

India's Number 1 Education App

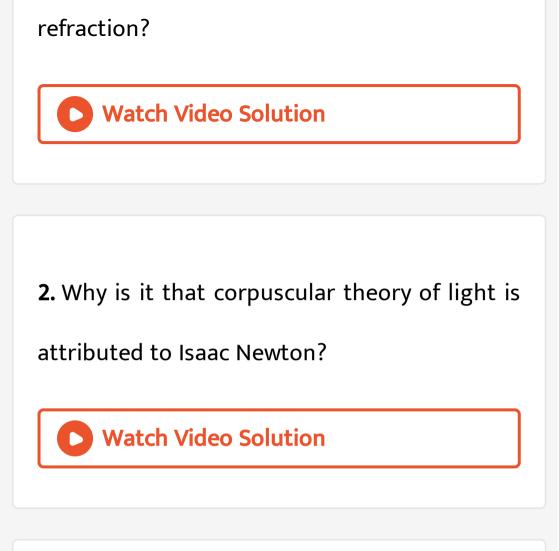
PHYSICS

BOOKS - JEEVITH PUBLICATIONS PHYSICS (KANNADA ENGLISH)

WAVE OPTICS

One Marks Questions With Answers

1. Name the person who gave the corpuscular model of light and derived Snell's law of



3. Who proposed the wave nature of light?

4. Who experimentally verified that the speed

of light in water is less than the speed of light

in air?



5. Name the physicist who established the wave nature of light.

6. Inspite of the wave nature of light, why is

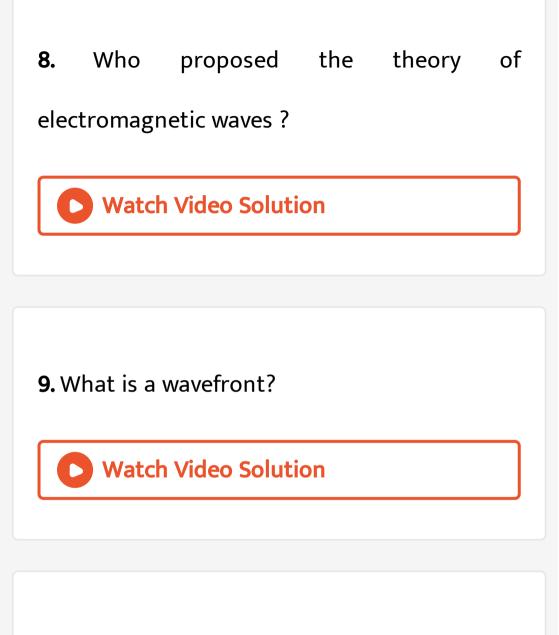
light assumed to travel in a straight line?



7. Name the branch of optics which neglects

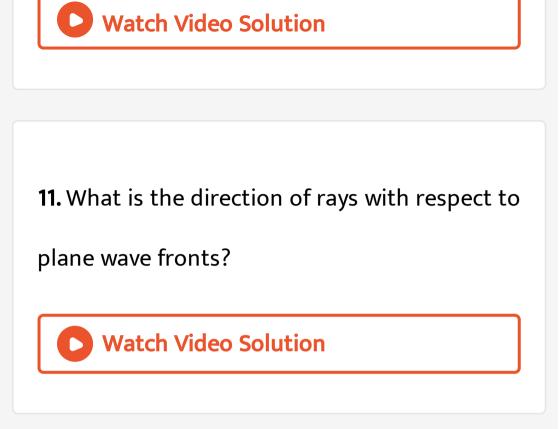
the wavelength $(\lambda
ightarrow 0)$ of light.





10. What is the shape of a wavefront at a large

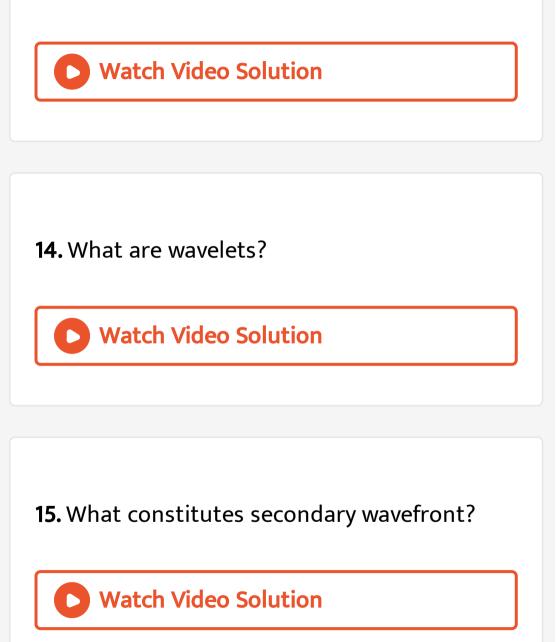
distance away from a point source?



