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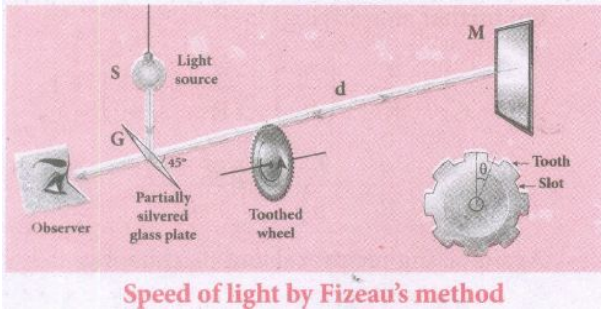
Answers Key:

PART-D

IV. ANSWERS ALL THE QUESTIONS

1. **Apparatus:**

The apparatus used by Fizeau for determining speed of light in air is shown in Figure



(i) The light from the source S was first allowed to fall on a partially silvered glass plate G kept at an angle of 45° to the incident light.
(ii) The light then was allowed to pass through a rotating toothed-wheel with N teeth and N cuts of equal widths whose speed of rotation could be varied through an external mechanism.
(iii) The light passing through one cut in the wheel will get reflected by a mirror M kept at a long distance d, about 8 km from the toothed wheel.
(iv) The toothed wheel was not rotating, the reflected light from the mirror would again pass through the same cut and reach the eyes of the observer, through the partially silvered glass plate.

Working:

(i) The angular speed of rotation of the toothed wheel was increased from zero to a value w until light passing through one cut would completely be blocked by the adjacent tooth.
(ii) This is ensured by the disappearance of light while looking through the partially silvered glass plate.

Expression for speed of light:

The speed of light in air 'v' is equal to the ratio of the distance 2d (the distance light travelled from the toothed wheel to the mirror and back) to the time taken 't'.

$v = \frac{2d}{t}$ ...(i)

(v) The distance d is a known value from the arrangement. The time taken 't' for the light to travel the distance (2d) is calculated from the angular speed 'ω' of the toothed wheel.
(vi) The angular speed 'ω' of the toothed wheel when the light disappeared for the first time is,

$\omega = \frac{\theta}{t}$ ...(2)

(vii) Here, θ is the angle between the tooth and the next slot which is turned within that time t.

$\theta = \frac{total\ angle\ of\ the\ circle\ in\ radian}{number\ of\ teeth + number\ of\ cuts}$

$\theta = \frac{2\pi}{2N} = \frac{\pi}{N}$

Substituting for θ in the equation for ω,

$\omega = \frac{\pi/N}{t} = \frac{\pi}{Nt}$

Rewriting the above equation for t,

$t = \frac{\pi}{N\omega}$ ....(3)

Substituting 't' in equation (1)

$V = \frac{2d}{\pi/N\omega}$

After rearranging,

$v = \frac{2dN\omega}{\pi}$

From this, the speed of light in air was determined as, v = 2.997 x 10^8 m/s.

2. When electron jumps from higher energy stationary orbit (m) to lower energy stationary orbit (n), emit radiation.

Wave number (or) Wave length of the emitted radiation is given by,

$\frac{1}{\lambda} = R\left[\frac{1}{n^2} - \frac{1}{m^2}\right] = \bar{v}$

V - Ware number; R- Rydberg constant = 1.09737 x 10^7 m^{-1}

m > n (where m, n are integers)

(a) Lyman series:

When electron jumps from any outer orbit to first orbit, (n = 1 and m = 2,3,4.....) the wave number or wavelength of spectral lines lies in ultra-violet region is

$v = \frac{1}{\lambda} = R\left[\frac{1}{1^2} - \frac{1}{m^2}\right]$

(b) Balmer series:

Wher electron jumps from any outer orbit to second orbit, (n = 2 and m = 3, 4, 5.....) the wave number or wavelength of spectral lines lies in visible region

is,

$\bar{v} = \frac{1}{\lambda} = R\left[\frac{1}{2^2} - \frac{1}{m^2}\right]$

(c) Paschen series:

