PHYSICS

BOOKS - CBSE COMPLEMENTARY MATERIAL PHYSICS (HINGLISH)

ELECTROMAGNETIC WAVES AND OPTICS

Very Short Answer Question

1. Every EM wave has certain frequency. Name two parameters of an em wave that oscillate with this frequency.

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2. In electromagnetic wave, the phase difference between electric and magnetic field vactors E and B is

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3. Name em radiations used for detecting fake currency notes.

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4. Give any two uses of microwaves.

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5. Name the phenomenon which justifies the transverse nature of em waves.

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6. Arrange the following em waves in descending order of wavelengths : γ ray, microwaves UV radiations.

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7. Write expression for speed of em waves in a medium of electrical permittivity $\in$ and magnetic permeability μ

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8. Which of the following has longest penetration power? UV radiation, X-ray, Microwaves.

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9. Which of the following has least frequency ? IR radiations, visible radiation, radio waves.

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10. Which physical quantity is the same for microwaves of wavelength 1 mm and UV radiations of 1600 A^o in vacuum?

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11. Name two physical quantities which are imparted by an em wave to a surface on which it falls.

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12. Name the physical quantity with unit same as that of $\left| \in_0 \frac{d_\phi}{dt} \right|$ where $\phi_e \rightarrow$ electric flux.

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13. What is the source of energy associated with propagating em waves?

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14. A mirror is turned through 15°. Through what angle will the reflected ray turn ?

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15. Name the device used for producing microwaves.

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16. Relative electric permittivity of a medium is 9 and relative permeability close to unity. What is the speed of em waves in the medium.

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17. Identify the part of the electromagnetic spectrum to which the following wavelengths belong :

$10^{-1}m$

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18. Identify the part of the electromagnetic spectrum to which the following wavelengths belong :

$10^{-12}m$

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19. Name the part of the electromagnetic spectrum of wavelength $10^{-2}m$ and mention its one application.

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20. Which of the following, if any, act as a source of electromagnetic waves? (i) A charge moving with a constant velocity (ii) A charge

moving in a circular orbit (iii) A charge at rest.Give reason.

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21. Mention the pair of space and time varying E and B fields which would generate a plane em wave travelling in Z-direction.

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22. The charging current for a capacitor is 0.2A. What is the displacement current?

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23. Give the ratio of velocities of light rays of wavelength 4000Å and 8000Å in vacuum.

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24. Which physical quantity has the same value for waves belonging to the different parts of the electromagnetic spectrum?

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25. Write the value of angle of reflection for a ray of light falling normally on a mirror.

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26. How does the dispersive power of glass prism change when it is dipped in water?

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27. Name the phenomenon due to which one cannot see through fog.

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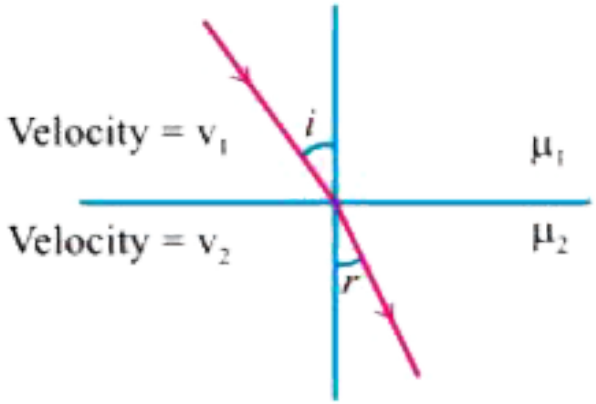
28. What is the ratio of sin i and sin r in terms of velocities in the given figure.



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29. What is the shape of fringes in Youngs double slit experiment ?