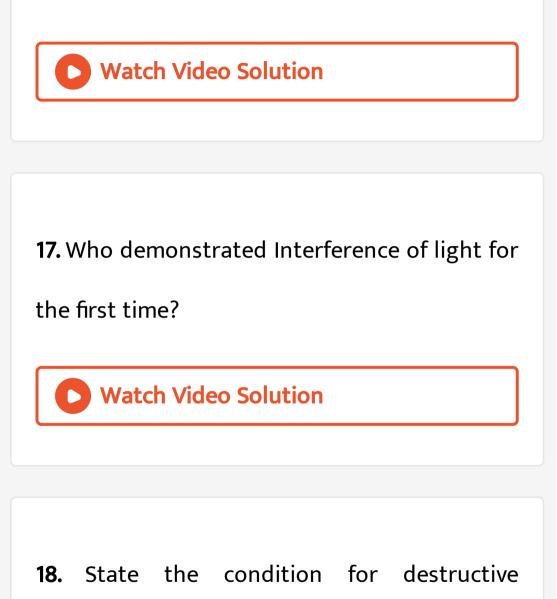
12. What is the shape of a wavefront due to a

spherical or point source?

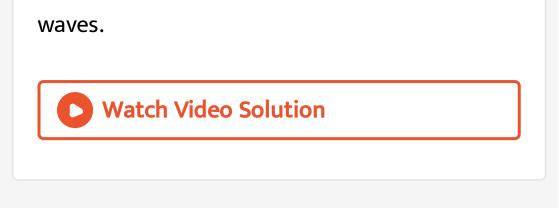
13. What is a primary disturbance?



16. What is interference of light?



interference in terms of path between the two



19. State the condition for constructive interference in terms of path difference between the two waves.

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20. State the condition for constructive interference in terms of phase difference

between the two waves.

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21. State the condition for destructive interference in terms of path between the two waves.

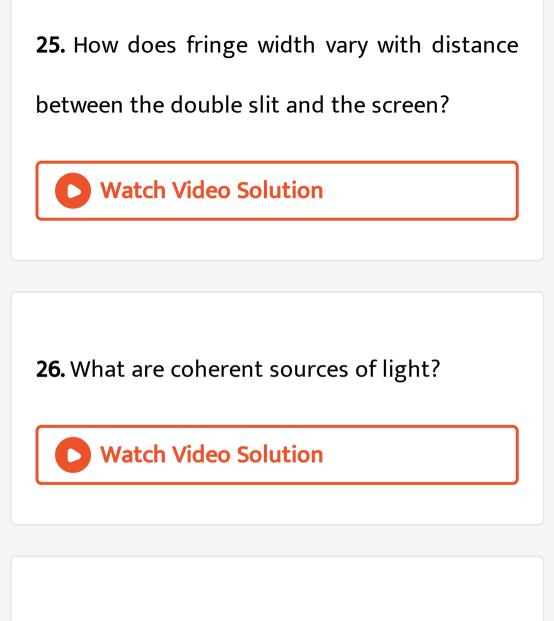
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22. What is fringe width?

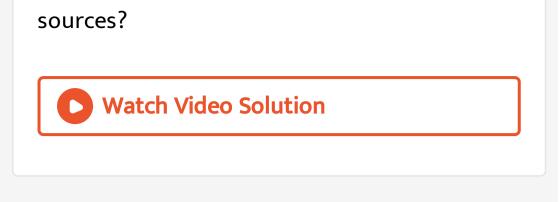
23. How does fringe width vary with wave length?



24. How does fringe width vary with slit separation?



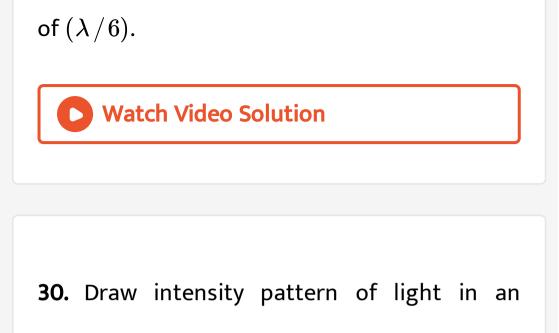
27. What is the principle behind young's double slit experiment in obtaining coherent



28. Does the law of conservation of energy hold good at the point of destructive interference?

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29. Calculate phase difference between the two waves corresponding to a path difference



interference of light waves.