When electron jumps from any outer orbit to third orbit, (n = 3 and m = 4, 5, 6.....) the wave number or wavelength of spectral lines lies in infra red (Near IR) region is

$\bar{v} = \frac{1}{\lambda} = R\left[\frac{1}{3^2} - \frac{1}{m^2}\right]$

(d) Bracket series:

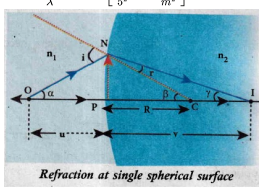
When electron jumps from any outer orbit to fourth orbit, (n = 4 and m = 5, 6, 7.....) the wave number or wavelength of spectral lines lies in infra red (Middle IR) region is

$\bar{v} = \frac{1}{\lambda} = R\left[\frac{1}{4^2} - \frac{1}{m^2}\right]$

(e) Pfund series:

When electron jumps from any outer orbit to fifth orbit, (n - 5 and m = 6, 7, 8.....) the wave number or wavelength of spectral lines lies in infra red (far IR) region is

$\bar{v} = \frac{1}{\lambda} = R\left[\frac{1}{5^2} - \frac{1}{m^2}\right]$



Refraction at single spherical surface

3.

(i) Let us consider two transparent media with refractive indices n, and n, which are separated by a spherical surface. Let C be the centre of curvature of the spherical surface. Let a point object O be in the medium n.

(ii) The line OC cuts the spherical surface at the pole P of the surface. As the rays considered are paraxial rays, the perpendicular dropped for the point of incidence to the principal axis is very close to the pole (or) passes through the pole itself.

(iii) Light from O falls on the refracting surface at N. The normal drawn at the point of incidence passes through the centre of curvature C.

(iv) As $n_2 > n_1$ light in the denser medium deviates towards the normal and meets the principal axis at I where the image is formed.

(v) Snell's law in product form for the refraction at the point N can be written from the cquation,

$n_1 \sin i = n_2 \sin r$ ...(1)

(vi) As the angles are small, sine of the angle could be approximated to the angle itself,

$n_1 i = n_2 r$ .....(2)

Let the angles be,

$\angle NOP = \alpha, \angle NCP = \beta, \angle NIP = \gamma$

From the right angle triangles, ΔNOP, ΔNCP and ΔNIP

$tan\alpha = \frac{PN}{PO}; tan\beta = \frac{PN}{PC}; tan\gamma = \frac{PN}{PI}$

As these angles are small, tan of the angle could be approximated to the angle itself.

$\alpha = \frac{PN}{PO}; \beta = \frac{PN}{PC}; \gamma = \frac{PN}{PI}$ .....(3)

For the triangle, ΔONC,

$i = \alpha + \beta$ .....(4)

For the triangle, ΔINC,

$\beta = r + \gamma (or) r = \beta - \gamma$ .....(5)

Substituting for i and r from equations (4) and (5) in equation (2),

$n_1(\alpha + \beta) = n_2(\beta - \gamma)$

After rearranging,

$n_1\alpha + n_2\gamma = (n_2 - n_1)\beta$

Substituting for α, β and y from equation

$n_1\left(\frac{PN}{PO}\right) + n_2\left(\frac{PN}{PI}\right) = (n_2 - n_1)\left(\frac{PN}{PC}\right)$

Further simplifying by cancelling PN,

$\frac{n_1}{PO} + \frac{n_2}{PI} = \frac{n_2 - n_1}{PC}$ .....(6)

Following sign conventions, PO = -u, PI = +v and PC = +R in equation (6)

$\frac{n_1}{-u} + \frac{n_2}{v} = \frac{(n_2 - n_1)}{R}$

After rearranging, finally we get,

$\frac{n_1}{-u} + \frac{n_2}{v} = \frac{(n_2 - n_1)}{R}$ .....(7)

(vii) If the first medium is air then, $n_1 = 1$ and the second medium is taken just as $n_2 = n$, then the equation (7) is reduced to,

$\frac{n}{v} - \frac{1}{u} = \frac{(n-1)}{R}$ ....(8)

4. (i) At any instant t, the number of decays per unit time, called rate of decay $\left(\frac{dN}{dt}\right)$ is proportional to the number of nuclei (N) at the same instant.

