OPTICS

24. Draw a neat labelled ray diagram of an astronomical telescope in normal adjustment.

[Delhi 2008, All India 2010, 2016, 2017]

25. Draw a schematic ray diagram of reflecting telescope showing how ray coming from a distant object are received at the eye-piece.

[Delhi 2008, 2016, Foreign 2010]

26. Draw a neat labelled ray diagram of a compound microscope.

[Foreign 2008, All India 2010, Delhi 2008, 2009, 2010, 2014]

27. Draw a ray diagram, showing the passage of a ray of light through a prism when the angle of incidence is 52°.

[Delhi 2010C]

28. A ray of monochromatic light is incident on one of the faces of an equilateral triangular prism of refracting angle A. Trace the path of ray passing through the prism.

[Foreign 2011]

29. An equiconvex lens of refractive index μ_1 focal length $'f'$ and radius of curvature 'R' is immersed in a liquid of refractive index μ_2. For (i) $\mu_2 > \mu_1$ and (ii) $\mu_2 < \mu_1$, draw the ray diagrams in the two cases when a beam of light coming parallel to the principal axis is incident on the lens.

[All India 2013C]

30. Draw a labelled ray diagram of a refracting telescope.

[All India 2013, Delhi 2013C]

31. Draw a diagram to show refraction of a plane wavefront incident on a convex lens and therefore draw the refracted wavefront.

[Delhi 2009]

32. Plot a graph showing the variation of stopping potential with the frequency of incident radiation for two different photosensitive materials having work function W_1 and $W_2 (W_1 > W_2)$.

[Delhi 2010]

33. Show the variation of photocurrent with collector plate potential for different intensities but same frequency of incident radiation.

[Foreign 2011]

34. Draw a graph between the frequency of incident radiation (n) and the maximum kinetic energy of the electrons emitted from the surface of a photosensitive material.

[Foreign 2012, Delhi 2014]

35. Show on a plot the nature of variation of photoelectric current with the intensity of radiation incident on a photosensitive surface.

[Delhi 2013C, 2014]

36. In Young's double slit experiment, plot a graph showing the variation of fringe width versus the distance of the screen from the plane of the slits keeping other parameters same.

[All India 2015]

37. Sketch the graphs showing variation of stopping potential with frequency of incident radiations for two photosensitive materials A and B having threshold frequencies$V_A > V_B$.
    (i) In which case is the stopping potential more and why?
    (ii) Does the slope of the graph depend on the nature of the material used? Explain.

[All India 2016]

38. Draw a graph showing the variation of intensity (I) of polarized light transmitted by an analyser with angle (θ) between polarizer and analyser.

[All India 2016]

39. Draw a proper diagram to show how the incident wavefront traverses through the lens and after refraction focusses on the focal point of the lens, giving the shape of the emergent wavefront.

[All India 2016]

40. Plot a graph showing variation of de-Broglie wavelength λ versus $\frac{1}{\sqrt{V}}$, where V is accelerating potential for two particles A and B carrying same charge but of masses $m_1, m_2 (m_1 > m_2)$.

[Delhi 2016]

41. Draw a graph showing variation of intensity in the interference pattern against position 'x' on the screen.

[Delhi 2016]

42. Plot a graph to show variation of the angle of deviation as a function of angle of incidence for light passing through a prism.

[Delhi 2016]

43. Draw the intensity pattern for single slit diffraction and double slit interference.

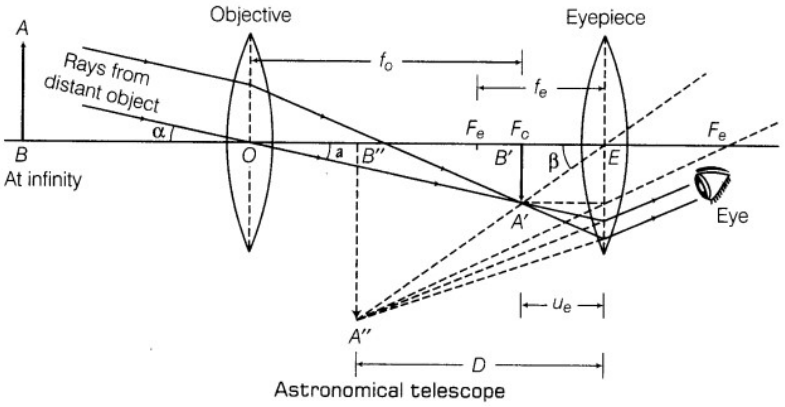
[All India 2017]