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31. What is diffraction of light?

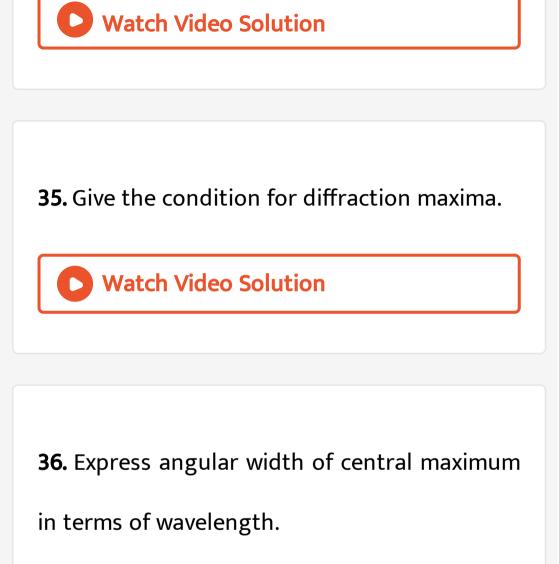
32. Who discovered the phenomenon of diffraction of light?
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33. State the condition for diffraction of light

to take place.



34. Give the condition for diffraction minima.





37. Give the expression for linear width of

central maximum.

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38. How does the width of central maximum

vary with the wavelength of light used?

39. How does width of central maximum vary

with the width of the slit used?

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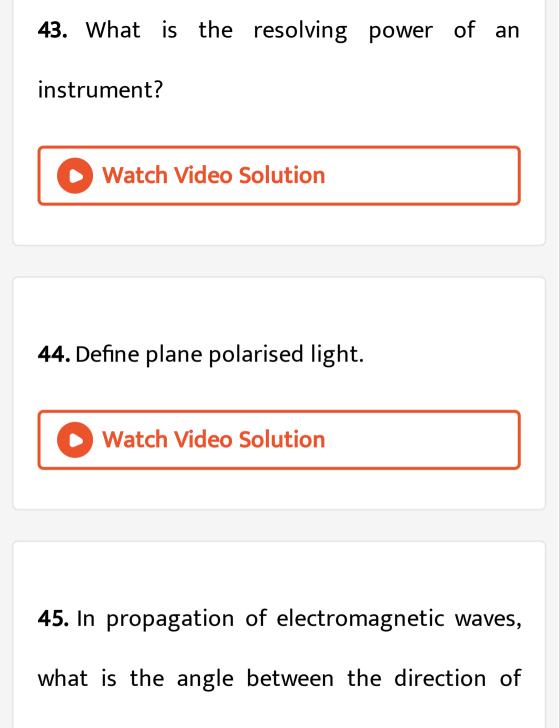
40. Compare the intensity of first secondary maximum with the intensity of central maximum for the single slit fraunhoffer diffraction pattern.

41. Compare the intensity of second secondary maximum with the intensity of central maximum for the single slit Fraunhofer diffraction pattern.

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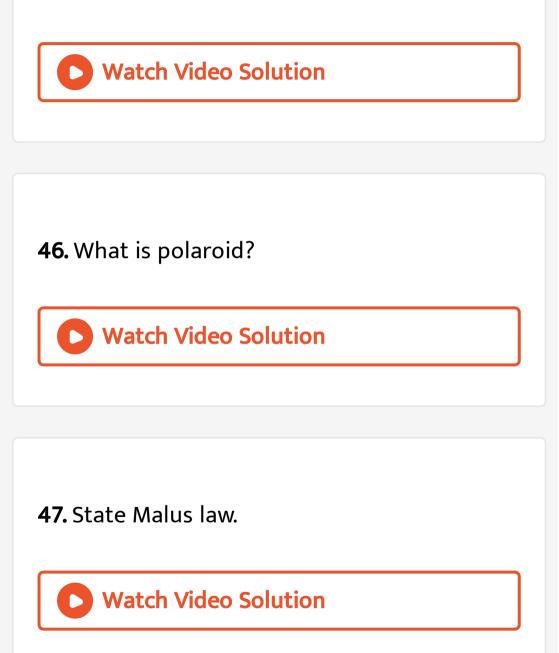
42. What type of wave front is used in

Fraunhofer diffraction?



propagation of the wave and the plane of

polarisation?