$\left(\frac{dN}{dt}\right) \propto N$

$\frac{dN}{dt} = -\lambda N$ ...(1)

(ii) Here, proportionality constant λ is called decay constant which is different for different radioactive sample and the negative sign in the equation implies that the N is decreasing with time. From (1)

$\frac{dN}{N} = -\lambda dt$ ...(2)

(iii) Here, dN represents number of nuclei decaying in the time interval dt.

(iv) Let us assume that at time t = 0 s, the number of nuclei present in the radioactive sample is N_o.

(v) By integrating the equation (2), we can calculate the number of undecayed nuclei N at any time t.

$\int_{N_0}^{N} \frac{dN}{N} = -\int_0^t \lambda dt$

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$[\ln N]_{N_0}^{N} = -\lambda t$

$\ln\left[\frac{N}{N_0}\right] = -\lambda t$

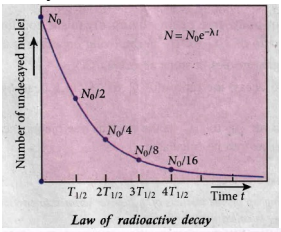
Taking exponential on both sides, we get

$N = N_0 e^{-\lambda t}$ .....(3)

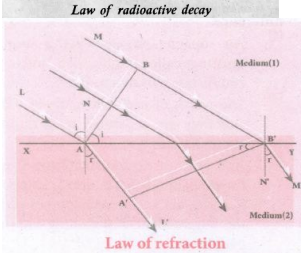
(vi) Equation (3) is called the law of radioactive decay.

(vii) Here N denotes the number of undecayed nuclei present at any time t and N_0 denotes the number of nuclei present initially time t = 0.

(viii) From equation (3) the number of atoms is decreasing exponentially over the time. This implies that the time taken for all the radioactive nuclei to decay will be infinite.



Law of radioactive decay



Law of refraction

5.

(i) Let us Consider a parallel beam of light is incident on a refracting plane surface XY such as a glass surface as shown in Figure.

(ii) The incident wavefront AB is in rarer medium (1) and the refracted wavefront A′B′ is in denser medium (2).

(iii) These wavefronts are perpendicular to the incident rays L, M and refracted rays L′, M′ respectively.

$t = \frac{BB'}{v_1} = \frac{AA'}{v_2}$ or $\frac{BB'}{AA'} = \frac{v_1}{v_2}$

(i) The incident rays, the refracted rays and the normal are in the same plane.

(ii) Angle of incidence

i = ∠ NAL = 90° - ∠NAB = ∠ BAB′

Angle of refraction,

r = ∠ N′B′M = 90°- ∠ N′B′A′ =∠ A′B′A

For the two right angle triangles ΔABB′ and ΔAA′B′,

$\frac{sini}{sinr} = \frac{\frac{BB'}{AB'}}{\frac{AA'}{AB'}} = \frac{BB'}{AA'} = \frac{v_1}{v_2} = \frac{\frac{c}{v_2}}{\frac{c}{v_1}}$

(iv) Here, C is speed of light in vacuum. The ratio $\frac{c}{v}$ is the constant, called refractive index of the medium. The refractive index of medium (1) is, $\frac{c}{v_1} = n_1$ and that of medium (2) is, $\frac{c}{v_1} = n_2$ In ratio form,

$\frac{sini}{sinr} = \frac{n_2}{n_1}$ .....(1)

In product form,

$n_1 \sin i = n_2 \sin r$ .....(2)

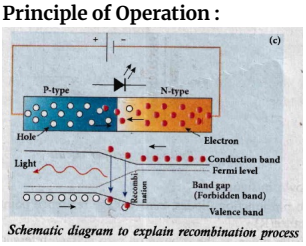
Hence, the laws of refraction are proved.

