Q. No. 2 (i)

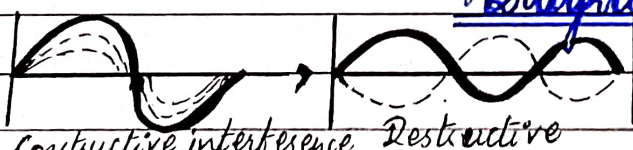
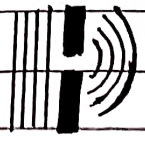
Reflection:- As one part of incident light rays is reflected from denser medium from upper side of soap bubble and become out of phase.

Phase difference:- While other part of light rays is reflected from rare medium (air) lower side of soap bubble and have no phase difference. The reflected rays have phase difference of 180°.

Path difference:- Path difference of $\lambda/2$ due to which destructive interference produce and soap bubble looks dark.

Conclusion:- When soap bubble is about to burst then its thickness is very small (almost zero).

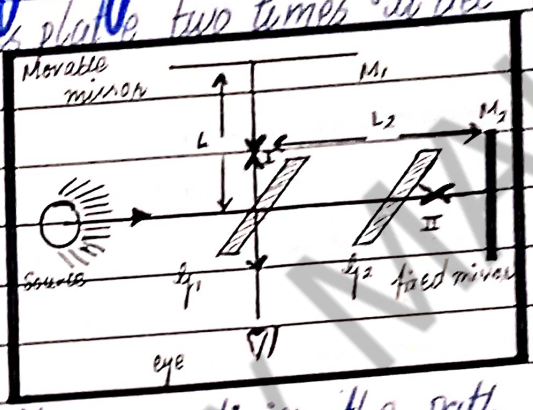
Q. No. 2 (ii)

	Interference	Diffraction
Definition	Due to superposition of two waves coming from two different wave fronts.	Due to waves coming from different parts of the same wave fronts.
Intensity of fringes	Bright fringes are of uniform high intensity.	Bright brands are of varying low intensity.
Fringe spacing	Equally spaced.	Not equally spaced.
Conclusion	Dark fringe are perfectly dark.	Are not perfectly dark.
Diagram	 Constructive interference Destructive	 diffraction

Cutting Line

Q. No. 2 (iii) **Reduction in speed of light:-** The ray - I have to travel through half silvered glass plate two times it decreases speed of light 2 times.

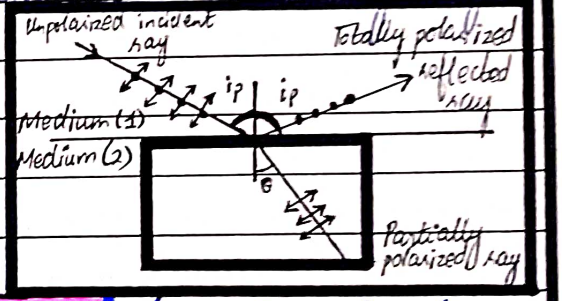
→ The glass plate l_{g_2} cut from the same piece of glass as l_{g_1} and is equal in thickness to l_{g_1} is introduced in the path of beam II to decrease its speed of light 2 times



Compensator plate:- l_{g_2} therefore equalizes the path of the beam I & II in glass and is called "compensator plate".

Conclusion:- The two beams, in this way, having their different paths are coherent. They produced interference effects when they arrive at observer's eyes.

Q. No. 2 (iv) **Un-polarized light:-** When un-polarized light falls on glass, water etc the light reflected is generally partially plane polarized but at a angle of incidence called polarizing angle it is completely polarized.



Relation b/w reflected and refracted ray:- When transmitted in a medium the are at 90° to each other.

Snell's law:- $n_1 \sin i_p = n_2 \sin r$ ($\because n_1 \& 2$ refractive index)

Mathematically:-

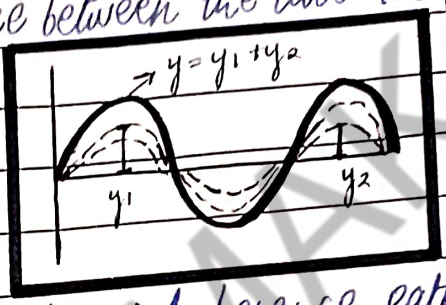
$i_p + 90° + r = 180° \Rightarrow r = 90° - i_p$ Putting values we have

$n_1 \sin i_p = n_2 \sin(90° - i_p) \Rightarrow n_1 \sin i_p = n_2 \cos i_p \Rightarrow \frac{n_2}{n_1} = \frac{\sin i_p}{\cos i_p}$

Conclusion:- $n_2/n_1 = \tan i_p$ This is Brewster's law.

Q. No. 2 (v) **Path difference:-** The path difference is difference between the distances travelled by 2 waves from 2 light sources meeting at a point to produce interference.

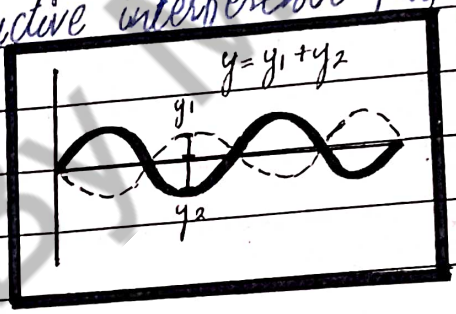
→ **Constructive interference:-** Difference between the distance travelled by two waves meeting at a point



Path difference:- $d = m\lambda$

Where $m = 0, 1, 2 \ldots$

→ **Destructive interference:-** For destructive interference path difference is odd integral multiple of wavelength $(\lambda/2)$



Path difference:- $d = \left(m + \frac{1}{2}\right)\lambda$

Where $m = 0, 1, 2 \ldots$

Q. No. 2 (vi) **Conditions:-**

(i)

Monochromatic

The interfering beams must be monochromatic.