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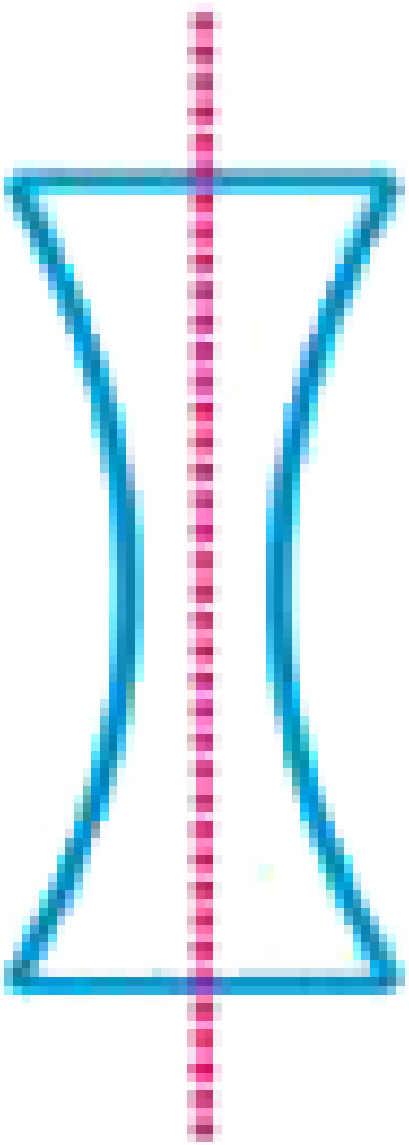
30. A equiconcave lens of focal length 15 cm is cut into two equal havles along dotted lines as shown in figure. What will be new focal length

of each half.



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31. For the same value of angle of incidence, the angles of refraction in three media A, B and C are $15^\circ, 25^\circ$ and 35° respectively. In which medium would the velocity of light be minimum ?

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32. What is the phase difference between any two points on a spherical wavefront?

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33. What is the 'power' of plane glass plate ?

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34. How does focal length of lens change when red light incident on it is replaced by violet light?

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35. Lower half of the concave mirror is painted black. What effect will this have on the image of an object placed in front of the mirror?

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36. An air bubble is formed inside water. Does it act as a converging lens or a diverging lens ?

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37. A water tank is 4 meter deep. A candle flame is kept 6 meter above the level μ for water is $4/3$. Where will the image of the candle be formed?

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38. The ratio of contributions made by the eletric field and magnetic field components to the intensity of an EM wave is.

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39. An EM wave of intensity 'I' falls on a surface kept in vacuum. What is the radiation pressure if wave is totally reflected?

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40. In a single slit diffraction pattern, how does the angular width of central maxima change when slit width is decreased

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41. In a single slit diffraction pattern, how does the angular width of central maxima change when distance between slit & screen is increased

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42. In a single slit diffraction pattern, how does the angular width of central maxima change when light of smaller visible wavelength is used ? Justify your answer.

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Short Answer Question 1 Mark

1. If the angle between the pass axis of polariser and analyser is 45°, write the ratio of intensities of original light and the transmitted light after passing through analyser.

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2. Light of wave lenght 600nm is incident normally on a slit of with 3mm. Calculate the angular width of central maximum on a screen kept 3m away from the steb.

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3. If the polarising angle for air glass interface is 56.3°, what is the angle of refraction in glass ?

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4. How does magnifying power change with change in length of tube for a given telescope ?

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5. The magnifying power of an astronomical telescope in the normal adjustment position is 100. The distance between the objective and eye piece is $101cm$. Calculate the focal lengths of objective and eye piece.

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Short Answer Question 2 Marks

1. Give one use of the UV ray

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2. Give one use of each of the following

y-ray

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3. Represent EM waves propagating along the x-axis in which electric and magnetic fields are along y-axis and z-axis respectively

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4. State the principles of production of EM waves. An EM wave of wavelength λ goes from vacuum to a medium of refractive index n. What will be the frequency of wave in the medium?

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5. An EM wave has amplitude of electric field E_0 and amplitude of magnetic field is B_0. The electric field at some instant become $\frac{3}{4}E_0$. What will be magnetic field at this instant? (Wave is travelling in vacuum).

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6. State two applications of infrared radiations

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7. State two applications of radio waves.

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8. State two applications of x-rays

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9. Show that the avearge energy density of the electric field $\vec{E}$ equals the average energy density of the magnetic field $\vec{B}$, in electromagnetic waves.

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10. Use mirror equation to deduce that an object placed between the pole and focus of a concave mirror produces a virtual and enlarged image.