6. **LED:**

(i) LED is a p-n junction diode that emits visible or invisible light when it is forward biased.

(ii) Since, electrical energy is converted into light energy, this process is also called electroluminescence.

Principle of Operation :



Schematic diagram to explain recombination process

(iii) When the p-n junction is forward biased, the conduction band electrons on the n-side and valence band holes on the p-side diffuse across the junction.

(vi) When they cross the junction, they become excess minority carriers (electrons in p-side and holes in n-side).

(vii) These excess minority carriers recombine with oppositely charged majority carriers in the respective regions, (i.e). the electrons in the conduction band recombine with holes in the valence band.

(viii) During the recombination process, energy is released in the form of light (radiative) or heat (non-radiative). For radiative recombination, a photon of energy h1 is emitted. For non - radiative recombination energy is liberated in the form of heat.

(ix) The colour of the light is determined by the energy bandgap of the material.

(x) Therefore, LEDs are available in a wide range of colours such as blue (SiC), green (AIGaP) and red (GaAsP). Now a days, LED which emits white light (GalnN) is also available.

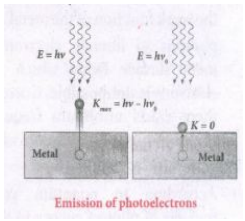
7. (i) When a photon of energy hv is incident on a metal surface, it is completely absorbed by a single electron and the electron is ejected.

(ii) In this process, a part of the photon energy is used for the ejection of the electrons from the metal surface (photoelectric work function Φ_0) and the

remaining energy as the kinetic energy of the ejected electron. From the law of conservation of energy,

$hv = \phi_0 + \frac{1}{2}mv^2$ .....(1)

(iii) where m is the mass of the electron and v its velocity.



(iv) If we reduce the frequency of the incident light is reduced, the speed or kinetic energy of photo electrons is also reduced. At some frequency v_0 of incident radiation, the photo electrons are ejected with almost zero kinetic energy.

Then the equation becomes.

$hv_0 = \phi_0$ .....(2)

(v) Where v_0 is the threshold frequency. B rewriting the equation, we get

$hv = hv_o + \frac{1}{2}mv^2$ .....(3)

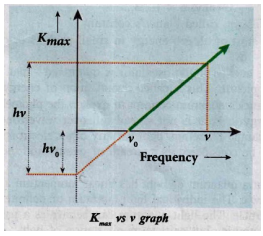
The equation is known as einstein's photoelectric equation.

(vi) If the electron does not lose energy by internal collisions, then it is emitted with maximum kinetic energy K_{max}. Then

$K_{max} = \frac{1}{2}mv^2_{max}$ .....(4)

(vii) where $v_{max}$is the maximum velocity of max the electron ejected. The equation (1) is rearranged as follows:

$K_{max} = hv - \phi_0$



A graph between maximum kinetic energy K_{max} of the photoelectron and frequency v of the incident light is a straight line.

8. **Principle:**

(i) The wave nature of the electron is used in the construction of microscope called electron microscope.

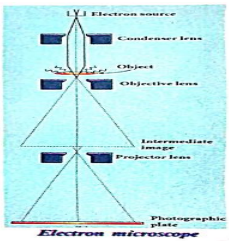
(ii)The resolving power of a microscope is inversely proportional to the wavelength of the radiation used for illuminating the object under study.

(iii) Higher magnification as well as higher resolving power can be obtained by employing the waves of shorter wavelengths.

(iv) De Broglie's wavelength of electron is very much less than (a few thousand less) that of the visible light being used in optical microscopes.

(v) As a result, the microscopes employing de Broglie waves of electrons have very much higher resolving power than optical microscope.

(vi) Electron microscopes giving magnification more than 2,00,000 times are common in research laboratories.



Working:

(i) The construction and working of an electron microscope is similar to that of an optical microscope except that in electron microscope focussing of electron beam is done by the electrostatic or magnetic lenses.