44. Draw a ray diagram to show the image formation by a combination of two thin convex lenses in contact.

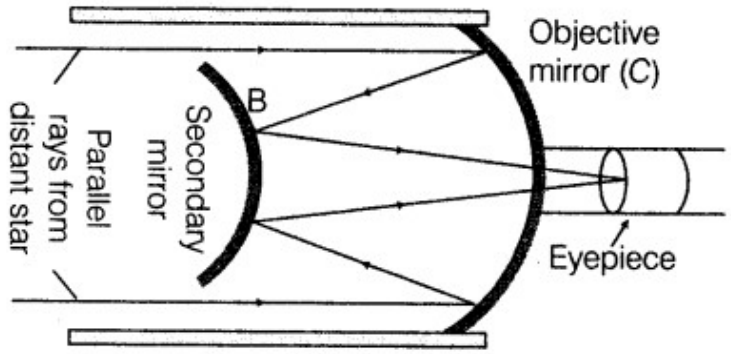
[All India 2017]

SOLUTIONS

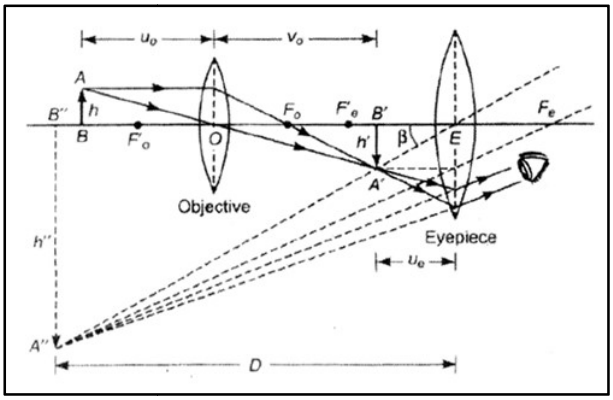
24. Ray diagram of an astronomical telescope in normal adjustment.



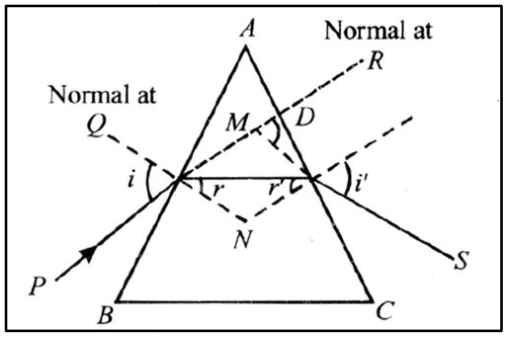
25. The ray diagram of reflecting telescope showing how ray coming from distant object are received at the eye-piece is shown in figure.



26. Ray diagram of a compound microscope:



27. The ray diagram in the condition of minimum deviation . Angle of incidence ∠i = 52°



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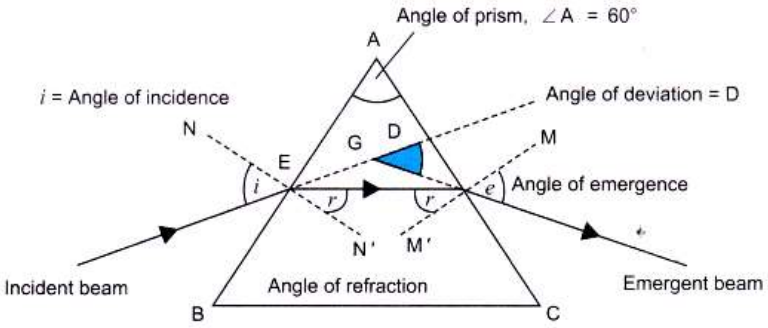
28. Ray passing through a prism.