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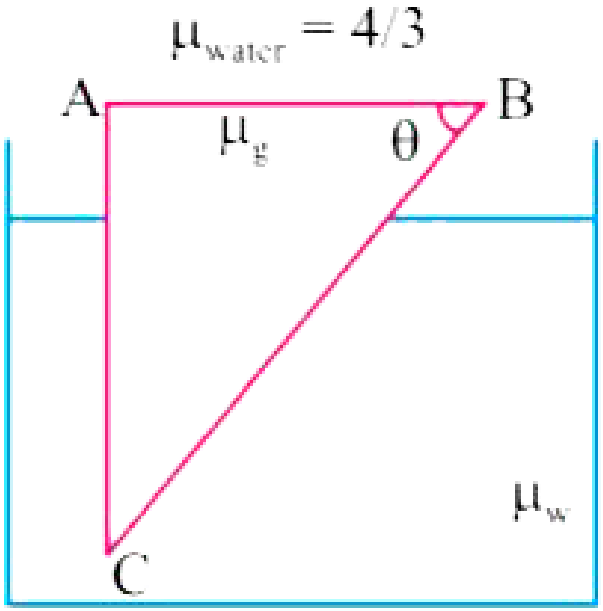
11. Calculate the value of θ, for which light incident normally on face AB grazes along the face BC.

$\mu_{glass} = 3/2$ and $\mu_{water} = 4/3$



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12. Name any two characteristics of light which do not change on polarisation

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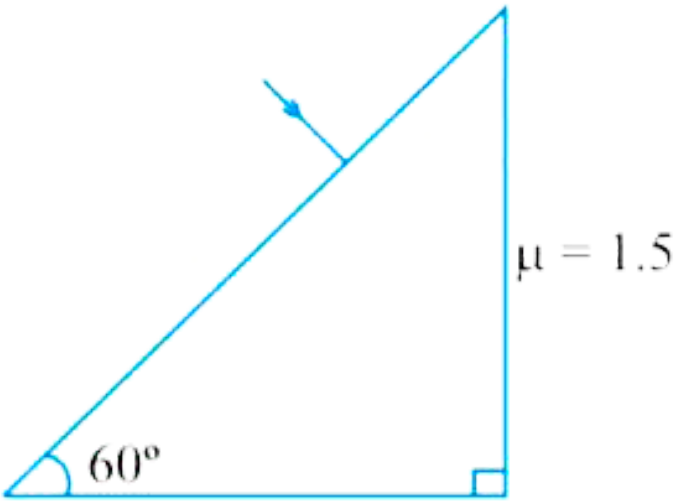
13. Complete the path of light with correct value of angle of emergence.



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14. Define diffraction. What should be the order of the size of the aperture to observe diffraction.

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15. Show that maximum intensity in interference pattern is four times the intensity due to each slit. Hence show that interference involves only redistribution of energy.

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16. Two poles-one 4 m high and the other is 4.5 m high are situated at distance 40 m and 50 m respectively from an eye. Which pole will appear taller

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17. S_1 and S_2 are two sources of light separated by a distance d. A detector can move along S_2 P perpendicular to S_1S_2. What should be the minimum and maximum path difference at the detector?

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18. If a jogger runs with constant speed towards a vehicle, how fast does the image of the jogger appear to move in the rear view mirror when

(i) the vehicle is stationery

(ii) the vehicle is moving with constant speed towards jogger.

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19. If the angle between the pass axis of polariser and analyser is 45°, write the ratio of intensities of original light and the transmitted light after passing through analyser.

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20. When does (i) a plane mirror and (ii) a convex mirror produce real image of objects

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21. A virtual cannot be caought on a screen, Yet when we see a virtual image, we bring it to the screen i.e., retina of our eye. This happnes because

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22. With a neat labelled diagram, explain advanced sunrise and delayed sunset.

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23. The image of a small electric bulb fixed on the wall of a room is to be obtained on the opposite wall $3m$ away by means of a large convex lens. What is the maximum possible focal length of the lens required for the purpose ?

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24. The angle subtended at the eye by an object is equal to the angle subtended at the

eye by the virtual image produced by a magnifying glass. In what sense then does magnifying glass produce angular magnification?

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25. Two independent light sources cannot act as coherent sources. Why?

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26. How is a wave front different from a ray? Draw the geometrical shape of the wavefronts when.

light diverges from a point source,

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27. What two main changes in diffraction pattern of a single slit will you observe, when the monochromatic source of light replaced by a source of white light

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28. You are provided with four convex lenses of focal length 1cm, 3cm, 10 cm and 100 cm. Which two would you prefer for a microscope and which two for a telescope.