(ii) The electron beam passing across a suitably arranged either electric or magnetic fields undergoes divergence or convergence thereby focussing of the beam is done.

(iii) The electrons emitted from the source are accelerated by high potentials.

(iv) The beam is made parallel by magnetic condenser lens; When the beam passes through the sample whose magnified image is needed, the beam carries the image of the sample.

(v) With the help of magnetic objective lens and magnetic projector lens system, the magnified image is obtained on the screen. These electron microscopes are being used in almost all brands of science.

9. (i) The satellite communication is a mode of transmission of signal between transmitter and receiver via satellite.

(ii) The message signal from the Earth station is transmitted to the satellite on board via an uplink (frequency band 6 GHz), amplified by a transponder and then retransmitted to another earth station via a downlink (frequency band 4 GHz).

Applications:

Satellites are classified into different types based on their applications.

(i) Weather Satellites:

They are used to monitor the weather and climate of Earth. By measuring cloud mass, these satellites enable us to predict rain and dangerous storms like hurricanes, cyclones etc.

(ii) Communication satellites:

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They are used to transmit television, radio, internet signals etc. Multiple satellites are used for long distance communication

(iii) Navigation satellites:

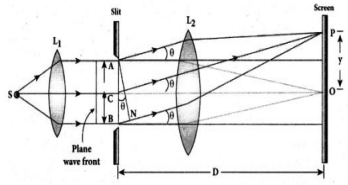
These are employed to determine the geographic location of ships, aircraft or any other object.

10. (i) Let a parallel beam of light (plane wavefront) fall normally on a single slit AB of width a as shown in figure. The diffracted beam falls on a screen kept at a distance D from the slit. The center of the slit is C.

(ii) A straight line through C perpendicular to the plane of slit meets the center of the screen at O. Consider any point P on the screen. All the light reaching the point P from different points on the slit make an angle θ with the normal CO.

(iii) All the light waves coming from different points on the slit interfere at point P (and other points) on the screen to give the resultant intensities. The point P is in the geometrically shadowed region, up to which the central maximum is spread due to diffraction as shown Figure.

(iv) We need to give the condition for the point P to be of various minima.



Diffraction at single slit (to redraw diffraction pattern)

(v) The basic idea is to divide the slit into much smaller even number of parts. Then, add their contributions at P with the proper path difference to show that destructive interference takes place at that point to make it minimum. To explain maximum, the slit is divided into odd number of parts.

Condition for P to the n^{th} order minimum:

(i) Dividing the slit into 2n number of (even number of) equal parts makes the light produced by one of the corresponding points to be cancelled by its counterpart. Thus, the condition for n^{th} order minimum is, $\frac{a}{2n}\sin\theta = \frac{\lambda}{2}$

$a\sin\theta = n\lambda$ (n^{th} minimum)

Where, n = 1,2,3... is the order of diffraction minimum.

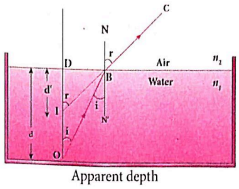
PART-C

III.ANSWER ANY 6 OF THE FOLLOWING QUESTIONS.(Q.NO.33 IS COMPULSORY)

11. (i) Light from the object O at the bottom of the tank passes from denser medium (water) to rarer medium (air) to reach our eyes for viewing the object.

(ii) It deviates away from the normal in the rarer medium at the point of incidence B as shown in Figure.

(iii) The refractive index of the denser medium is n_1 and that of rarer medium is n_2. Here, $n_1 > n_2$.



Apparent depth

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The angle of incidence in the denser medium is i and the angle of refraction in the rarer medium is r. The lines NN′and OD are parallel. Thus, the angle ∠DIB is also r. The angles i and r are very small as the diverging light from O entering the eye is very narrow. The Snell's law in product form for this refraction from equation is,

$n_1 \sin i = n_2 \sin r$

As the angles i and r are small, we can approximate, sin i = tan i and sin r tan r.