Refraction of light through a prism

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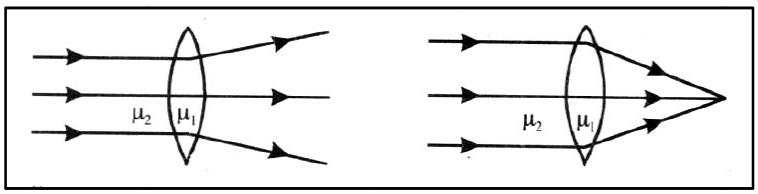
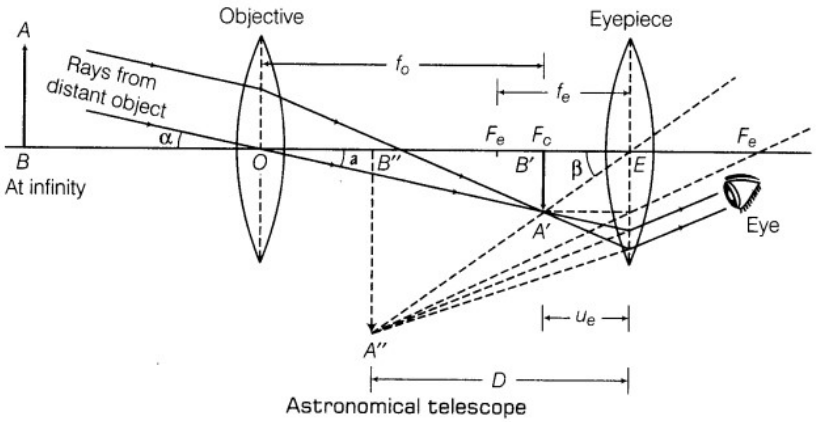
29. (i) Ray diagram: for $\mu_2 > \mu_1$ (ii) Ray diagram: for $\mu_2 > \mu_1$



30. Ray diagram of a refracting type telescope.



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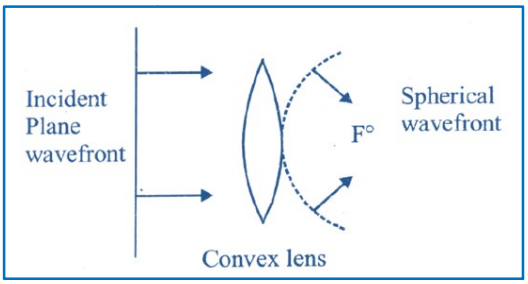
31. Diagram showing refraction of a plane wavefront



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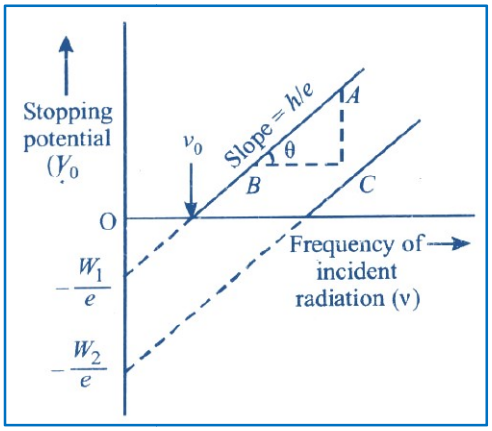
32. The variation of stopping potential with frequency of incident radiation .



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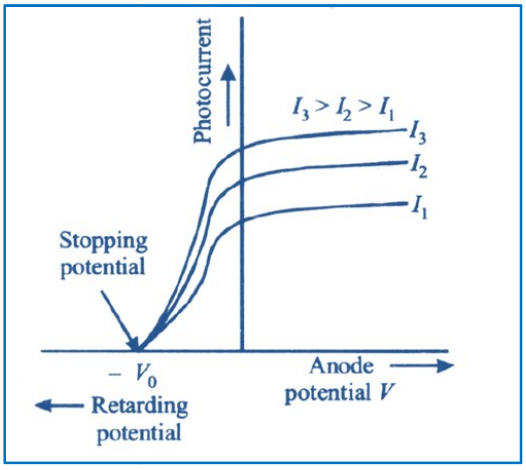
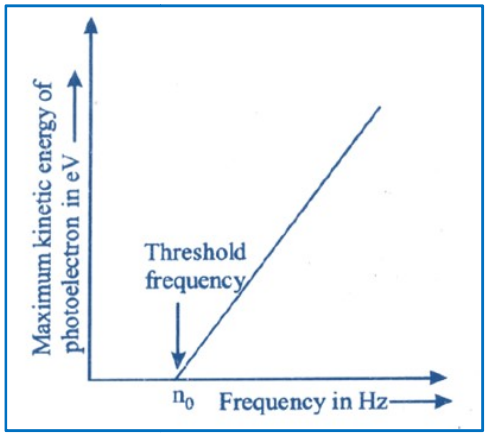
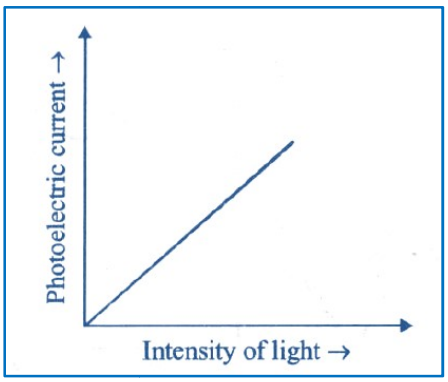
33. The variation of photocurrent for different intensities at constant frequency .