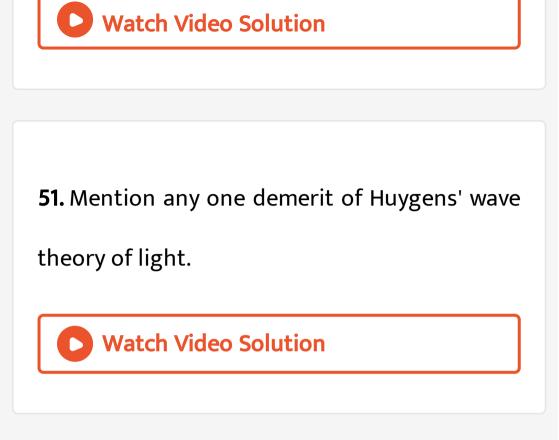


48. Say whether radio signals are plane polarised or circularly polarised?
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49. What properties are attributed to ether medium?



50. What is ether?



52. Mention any one demerit of newton's

corpuscular theory of light



53. How did Newton account for different colours of light?
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Two Marks Questions With Answers

1. When are two identical waves said to

interfere (a) constructively (b) destructively?

2. Give any two characteristics of interference

of light waves.

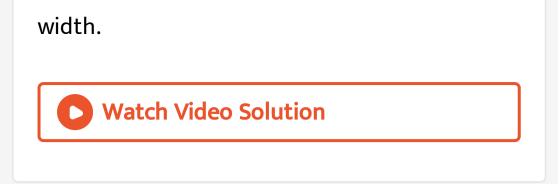


3. Compare width of slits with the intensity

and hence amplitude of the waves.

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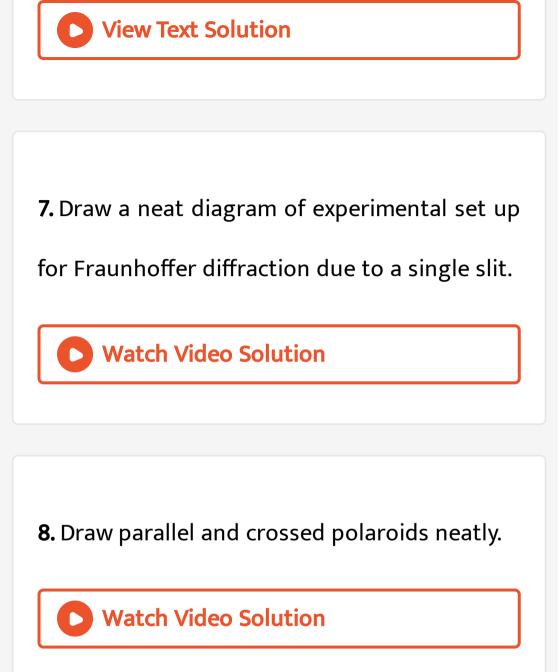
4. If the apparatus used in YDSE is immersed in water then what will happen to the fringe



5. A thin glass plate is introduced in front of one of the double slits. What will happen to the fringe width?

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6. Draw a neat labelled diagram of diffraction image of an object.



9. Name the scientists associated with the discovery of Polarisation by reflection
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10. Name the scientists associated with the discovery of

(ii) Birefringence.

11. What is meant by an unpolarised wave?



12. Draw a neat labelled diagram to show the

real image formed by the objective lens of the microscope.



13. What is meant by red shift and blue shift?



14. In what way is diffraction from each slit related to interference pattern in a double slit experiment?

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15. Answer the following questions:

(c) When a tiny circular obstacle is placed in

the path of light from a distant source, a

bright spot is seen at the centre of the

shadow of the obstacle. Explain why?



16. Give the expression for limit of resolution

of a microscope along with the meaning of the

symbols used.



17. Give the expression for limit of resolution

of a telescope along with the explanation of

the symbols used.



Three Marks Questions With Answers

1. State any three conditions for a sustained

interference of light waves.

2. Give the formula for the linear separation of

bright and dark fringes.



3. Give the formula for angular separation of

bright and dark fringes.

4. Compare $I_{
m max}$ and $I_{
m min}$ with amplitudes of

the interfering waves.