$n_1 \tan i = n_2 \tan r$

In triangles ΔDOB and ΔDIB,

$tan\ i = \frac{DB}{DO} and\ tan\ r = \frac{DB}{DI}$

$n_1 \frac{DB}{DO} = n_2 \frac{DB}{DI}$

DB is cancelled both sides. Now, DO is the actual depth d and DI is the apparent depth d′.

$n_1 \frac{1}{d} = n_2 \frac{1}{d'}$

After rearranging, $\frac{d'}{d} = \frac{n_2}{n_1}$

Rewriting the above equation for the apparent depth d′, $d' = = \frac{n_2}{n_1} d$

As the rarer medium is air, its refractive index n, can be taken as 1, (n_2 = 1) and the refractive index n_1 of denser medium could then be taken as n itself, (n_1 = n). Now, the equation for apparent depth becomes,

$d' = \frac{d}{n}$

The bottom appears to be elevated by d-d′,

$d - d' = d - \frac{d}{n} (or) d - d' = d(1 - \frac{1}{n})$

12. Snell's law in the product form for critical angle incidence becomes,

$n_1 \sin i_c = n_2 \sin 90^\circ$

$n_1 \sin i_c = n_2$

$\sin i_c = \frac{n_2}{n_1}$

$Here, \mathrm{n}_1 > \mathrm{n}_2$

n_1 - refractive index of denser medium = n

n_2 - refractive index of rarer medium = 1 (for air)

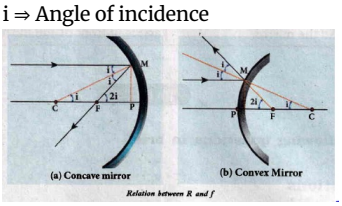
$\sin i_c = \frac{1}{n} (or) i_c = \sin^{-1}\left[\frac{1}{n}\right]$

Critical angle i_c depends on the refractive index n of the mediunm.

13. **Relation between f and R:**

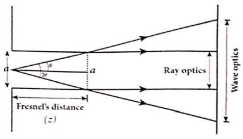
C ⇒ Center of curvature

F ⇒ Principal focus
i ⇒ Angle of incidence



The angles From right angle triangles ΔMCR, and ΔMFP,
$\tan i = \frac{PM}{PC}$ and $\tan 2i = \frac{PM}{PF}$
As the angles are small, tan i = i and tan 2i = 2i.
$i = \frac{PM}{PC}$ and $2i = \frac{PM}{PF}$
Simplifying further,
$2\frac{PM}{PC} = \frac{PM}{PF}; 2PF = PC, R = 2f$
PF is focal length f and PC is the radius of curvature R.
R = 2f (or) f = R/2

14. Fresnel's distance is the distance upto which the ray optics is valid in terms of rectilinear propagation of light.
(or)
Fresnel's distance is the distance upto which ray optics is obeyed and beyond which ray optics is not obeyed but, wave optics becomes significant,

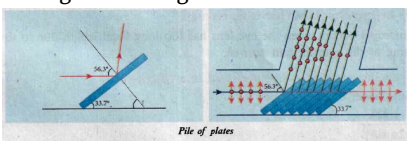


The diffraction equation for first minimum is, $\sin\theta = \frac{\lambda}{2}$;
When θ is small, $\theta = \frac{\lambda}{2}$
From the definition of Fresnel's distance, $2\theta = \frac{a}{z}$ (or) $\theta = \frac{a}{2z}$
Equating the above two equation for θ gives, $\frac{\lambda}{a} = \frac{a}{2z}$
After rearranging, we get Fresnel's distance z as,
$z = \frac{a^2}{2\lambda}$

15.

S.No	Polarised Light	Unpolarised Light
(i)	It consists of waves having their electric field vibrations in a single plane normal to the direction of ray.	It consists of waves having their electric field and magnetic field vibrations in all directions normal to the direction of ray.
(ii)	Asymmetrical about the ray direction	Symmetrical about the ray direction.
(iii)	|It is obtained by converting unpolarised light using polaroids.	Produced by conventional light sources.