34. Graph between the frequency of incident radiation and the maximum kinetic energy of the electrons emitted.



35. Graph of photoelectric current versus intensity of light



36. The fringe width in Young's double slit experiment is given by

$\beta = \frac{\lambda D}{d}$

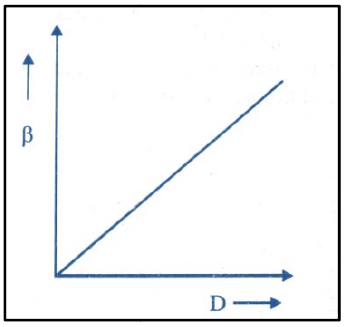
where λ = wavelength of source

D = distance between the slits and screen

d = distance between the slits

$\Rightarrow \beta \propto D$

The variation of fringe width with distance of screen from the slits



It is linear graph with slope equal to λ/d. So for the fringe width to vary linearly with distance of screen from the slits, the ratio of wavelength to distance between the slits should remain constant. Therefore, we take wavelengths (λ) of incident light almost equal to the width of the slit(β).

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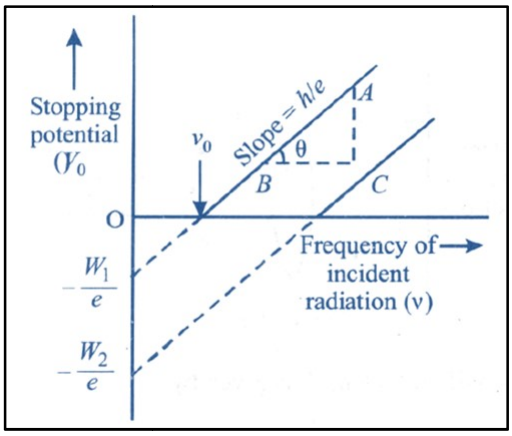
37. The variation of stopping potential with frequency of incident radiation for two photosensitive materials A and B having threshold frequencies



$v_A > v_B$.

From the graph, we see

(i) the stopping potential is inversely proportional to the threshold frequency, hence the stopping potential is higher for metal B.

(ii) the slope of the graph does not depend on the material used

As we know, from Einsteins photoelectric equation,

$K_{max} = h\nu - \phi_0 = eV_0$

Dividing by e, we get

$\frac{h\nu}{e} - \frac{\phi_0}{e} = V_0$

Hence the slope of the graph is $\frac{h}{e}$ (on comparing with the straight line equation) which is independent of the nature of the photoelectric material used.

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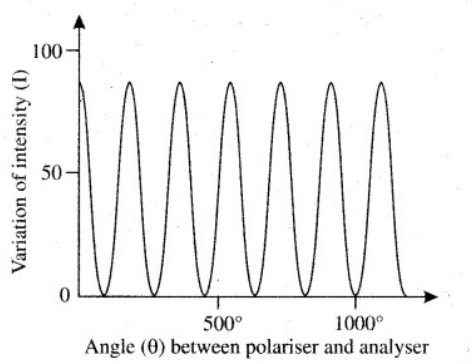
38. Variation of Intensity through Analyser



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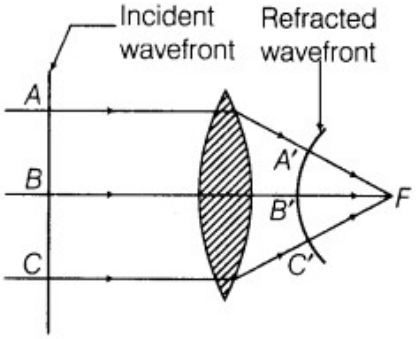
39. Diagram showing how the incident wavefront traverses through the lens.