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29. Give reasons for the following

Sun looks reddish at sunset

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30. Why do clouds generally look white ?

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31. Using Huygens' principle for the wave theory of light, verify the law of refraction.

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32. Using Huygens' principle for the wave theory of light, verify the law of refraction.

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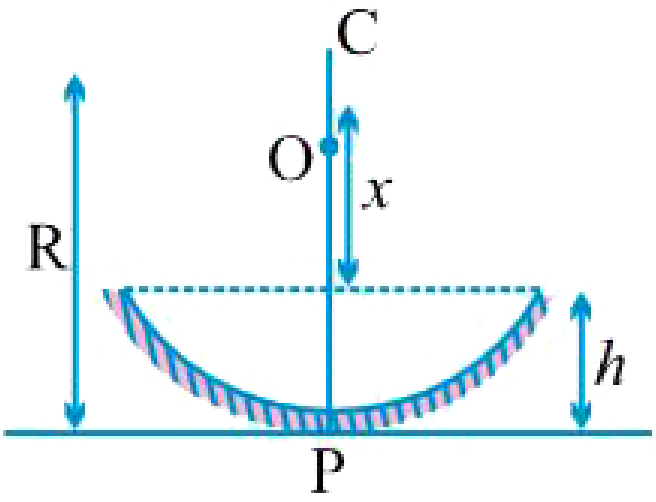
33. Water (refractive index μ) is poured into a concave mirror of radius of curvature 'R' up to a height h as shown in figure. What should be the value of x so that the image of object 'O' is

formed on itself?



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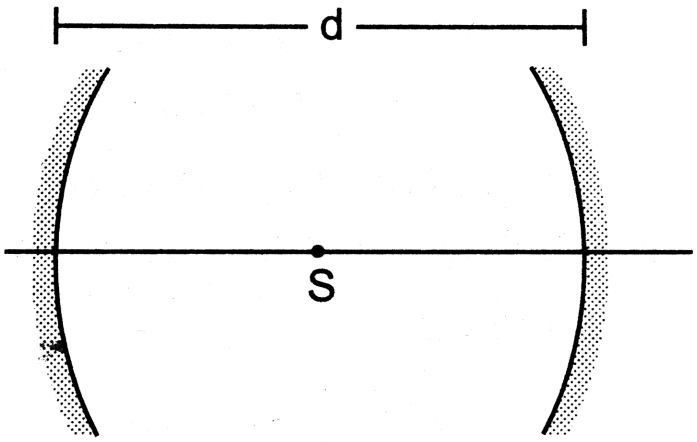
34. A point source S is placed midway between two converging mirrors having equal focal length f as shown in figure. Find the values of

d for which only one image is formed.



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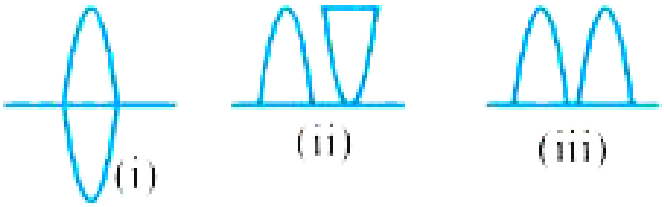
35. A thin double convex lens of focal length f is broken into two equal halves at the axis. The two halves are combined as shown in figure. What is the focal length of combination in (ii)

and (iii).



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36. How much water should be filled in a container of height $21cm$, so that it appears half filled to the observer when viewed from the top of the container $(\mu = 4/3)$.

