the actual sunrise, and about 2 minutes after the actual sunset because of atmospheric refraction.
29. The colour of the clear sky, blue is due scattering of light.
30. Sun appears red in colour during sunrise and sunset time due to scattering of light.
31. Light consisting of single colour or wavelength is called monochromatic light.
32. **Rainbow:** It is the spectrum of sunlight in nature. It is formed due to the dispersion of sunlight by the tiny water droplet, present in the atmosphere.

III. ELECTRICITY

1. Charge is the property of matter that produces and experiences electrical and magnetic effects.
2. The electric charge of any system is always an integral multiple of the least amount of charge. It means that the quantity can take only one of the discrete set of values. i.e, $Q = \pm n e$ Here n= integer and
   e = charge of electron
   e= 1.6×10^{-19} coulombs(c)

3. The strength of electric current is defined as rate of flow of charge through any cross section of a conductor.
4. If a net charge Q passes through any cross-section of the conductor in time'‘t’ then current (I)

$\therefore$ Current (I) = $\frac{Charge(Q)}{Time(t)}$

Current is a scalar quantity

S.I Unit is Ampere (A)

$\therefore$ 1 A=$\frac{1C}{1S}$

5. **Number of electrons constituting one coulomb of charge is**

Q=ne

n=$\frac{Q}{e}$

6. Electric potential (v) at a point in an electric field is defined as the work done (w) per unit positive test charge (q) in bringing it from infinity to that point against the electric field.

$\therefore$ Electric potential (v)=$\frac{workdone(w)}{charge(q)}$

$\therefore$ v = $\frac{w}{q}$ (or) w = vq

S.I Unit is volt(v)

S.I Unit of work (w)=Joule(J)

S.I Unit of charge (q)=Coulomb (c)

$\therefore 1v = \frac{1J}{1C}$

7. Potential difference between two points in an electric field is defined as the work done (w) per unit positive charge (q) in moving it from one point to the other against the electric field.
8. For a given conductor at a given temperature the strength of electric current through it is directly proportional to the potential difference applied across it.

$$V \alpha I$$

9. The resistance of a conductor is defined as the ratio of the potential difference ‘v’ across the conductor to the current ‘i’ Flowing through the conductor.

$\therefore$ Resistance (R) $= \dfrac{Potential\,(v)}{Current\,(I)}$

10. The resistance of a specimen is said to be one ohm if one volt potential difference across it causes a current of one Ampere to flow through it.

$$\therefore 1ohm(\Omega) = \frac{1volt(v)}{1Ampure(A)}$$

11. $\therefore$ R= $\dfrac{\rho l}{A}$

ρ =specific resistance (or) resistivity

12. $\rho = \dfrac{RA}{l}$

S.I unit of resistance= Ω -m

Area (A) = m^2

Length (l) = m

$$\therefore\ \rho = \frac{1\Omega.m^2}{m}$$

13. In a series circuit, all components are connected end-to-end, forming a single path for electrons to flow.
14. In a parallel circuit, all components are connected across each other, forming exactly two sets of electrically common points.
15. In a series circuit, the current that flows through each of the components is the same, and the voltage across the circuit is the sum of the individual voltage drops across each component.
16. In a parallel circuit, the voltage across each of the components is the same, and the total current is the sum of the currents flowing through each component.
17. House hold consumption of electrical energy is measured in kilowatt hours (Kwh).
18. One Kilowatt hour (1kwh) is defined as the electrical energy consumed at the rate of one kilowatt (one thousand watts) for one hour

$\therefore$ 1 Kilowatt-hour (1kwh)=1000 wat×1hr

1kwh=(1000 watts) (3600 seconds)

$=36\times10^5$ Joules

1 kwh=36×10^5J

(or) 1 kwh=3.6×10^6J

19. The rate of electrical work is done by the source of e.m.f is called electric power

$\therefore$ Electric power (P)= $\dfrac{Work(w)}{time(t)}$

P= $\dfrac{Vit}{t}$ =Vi

S.I-Unit=watt (or) J/S (or) J.S^{-1}

20. Expression for electric power in terms of I and R According to ohms law v= IR now eq of power (P)=i^2R
21. Expression for electric power in terms of v and R

V=Ir ài= $\dfrac{v}{R}$

And power (P)= $\dfrac{V^2}{R}$

Here (v)=potential

R=Resistance