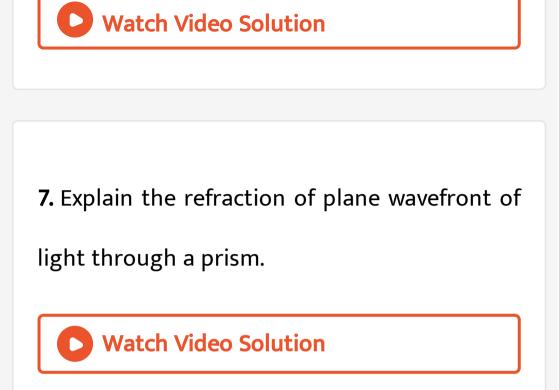
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5. What is Doppler effect in light? Write the

expression for Doppler shift.

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6. Mention any three application of polaroids

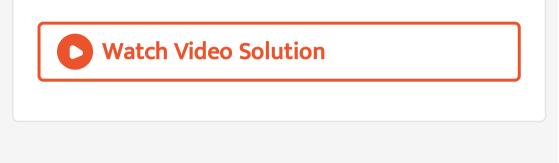


8. Explain the refraction of plane wavefront of

light through a convex lens.

9. Explain the refraction of plane wavefront of

light in a concave mirror.



Five Marks Questions With Answers

1. Prove Snell's law of refraction by using

Huygens's concept of plane wavefronts.

2. Explain refraction of light from a denser to a

rear medium, using the concept of wavefronts.



3. Using Huygens principle, show that the angle of incidence is equal to angle of reflection during a plane wave front reflected by a plane surface.

4. Describe an experimental set up to Young's

double slit experiment.

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5. Obtain the expression for fringe width in

the case of interference of light waves.

6. Show that two waves interfere constructively when the path difference them is an integral multiple of wave length.



7. Show that two waves interfere destructively

when the path difference between them is an

odd multiple of half wavelength.



8. S.T. for a constructive interference of two identical and coherent light waves, the maximum intensity is four times the intensity of individual waves and zero for a destructive interference.

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9. Give an account of the analysis of Fraunhoffer diffraction due to a single slit.



10. Prove Brewster's Law.

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11. Write any three difference between

interference and diffraction.

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Numericals With Solutions

1. In young's double slit experiment using a source of light of wavelength 5000 $\stackrel{\circ}{A}$, the bandwidth obtained is 0.6 cm. If the distance between the screen and the slit is reduced to half, what should be the wavelength of the source to get fringes 0.003m wide?



2. In young's double slit experiment , two slits 0.18 mm apart illuminated by a light of wavelength 589.3 nm. Calculate the distance of

(i) 5^{th} bright and (ii) 3^{rd} dark fringes from the midpoint of the interference pattern obtained on a screen kept 0.6 m away from the slits.

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3. In young's double slit experiment, the total width of 10 fringes is observed as $2 \times 10^{-3}m$ and the slits are separated by the distance of $2 \times 10^{-3}m$. Find the distance between the slits and the screen, when a light of wavelength 6000 \mathring{A} is used.



4. In young's double slit experiment, distance between the slits is `1mm. The fringe width is found to be 0.6 mm. When the screen is moved through a distance of 0.25 m, the fringe width becomes 0.75 mm. Find the wavelength of light used.

5. Calculate the distance between the centers of 4^{th} and 7^{th} bright fringes in an interference pattern produced in young's slit experiment. Give separation between the slits $= 1.1 \times 10^{-3}$, wavelength of light used = 589.3nm, and distance of the screen from the double slit = 1.3m.

6. Light of wavelength 6000 $\stackrel{\circ}{A}$ is used to obtain interference fringe of width 6 mm in a young's double slit experiment. Calculate the wavelength of light required to obtain fringe of width 4 mm if the distance between the screen and slits is reduced to half of its initial value.



7. Calculate the fringe width of the interference pattern. Given wavelength of light used = 678 nm, distance between the slits = 0.35mm, distance between the screen and the double slit = 1 m.

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8. A beam of light consisting of two wavelengths 500 nm and 400 nm is used to obtain interference fringes in Young's double

slit experiment. The distance between the slits is 0.3 mm and the distance between the slits and the screen is 1.5 m. Compute the least distance of the point from the central maximum, where the bright fringes due to both the wavelengths coincide.