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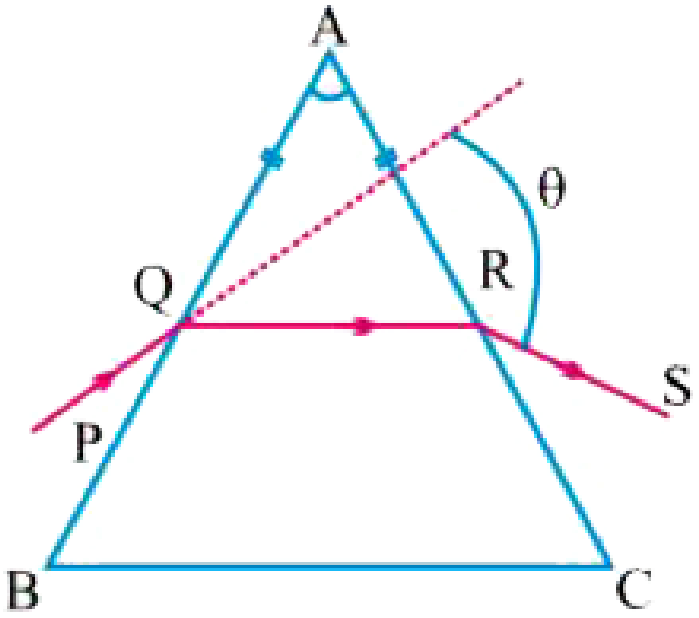
37. A ray PQ incident on the refracting face BA is refracted in the prism BAC as shown in figure and emerges from the other refracting face AC as RS such that AQ = AR. If the angle, of prism A = 60° and μ of material of prism is then find angle θ .



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Short Answer Questions 3 Marks

1. Name EM radiations used

For detecting flow in pipes carrying oil.

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2. Name EM radiations used

In sterilizing surgical instruments.

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3. Obtain the formula for combined focal length of two thin lenses in contact, taking one divergent and the other convergent.

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4. Explain with reason, how the resolving power of a compound microscope will change when (i) frequency of the incident light on the objective lens is increased, (ii) focal length of

the objective lens is increased, (iii) aperture of objective lens is increased.

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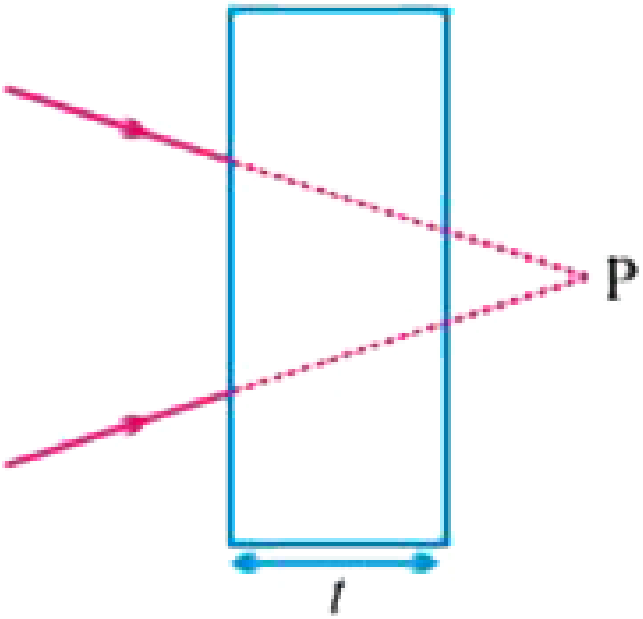
5. A converging beam of light is intercepted by a slab of thickness t andrefractive index μ, By what distance will the convergence point be

shiffted? Illustrate the answer.



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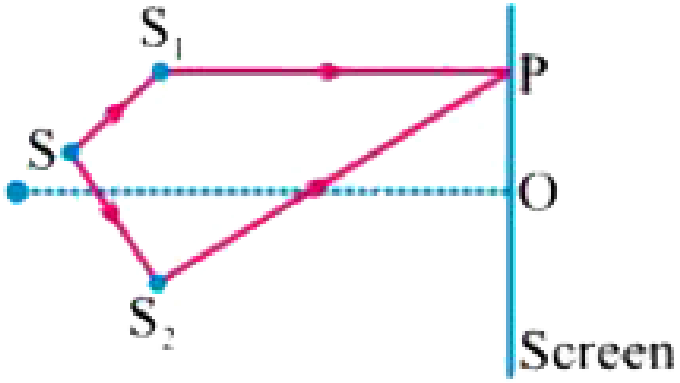
6. In double slit experiment SS_2 is greater than SS_1 by 0.25λ. Calculatethe path

difference between two interfering beam from S_1 and S_2 forminima and maxima on the point P as shown in figure.



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Long Answer Question

1. Draw course of rays through a compound microscope. Deduce an expression for its magnifying power. How can the magnifying power be increased ?

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2. Derive lens maker's formula for a thin convex lens.

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3. How will the interference pattern in Youngs double slit experiment change, when distance between the slits S_1 and S_2 are reduced

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4. How will the interference pattern in Youngs double slit experiment change, when the entire set up is immersed in water ?

