Contents

Nature and propagation of light

Theories of nature and propagation of light

The main theories on nature of propagation of light are

- Newton's corpuscular theory
- Huygen's wave theory
- Maxwell's electromagnetic theory
- Plack's quantum theory
- De- Broglie's dual nature theory

Newton's corpuscular theory

Source of corpuscles in newton's corpuscular theory

The source of corpuscles in newton's corpuscular theory is

- Luminious body

Nature of properties of corpuscles in newton's corpuscular theory

The properties of corpuscles in newton's corpuscular theory are

- Extremely tiny
- Light
- Elastic

Speed of light in denser medium in newton's corpuscular theory

The speed of light in denser medium in newton's corpuscular theory is - Greater than in rarer medium

Speed of light in rarer medium in newton's corpuscular theory

The speed of light in rarer medium in newton's corpuscular theory is

- Smaller than in denser medium

Observation of light explained by newton's corpuscular theory

The observations of light explained by newton's corpuscular theory are

- Rectilinear propagation of light
- Reflection of light
- Refraction of light
- Total internal reflection

Observation of light unexplained by newton's corpuscular theory

The observations of light unexplained by newton's corpuscular theory are

- Interference of light
- Polarization of light
- Diffraction of light

Huygen's wave theory

Medium of propagation of light in huygen's wave theory

The medium of propagation of light in huygen's wave theory is

- Ether

Nature of ether in huygen's wave theory

The properties of ether in huygen's wave theory are

- Ether is massless.
- Ether is colorless.
- Ether is elastic.
- Ether is invisible.
- Ether has no density.

Type of wave expressed as light wave in huygen's wave theory on the basis of direction of propagation particle with wave

The type of expressed as light wave in hugen's wave theory on the basis of direction of propagation of particle with wave is

- Longitudinal wave

Observation of light explained by huygen's wave theory

The observations of light explained by hyugen's wave theory are

- Reflection of light
- Refraction of light
- Diffraction of light
- Interference of light

Observation of light unexplained by huygen's wave theory

The observations of light unexplained by huygen's wave theory are

- Polarization

Maxwell's electromagnetic theory

Type of wave as light on the basis of medium of travel in maxwell's electromagnetic wave

The type of light wave as on the basis of medium of travel in maxwell's electromagnetic wave is

- Electromagnetic wave

Type of wave as light on the basis of direction of vibration of particle with respect to the direction of propagation of wave in maxwell's electromagnetic wave

The type of wave as light on the basis of direction of vibration of particle with respect to the direction of propagation of wave in maxwell's electromagnetic wave is

- Transverse wave

Contents present in electromagnetic wave

The contents present in electromagnetic wave are

- Electric field
- Magnetic field

Nature of motion of electromagnetic wave

The nature of motion of electromagnetic wave is

- Oscillating
- Fluctuating

Direction of contents present in electromagnetic wave with each other

The direction of contents present in electromagnetic wave with each other is

- Electric field are perpendicular with magnetic field.
- Magnetic field are perpendicular with electric field.

Observation of light explained by maxwell's electromagnetic nature of light wave propagation

The observations of light explained by maxwell's electromagnetic nature of light wave propagation are

- All observations of light

Planck's quantum theory

Source of radiation in planck's quantum theory

The source of radiation in planck's quantum theory is

- Excited body

Form of radiation in planck's quantum theory

The form of structure of radiation in planck's quantum theory is

- Packets

Term for radiation in heat in planck's quantum theory

The term for radiation in heat in planck's quantum theory is

- Quanta

Term for radiation in light in planck's quantum theory

The term for radiation in light in planck's quantum theory is

- Photon

Nature of quantity of radiation emitted by excited body in planck's quantum theory

The nature of quantity of radiation emitted by excited body in planck's quantum theory is

- The packets of radiation are discrete.
- The packets of radiations are not continuous.

Observation of radiation of matter explained by planck's quantum theory

The observations of radiation of matter explained by planck's quantum theory are

- Photoelectric effect
- Compton effect
- Raman effect

Compton effect

- Compton effect is scattering of photon.
- Compton effect occurs after interaction of photon with charged particle.

Raman effect

- Raman effect is change in wavelength of light
- Raman effect occurs after the travel of light in different chemical medium.

Observation of light unexplained by planck's quantum theory

The observations of light unexplained by planck's quantum theory are

- Interference of light
- Diffraction of light
- Polarization of light

De broglie dual nature theory

Statement of debroglie dual nature theory

- Light behaves both as particle.
- Light behaves as wave.

Wave front

Contents for the formation of wave front

The contents for the formation of wave front are

- Source of light
- Medium of propagation of wave front

Process of formation of wave front

The process of formation of wave front is

- A disturbance travels in the medium.
- The disturbance travels in all directions in the medium.
- The source of disturbance in the medium is source of light.
- The effect of disturbance is oscillation of particles.