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9. Two towers on top of the two hills are 40 km part. The line joining them passes 50 m above the hill half way between the towers. What is

the longest wavelength of radio waves, which can be sent between the towers without appreciable diffraction effects?

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10. A parallel beam of light of wavelength 500nm falls on a narrow slit and resulting diffraction pattern is observed on a screen 1m away. It is observed that the first minimum is at a distance of 2.5 mm from the centre of the screen. Find the width of the slit.





11. The diameter of the objective of a telescope is 1.2m. Ig the wavelength of light used is 546 nm, then calculate the limit of resolution of the telescope.



12. Calculate the resolving power of a telescope whose limit of resolution is $2.44 imes 10^{-6}$ rad.



13. In an experiment with a microscope, light of wave length 4240 $\stackrel{\circ}{A}$ is used. The limit of resolution is found to be $3 \times 10^{-7}m$. What is the semi vertical angle?

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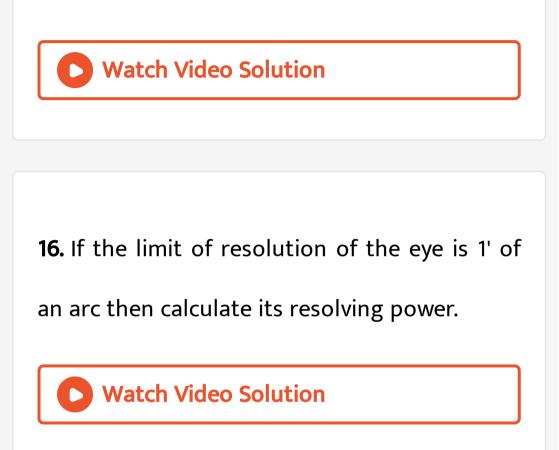
14. Calculate the resolving power of a microscope, whose limit of resolution is

 $2.4 imes 10^{-4}m.$

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15. The semi vertical angle subtended by two points of an object at the objective of a microscope is 30° . The object is illuminated using light of wavelength 589.3 nm. Calculate the minimum distance between the two points if these are just resolved. If a medium of R. I1.48 is used between the object and the objective, then calculate the new limit of resolution. Comment on the improvement in

the limit of resolution.



17. A telescope of aperture 0.02 m is used to focus the two head lamps 1.2m apart. If the

wavelength of light emitted by the automobile is 589.6 nm then calculate the resolving power of the telescope. If the R.P of the eye is $3.436 \times 10^3 \text{rad}^{-1}$, then calculate the magnifying power of the telescope.

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18. A telescope of aperture 0.15 m is used to view two heavenly separated by a certain linear distance. If the distance of these two is 1 million light years from the earth and the wavelength of light emitted is 449 nm, the

calculate the linear separation between them.



19. The angular width of central maximum is

 0.1° If the width of the single slit is 10^{-5} m,

then calculate the wavelength of light used.



20. Calculate the angular width of 2^{nd} secondary maximum and fourth dark fringe in the diffraction pattern obtained due to a single slit of width $10^{-5}m$ illuminated by a wavelength of light 541 nm.

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21. Refractive index of glass is 1.5. Find the

polarising angle for air-glass interface.

22. Polarising angle for water is 53 8'. Find the

critical angle for air-water interface.

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23. Refractive index of glass is 1.5 and of diamond is 2.42. Calculate the polarising angle for glass-diamond interface.

24. A ray of light is incident on the surface of a glass plate of R.I 1.55, at the polarising angle of incidence. Calculate the angle of refractions.

25. If three fringes are missing in front of the double slit then express ' λ ' in terms of 'd' and 'D'

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26. Calculate the semi angular width of the

fifth bright fringe from the central fringe.

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27. If the distance between the double slit and the screen is doubled and width of the double slit is halved then what will be the new fringe width.



28. A bright fringe is formed in front of one of the double slits. What will be the fringe width of the interference pattern?

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29. A light of intensity 100 Wm^{-2} strikes a film at 57°. Find the intensity of transmitted light.

30. Two polaroid sheets are placed in such way that one is inclined at an angle of 47° and the second at 63° . If the intensity of incident light is $1000Wm^{-2}$, then find the intensity of light at the transmitted ends of the sheets.

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31. A ray of light is incident on the surface of a

glass plate of R.I 1.55, at the polarising angle of

incidence. Calculate the angle of refractions.

32. In a single slit diffraction experiment, the width of the slit is made double the original width. How does this affect the size and intensity of the central diffraction band.