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Numericals

1. A monochromatic beam of light of wavelength $6000A$ in vacuum enters a medium of refractive index 1.5. In the medium its wavelength is...., its frequency is.....

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2. An EM wave is travelling in vacuum. Amplitude of the electric field vector is

$5 \times 10^4 V/m$. Calculate amplitude of magnetic field vector

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3. Suppose that the electric field amplitude of an electromagnetic wave us $E_0 = 120 N/C$ and that its frequency is $50.0 MHz$.

(a) Determine B_0, ω, k and λ,

(b) find expressions for E and B.

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4. Suppose that the electric field amplitude of an electromagnetic wave us $E_0 = 120N/C$ and that its frequency is $50.0MHz$.

(a) Determine B_0, ω, k and λ,

(b) find expressions for E and B.

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5. An EM wave travelling through a medium has electric field vector.

$E_y = 4 \times 10^5 \cos\left(3.14 \times 10^8 t - 1.57x\right) N/C.$

Here x is in m and t in s. Then find :

Wavelength

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6. An EM wave travelling through a medium has electric field vector.

$E_y = 4 \times 10^5 \cos\left(3.14 \times 10^8 t - 1.57x\right) N/C.$

Here x is in m and t in s. Then find :

Frequency

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7. An EM wave travelling through a medium has electric field vector.

$E_y = 4 \times 10^5 \cos\left(3.14 \times 10^8 t - 1.57x\right) N/C.$

Here x is in m and t in s. Then find :

Direction of propagation

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8. An EM wave travelling through a medium has electric field vector.

$E_y = 4 \times 10^5 \cos\left(3.14 \times 10^8 t - 1.57x\right) N/C.$

Here x is in m and t in s. Then find :

Speed of wave

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9. An EM wave travelling through a medium has electric field vector.

$E_y = 4 \times 10^5 \cos\left(3.14 \times 10^8 t - 1.57x\right) N/C.$

Here x is in m and t in s. Then find :

Refractive index of medium

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10. An EM wave travelling through a medium has electric field vector. $E_y = 4 \times 10^5 \cos\left(3.14 \times 10^8 t - 1.57x\right) N/C.$ Here x is in m and t in s. Then find :

Amplitude of magnetic field vector.

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11. An object of length 2.5 cm is placed at a distance of 1.5 f from a concave mirror where f is the focal length of the mirror. The length of object is perpendicular to principal axis. Find

the size of image. Is the image erect or inverted?

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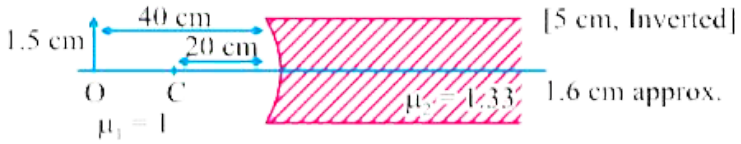
12. Find the size of image formed in the situation shown in figure.



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13. A ray of light passes through an equilateral glass prism in such a manner that the angle of incidence is equal to the angle of emergence and each of these angles is equal to $3/4$ of the angle of the prism. The angle of deviation is

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14. Critical angle for a certain wavelength of light in glass is 30°. Calculate the polarising

angle and the angle of refraction in glass corresponding to this.

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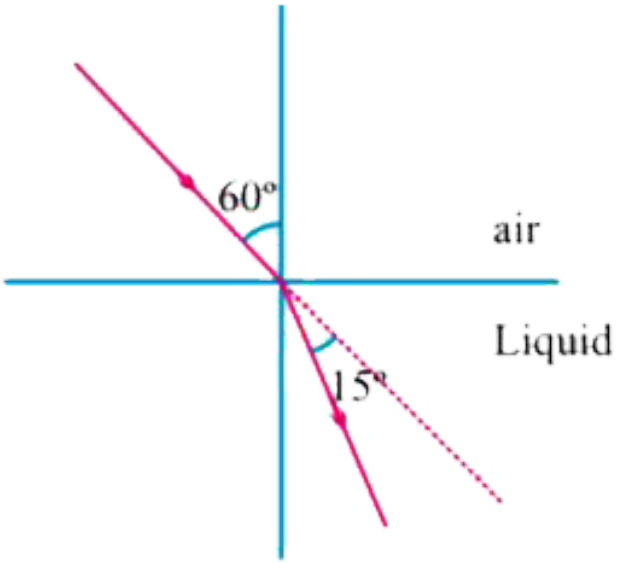
15. A light ray passes from air into a liquid as shown in figure. Find refractive index of liquid.