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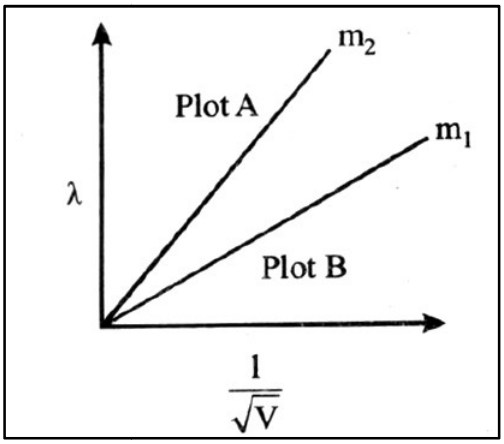
40. The de Brogile wavelength is given by $\lambda = \frac{h}{\sqrt{2mqV}}$ Where h- Planck's constant

The slope of the graph λ versus $\frac{1}{\sqrt{V}}$ is $\frac{h}{\sqrt{2mq}}$



The slope of the smaller mass (m_2) is larger; therefore, plot A in the above graph is for mass m_2

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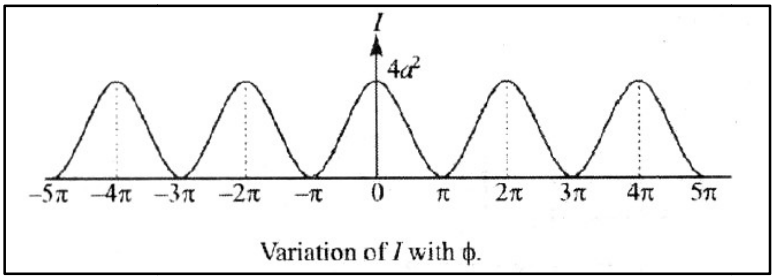
41. Graph of intensity distribution in Young's double-slit experiment



Variation of I with ϕ.

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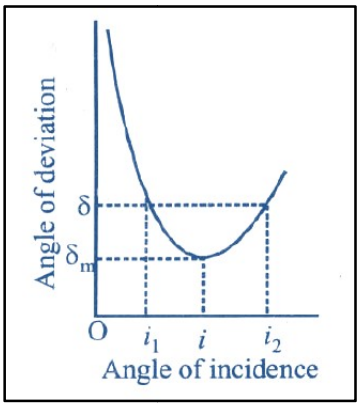
42. (i) If the angle of incidence is increased gradually, then the angle of deviation first decreases, attains a minimum value (δ_m) and then again starts increasing.



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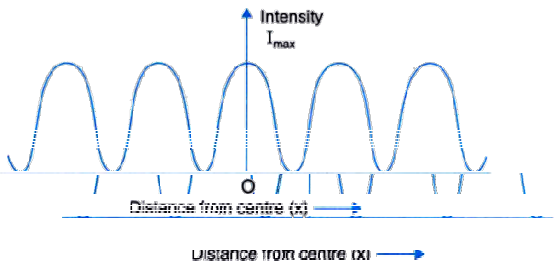
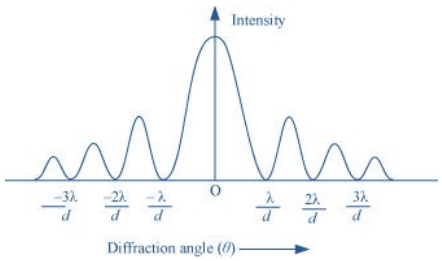
43. Intensity pattern for single slit diffraction



Intensity pattern for double slit diffraction



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44. (a) Ray diagram to show the image formation by a combination of two thin convex lenses in contact:

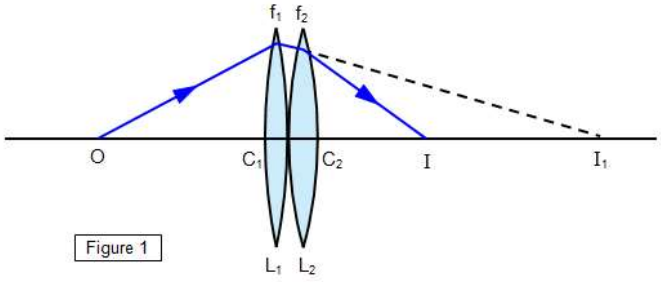

Figure 1