16. **Plane Polarised Light:**
In plane polarised light the intensity varies from maximum to zero for every rotation of 90° of the analyser.
Partially Polarised Light:
If the intensity of light varies between maximum and minimum for every rotation of 90° of the analyser, the light is said to be partially polarised light.
Unpolarise Light:
The light is coming out from the source before entering a polarised is called unpolarized light.



17.
(i) Pile of plates makes use of Brewster's law to convert the partially polarised refracted light into plane polarised light.
(ii) It consists of several plates kept one behind the other at an angle 90° - i_p with the horizontal surface as shown in Figure.
(iii) This arrangement ensures that the parallel light falls on these plates at i_p. When this unpolarised light passes successively through these plates, the few parallel vibrations to the surface which may be present in the refracted light, get a chance for further reflections at the succeeding plates.
(iv) Thus, both the reflected and the refracted lights are found to be plane polarised.
Uses :
The pile of plates is used as a polarizer and also as an analyser.

18. **Advantages:**
Only one surface it to be polished and maintained. Support can be given from the entire back of the miror rather than only at the rim for lens. Mirrors weigh much less compared to lens.
Disadvantages:
The objective mirror would focus the light inside the telescope tube.

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QUESTION BANK 365

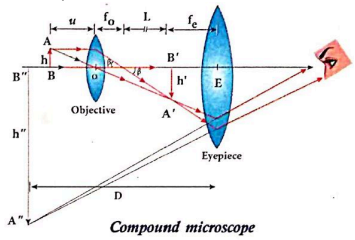
19. (i) It forms a real, inverted and magnified image of the object. This serves as the object for the lens close to the eye called as eyepiece.
(ii) The eyepiece serves as a simple microscope that produces finally an enlarged and virtual image.
(iii) The first inverted image formed by the objective is to be adjusted within the focus of the eyepiece so that the final image is formed nearly at infinity (or) at the near point.
(iv) The final image is inverted with respect to the object
Magnification of compound microscope:
(i) From the ray diagram, the linear magnification due to the objective is,

$M_0 = \frac{h'}{h}$ .....(1)

From the Figure, $tan\beta = \frac{h}{f_0} = \frac{h'}{L}$ then

$\frac{h'}{h} = \frac{L}{f_0}$ .....(2)

$m_0 = \frac{L}{f_0}$ .....(3)



Compound microscope

(ii) Here, the distance L is between the first focal point of the eyepiece to the second focal point of the objective. This is called the tube length of the microscope as f_0 and f_e are comparatively smaller than L.
(iii) If the final image is formed at (near point focussing); the magnification (m_e) of the eyepiece is,

$m_e = 1 + \frac{D}{f_e}$ .....(4)

The total magnification m in near point focusing is,

$m = m_0 m_e \left(\frac{L}{f_0}\right)\left(1 + \frac{D}{f_e}\right)$ .....(5)

If the final image is formed at infinity (normal focusing), the magnification m_e of the eyepiece is,

$m_e = \frac{D}{f_e}$ .....(6)

The total magnification m in normal focusing is,

$m = m_0 m_e = \left(\frac{L}{f_0}\right)\left(\frac{D}{f_e}\right)$ .....(7)

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PART-B

II.ANSWER ANY 6 OF THE FOLLOWING QUESTIONS.(Q.NO.24 IS COMPULSORY)

20. The power of a lens P is defined as the reciprocal of its focal length (in metre).
$P = \frac{1}{f}$

21. Angle of minimum deviation:
(i) The angle between the direction of incident ray and the emergent of a prism called the 'Angle of deviation' 'd'.
(ii) The minimum value of angle of deviation is called 'Angle of minimum deviation' 'D'.
At 'D' $i_1 = i_2$, $r_1 = r_2$

22. Dispersion is splitting of white light into its constituent colours. This band of Colours of light is called its spectrum.