Type of motion of particles in propagation of wave

The type of motion executed by the particles in propagation of wave is

- Simple harmonic motion

Relation of phase of particles in propagation of wave

The phase of particles along the direction of propagation of wave is

- Different

Nature of shape of wave front in isotropic and homogenous medium

The nature of shape of wave front in isotropic and homogeneous medium is

- Regular

Condition of medium for regular wavefront

The condition of medium for regular wavefront is

- Homogeneous medium
- Isotropic medium

Meaning of isotropy

Isotropy stands for

- Uniformity in parameter of a medium.
  - Uniformity in physical parameters of medium.
  - Uniformity in chemical parameters of medium.

Nature of shape of wave front in anisotropic and heterogenous medium

The nature of shape of wave front in anisotropic and heterogeneous medium is

- Irregular
- Complicated

Condition of medium for irregular wavefront

The condition of medium for irregular wavefront is

- Anisotropic medium
- Heterogeneous medium

Phase and distance in propagation of wave front

- The phase of particles is same.
- The particles having the same phase are
  - Equidistant from source

Geometrical interpretation of wave front

- The wave front is a set of particles.

Elements in set of particles of a wavefront

The set of particles of a wavefront are

- Particles vibrating in same phase

Types of wave front

The types of wave front are

- Spherical wave front
- Cylindrical wave front
- Plane wave front

Basis for the division of types of wave front

The basis of division of types of wave front are

- Shape of source of light
- Distance of source of light from the observer

Producers of Spherical wave front

The producers of spherical wave front are

- Point source of light

Producers of cylindrical wave front

The producers of cylindrical wave front are

- Distant source of light

Producers of plane wave front

The producers of plane wave front are

- Distant source of light

Rays

Existential domain of ray in nature

The existential domain of ray in nature is

- Imaginary

Direction of ray with the wave front

The direction of ray with the wave front is

- Perpendicular

Huygen's principle

First principle of huygen's statement

Role of primary wavefront in huygen's principle

The role of primary wave front in huygen's principle is

- Primary wave front acts as new source of disturbance

Secondary wavelets in huygen's principle

Secondary wavelets are

- The disturbances of primary wave front.

Direction of propagation of secondary wavelet in huygen's principle

The direction of propagation of secondary wavelet is

- Secondary wavelet travel in all direction

Velocity of propagation of secondary wavelet in huygen's principle

The velocity of propagation of secondary wavelet in huygen's principle is

- Speed of light

Second principle of huygen's statement

Process of formation of new wavefront

The process of formation of new wavefront is

- Construction of tangential plane to secondary wavelets.

Contents of wave produced by secondary wavelet at the instant of propgation

The contents of secondary wavelet at the instant of propagation is

- Forward envelope of secondary wavelet at the instance of propagation

Analysis of huygen's wave theory of light

Quantities for relation of propagation

Expression for Amplitude

The expression for amplitude in huygen's wave theory of light is

- $$A$$

Angle of propagation

The angle of propagation is between

- The ray of light at the point
- The direction of secondary wavelet

Expression of Angle of propagation

The expression for angle of propagation in huygen's wave theory of light is

- $$\theta$$

Expression for relation of amplitude with the angle of propagation

The expression for relation of amplitude with the angle of propagation is

- $$A\alpha(1+\cos\theta)$$

Backward wave front

Magnitude of angle in backward wave front

The angle in backward wave front is

- $$\theta = 180^\circ$$

Magnitude of intensity in backward wave front

The magnitude of intensity in backward wave front is

- Minimum

Forward wave front

Magnitude of angle in forward wave front

The magnitude of angle in forward wave front is

- $$\theta = 0^\circ$$

Magnitude of intensity of forward wave front huygen's principle

The magnitude of intensity of forward wave front in huygen's principle is

- Minimum

Application of huygen's wave theory of light

Laws of reflection of light on the basis of huygen's wave theory of light

Laws of reflection

The laws of reflection of light are

- The magnitude of angle of incidence and the magnitude of angle of reflection is equal.
- The angle of incidence , the angle of reflection and the normal all lie at the same plane of incidence.

Setup of apparatus for the verification of reflection of light on the basis of huygens's wave theory of light

Plane

The expression for plane for the reflection of light is

$$XY$$

Expression for events on the instant of time of consideration of relection

The expression for events on the instant of time of consideration of reflection are

- The first wavelet incidents on point A .
- The other wavelets incident on point C'.
- The other wavelets incident on point B'.

Expression of events at a particular instance of time.