(ii)

Coherency

The interfering beams must be coherent.

(iii)

Distance

The sources should be narrow and very close to each other.

(iv)

Intensity

The intensity of sources must be comparable.

Conclusion:- Since all the above conditions are not fulfilled so there is not interference b/w light beams & head lamps of a car.

Q. No. 2 (vii) **Reason:-** It is due to greater diffraction of sound around pole than diffraction of light.

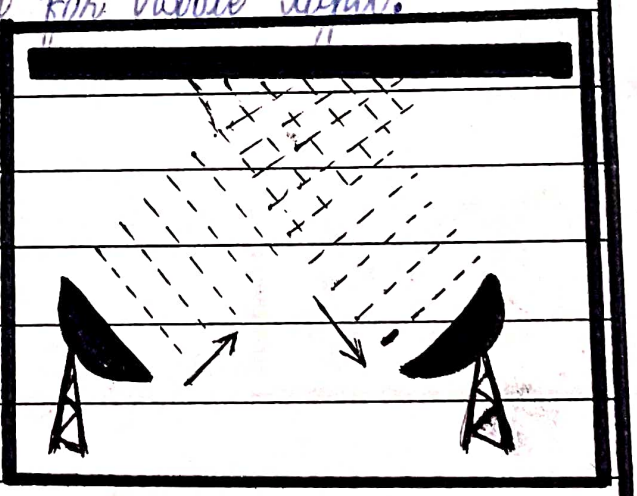
Nature:- The sound and light both are waves.

Compassion of wave length:- But the wavelength of sound waves is very large as compared to the wave length of light waves. Hence, the sound waves bend around the corners of the pole so they are heard.

Compassion of light's wave length & dimension of pole:- The wave length of light wave is shorter and are not comparable to dimension of pole.

Conclusion:- Thus light waves are not diffracted and shadow of pole is observed while sound waves are diffracted thus we hear sound.

Q. No. 2 (viii) For young's double slit experiment, the double slits are used to observe interference phenomenon for visible light.



Slit size:- To observe the diffraction slit size must be comparable with the wavelength of incident waves.

Wave length of x-rays:- But wavelength of x-rays is very short wave length ($\approx 10^{-10}$ m) as compare to slit size used for experiment.

Use of crystal:- x-Rays are diffracted by crystals.

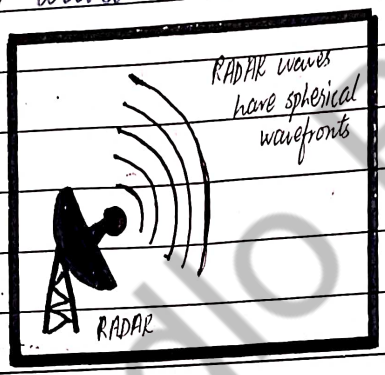
Conclusion:- That is why in Young's double slit experiment the diffraction of x-rays is not possible.

Q. No. 2 (ix) **Reason:-** Yes, we can apply Huygens principle to radar waves.

Nature of RADAR waves:- RADAR waves are transverse electromagnetic radio waves.

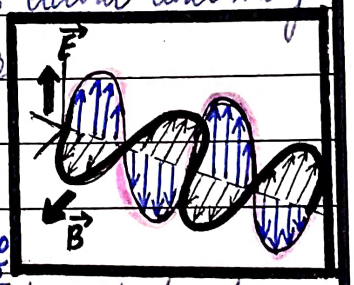
Propagation of waves:- These waves propagate through space with speed of light.

Conclusion:- Thus this principle applies on radar waves like that of light waves.

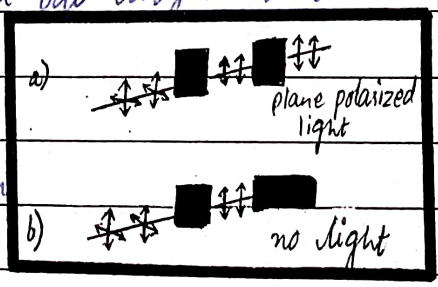


Q. No. 2 (x) The phenomenan of polarization of light waves proves that light waves are transeverse waves.

Components of light waves:- The light has electric and magnetic field component which are perpendicular to each other and propagation of light is ⊥ to both electric and magnetic field.



Comparsion of longitudinal and transverse waves:- The transverse waves are polarized but longitudinal waves cannot.



Conclusion:- As wave propagates in z-direction, the electric field is oscillating in y-direction and magnetic field in x-direction.

As they are ⊥ to each other thus, light is a transverse waves.

Cutting Line

CONCEPTUAL QUESTIONS

Give a short response to the following questions

1. A soap bubble looks black when it bursts, why?
2. What is the difference between interference and diffraction?
3. In a Michelson interferometer a second glass plate is also used, why?
4. How you can explain Brewster's law of polarization?
5. What is meant by the path difference with reference to the interference of two wave motion?
6. Why it is not possible to see the interference where the light beams from the head lamps of a car overlap?
7. A telephone pole casts a clear shadow in the light from a distant head lamp of a car, but no such effect is noticed for the sound from the car horn. Why?
8. Why it is not possible to obtain the diffraction of X-rays by Young's double slits experiment?

9. Can we apply Huygen's principle to radar waves?
10. How would you justify that light waves are transverse?