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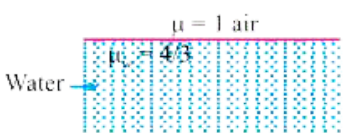
16. At what angle with the water surface does fish in figure see the setting sun ?



$[C = \text{Sin}^{-1}(0.7518)]$

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17. Three immiscible liquids of densities $d_1 > d_2 > d_3$ and refractive indices $\mu_1 > \mu_2 > \mu_3$ are put in a beaker. The height

of each liquid column is $\frac{h}{3}$. A dot is made at the bottom of the beaker. For near normal vision, find the apparent depth of the dot.

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18. A point object O is kept at a distance of 30 cm from a convex lens of power + 4D towards its left. It is observed that when a convex mirror is kept on right side at 50 cm from the lens, the image of object O formed by lens-

mirror combination coincides with object itself. Calculate focal length of mirror

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19. Using the data given below, state which two of the given lenses will be preferred to construct a (i) telescope (ii) Microscope. Also indicate which is to be used as objective and as eyepiece in each case

Lenses	Power (p)	Apetune (A)
L_1	6 D	1 cm
L_2	3 D	8 cm
L_3	10 D	1 cm

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20. Two thin converging lens of focal lengths 15 cm and 30 cm respectively are held in contact with each other. Calculate power and focal length of the combination.

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21. An object is placed in front of a concave mirror of focal length 20 cm. The image formed is three times the size of the object.

Calculate two possible distances of the object from the mirror?

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22. The focal lengths of objective and eye piece of a microscope are $1.25cm$ and $5cm$ respectively. Find the position of the object relative to the objective in order to obtain an angular magnification of 30 in normal adjustment.

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23. A small telescope has an objective lens of focal length $150cm$ and and eye piece of focal length $5cm$. If his telescope is used to view a $100m$ high tower $3km$ away, find the height of the final image when it is formed $25cm$ away from the eye piece.

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1 Mark Question

1. Which part of electromagnetic spectrum is used in operating a RADAR ?

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2. How are electromagnetic waves produces by oscillating charges ? Draw a sketch of linearly polarised em waves propagating in z-direction. Indicate the direction of oscillating electric and magnetic fields

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3. Name the radiation of the electromagnetic spectrum which is used for the following:

(i) Radar (ii) Eye surgery

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4. Name the radiation of the electromagnetic spectrum which is used for the following:

To photograph internal parts of human body

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5. Name the radiation of the electromagnetic spectrum which is used for the following:taking photographs of the sky during night and foggy conditions Give the frequency range .

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6. Two polaroid A and B are kept in crossed position. How should a third polaroid C be placed between them so that the intensity of

polarized light transmitted by polaroid B reduces to $\frac{1}{8}th$ of the intensity of unplarised light incident on A ?

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7. In Young's double slit experiment using monochromatic light of wavelength λ, the intensity of light at a point on the screen where path diff. is λ is K units. Find the intensity of light at a point where path difference is $\lambda/3$.

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8. Two nicols are so oriented that the maximum amount of light is transmitted. To what fraction of its maximum value is the intensity of transmitted light reduced when the analyser is rotated through (i) 30° (ii) 60° ?

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9. Two nicols are so oriented that the maximum amount of light is transmitted. To what fraction of its maximum value is the intensity of transmitted light reduced when the analyser is rotated through (i) 30° (ii) 60° ?

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10. Laser light of wavelength $630nm$ incident on a pair of slits produces an interference

pattern where bright fringes are separated by $8.1mm$. Another light produces the interference pattern, where the bright fringes are separated by $7.2mm$. Calculate the wavelength of second light.

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11. A beam of light consisting of two wavelength $800nm$ and $600nm$ is used to obtain the interference fringes in YDSE on a screen held $1.4m$ away. If the two slits are

separated by $0.28mm$, calculate the least distance from thecentral bright maximum, where the bright fringes of the two waveength coincide.

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