23. **Salient features of corpuscular theory:**
(i) A luminous body emits tiny massless perfectly elastic particles called corpuscles.
(ii) As the corpuscles are very small, the source does not suffer appreciable loss of mass.
(iii) They are not affected by gravity. so they travel with high speed in a straight line.
(iv) When these corpuscles impinge on the retina of the eye, the vision is produced.
(v) The different size of corpuscles is the reason for different colors.
(vi) The reflection is due to repulsion of the corpuscles by the medium.
(vii) The refraction is due to the attraction of the corpuscles by the medium.
(viii) This theory could not explain the reason why the speed of light is lesser in denser medium than in denser medium and also the phenomena like interference, diffraction and polarisation.

24. **Wave theory of light:**
(i) According to Huygen's wave theory, light is propagated in the form of longitudinal waves through an invisible elastic medium called ether, which pervades all space.
(ii) Later Fresnel and Young suggested that light waves are transverse. Wave theory could satisfactorily explain reflection, refraction, interference diffraction and polarisation.
(iii) According to this theory, the velocity of light in a denser medium is lesser than that in a rarer medium.

25. **Electromagnetic wave theory of light:**
Light is an electromagnetic wave which is transverse in nature carrying electromagnetic energy. No medium is necessary for the propagation of electromagnetic waves. All the phenomenon of light could be successfully explained by this theory.

26. This is the most commonly used method for producing two coherent sources. If two points are chosen on the wavefront by using a double slit, the two points will act as coherent sources.

27. **Source and images**
In this method, a source and its image will act as a set of coherent source, because the source and its image will have waves in-phase or constant phase

difference.

Examples: Fresnel's Biprism, Lloyd's Mirror

28. The Phenomenon of restricting the vibrations of light to a particular direction perpendicular to the direction of wave propagation motion is called polarization of light.

PART-A

I. CHOOSE THE BEST ANSWER

29. $\frac{I}{f} = \left(\frac{\mu_L}{\mu_L} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

When the biconvex lens of glass dipped in liquid, it acts as a plane sheet of glass.

$\therefore f = \infty, \frac{1}{f} = 0 \quad \frac{\mu_g}{\mu_L} - 1 = 0; \frac{\mu_s}{\mu_L} = 1, \mu_s = \mu_L$

30. For total internal reflection,

sin i > sin c

$n = \frac{1}{\sin c}$

$\sin c = \frac{1}{n}$

$\sin i > \frac{1}{n}$

$n > \frac{1}{\sin i}$

n >$\sqrt{2}$

n >1.414 = 1.5

31. Refractive index for violet is more and wavelength for violet is very low comparing other colours. So, the letter which appears to be raised more is violet.

32. (b) 500 $\mathring{A}$

33. (d) polarisation

34. (b) $\sqrt{\frac{6hv_0}{m}}$

35. $P = \frac{n}{t}\frac{hc}{\lambda}$

$\frac{n}{t} = \frac{P\lambda}{hc}$

$\frac{n}{t} = \frac{3.8\times10^{26}\times550\times10^{-9}}{6.6\times10^{-34}\times3\times10^{8}} = 1\times10^{-15}$

36. $E = \frac{12400\mathring{A}}{4100\mathring{A}} = 3.02eV$

37. (c) thermionic

38. $V_{ionisation} = \frac{13.6}{n^2}Z^2 volt$

$Z = \sqrt{\frac{V\times n^2}{13.6}} = \sqrt{\frac{122.4\times I^2}{13.6}} = \sqrt{9} = 3$

39. $T_{A1/2} = T_B$

$\frac{0.6931}{\lambda_A} = \frac{1}{\lambda_B}$

$\lambda_B = \frac{\lambda_A}{0.6931} = 1.44\lambda_A$

Hence, B will decay at faster rate than A

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40. A = 1, B = 0, C = 1

y = A + B, y = (A + B).C

y = (1 + 0).1 ⇒ y = 1

41. (d) Steel and aluminum

42. Albert Einstein theoretically proposed the existence of gravitational waves in the year 1915.

43. (d) the higher concentration of electrons in the n-region than that in the p-region