- The secondary wavelet of A reaches A'.
- The secondary wavelet of C' reaches C'' .
- The secondary wavelet of B is just reaching B'

Position of wavelets in the plane The wavelets that are present in the plane are

- $$A$$
- $$B'$$
- $$C'$$

Position of wavelets not in the plane The wavelets that are not in the plane are

- A'
- C''

First incident wavelet The expression for first incident wavelet is

- $$A$$

Secondary wavelet of first incident wavelet The secondary wavelet of first incident wavelet is

- $$A'$$

Second incident wavelet The expression for second incident wavelet is

- $$C$$

Secondary wavelet of second incident wavelet The secondary wavelet of second incident wavelet is

- $$C''$$

Third incident wavelet The expression for third incident wavelet is

- $$B$$

Secondary wavelet of third incident wavelet The secondary wavelet of third incident wavelet is

- $$B'$$

Plane wave front of incidence

The plane wave front of incidence is

- $$AB$$

The plane wave front of incidence including all points of consideration is

- $$ACB$$

Plane wave front for reflection

The plane wave front for reflection is

- $$A^{'}B^{'}$$

The plane wave front for reflection including all points of consideration is

- $$A^{'}C^{''}B^{'}$$
- The plane wavefront for reflection represents the tangential envelope of secondary wavelets.

Proof for congruency of triangles formed by the incident and the reflected plane

The triangle in consideration are

- Triangle formed by incident wave front
  - $$ABB^{'}$$
- Triangle formed by reflected wave front
  - $$AA^{'}B^{'}$$

$$\angle ABB' = \angle AA'B \text{ The magnitude of angle is } 90^\circ$$
$$AB' = AB' \text{ Plane of reflection as common side}$$
$$BB' = AA' \text{Distance travelled by light in same time}$$
$$\triangle ABB' \cong AA'B$$

Derivation for expression of equality of angle of incidence of plane wavefront and the angle of reflection of plane wavefront

$$\triangle ABB' \cong AA'B$$
$$\angle BAB' = \angle A'B'A \text{ Corresponding angle of congruent triangle}$$
$$i = r$$

Verification of conincidence of incident wavefront reflected wavefront and normal

The quantities lying on the same plane of paper are

- Angle of reflection
- Angle of incidence
- Normal

The quantities are equiplanar.

Laws of refraction of light on the basis of huygen's wave theory of light

Laws of refraction

The snell's laws of refraction are

- The incident ray , the refracted ray and the normal lie on the same plane of incidence.
- The ratio of sine of incident ray to the sine of refracted ray is constant.
- The constant in the expression of refracted ray by snell's law is expressed as
-

$$\mu$$

Setup of apparatus for the verification of refraction of light on the basis of huygens's wave theory of light

The setup apparatus for the verification of refraction of light on the basis of huygen's wave theory of light is

Plane

- The plane of incidence is XY .
- The plane of refraction is XY .

Magnitude of angles

- The magnitude of incident ray is i.
- The magnitude of refracted ray is r .

Medium of travel

- The medium of incidence is m_1 .
- The medium of refraction is m_2 .

Velocity of light in medias

- The velocity of light in medium m_1 is v_1 .
- The velocity of light in medium m_2 is v_2 .

Working principle of verification of laws of refraction of light on the basis of huygen's wave theory of light

The working principle for the verification of refraction of light on the basis of huygen's wave theory of light is

Travel of light waves in medium

- The light waves travel in m_1 .
- The form of motion exhibited by the light waves in medium m_1 is wave.

Disturbance of light waves in medium

- The disturbance is set up by a wavelet.
- The ray of incident light is perpendicular.

Nature of angle of rays with wavelet

- The perpendicularity of ray of light is expressed with the wavelet.
- The disturbance set up by the wavelet genarates secondary wavelets.

Velocity of wavelets in medias

- The velocity of wavelets in medium m_1 is v_1
- The velocity of wavelets in medium m_2 is v_2

Time of travel of wavelets in media

- The time instance of travel of wavelets in media m_1 is t .
- The time instance of travel of wavelets in media m_2 is t .

Distance of travel of wavelets in media

- The distance of travel of secondary wavelets in media m_1 is
- $$d_1 = v_1 t$$
- The distance of travel of secondary wavelets in media m_2 is
- $$d_2 = v_2 t$$

Analysis of travel of distance in different media

$$d_2 < d_1$$

Reason for difference in travel of distance in different media

- The velocity of light in media are different.
- The velocity of light in media m_1 is greater.
- The velocity of light in media m_2 is smaller.

Derivation for the expression of laws of refraction of light on the basis of huygen's wave theory of light

Expression for refractive index at medium m_2 with respect to m_1

$$\mu_{m_2} = \frac{v_1}{v_2}$$

Expression in triangle ABC

$$\sin i = \frac{v_1 t}{AC}$$

Expression of triangle ADC

$$\sin r = \frac{v_2 t}{AC}$$

Combination of expression of resolution of the wavelets in incidence and refraction

$$\frac{\sin i}{\sin r} = \frac{v_1}{v_2}$$
$$\frac{\sin_i}{\sin r} = \mu_{m_2}$$

Verification of point of incidence refraction and normal in snells law

The location of the following parameters are on the plane of paper.

- point of incidence
- point of refraction
- normal