Superposition of waves.

Q-1) What is phase difference?

> Phase difference is the displacement of the particles when they vibrate out of phase (difference in angles).

$$\underset{\text{phase difference}}{2\pi\ (360^\circ)} = \underset{\text{path difference.}}{\lambda}$$

Q-2) What is the principle of superposition of waves?

> When 2 waves meet at a point, the resultant displacement is the vector sum of the displacement of the individual waves.

Q-3) What is interference?

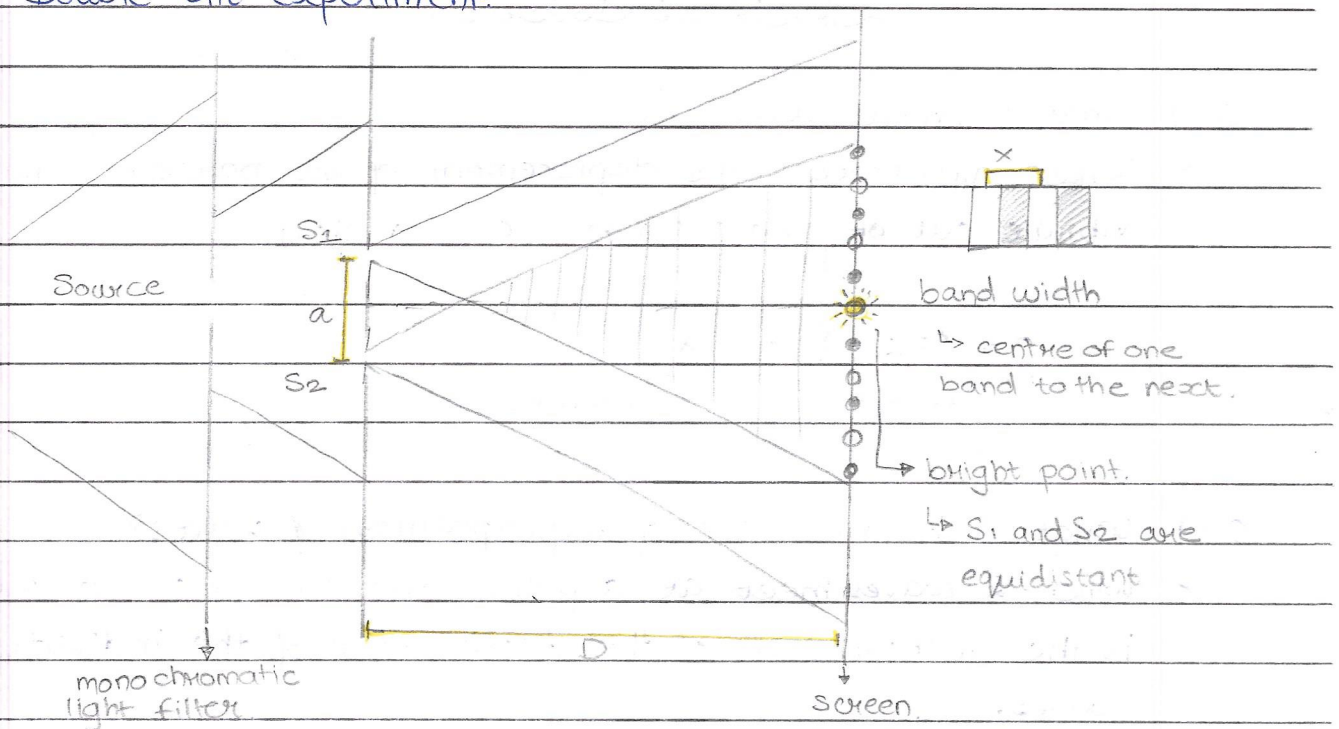
> The variation in the intensity of the resultant wave due to the superposition of 2 waves at a point is called interference.

Constructive interference	Destructive interference
① displacements add up	① displacements subtract/cancel.
② intensity is higher	② intensity is lower
③ path difference = $n\lambda$	③ path difference = $(n + 1/2)\lambda$
④ phase difference = $2n\pi$	④ phase difference = $(2n+1)\pi$
⑤ point at which they meet is a ~~dark~~ bright point	⑤ point at which they meet is a dim/dark point.

General conditions for interference:

* 2 sources of light must be coherent. - have constant phase differenc
  ↳ same source (original source)
* Wavelength should be the same.
* Frequency doesn't change for coherent sources.
* sources should be close to each other

Q-4) Double slit experiment.



can be measured with a travelling microscope

distance between sources & screen.

$$x = \frac{D\lambda}{a}$$

x ~ band width

a ~ distance between 2 sources.

When 2 waves coming from 2 coherent sources overlap/ superimpose, there is constructive and destructive interference, forming bright & dark spots on the screen.

Conditions.

* width of the slit should be fraction of a mm
  ↳ otherwise v. little light would come out.
* the 2 sources should be 1 mm apart
  ↳ further apart = narrower band width, so it would be difficult to seperate the fringes.
* Distance from source to screen should be 1 metre.
  ↳ so the waves overlap.
* sources should be coherent.

Ideal conditions.

* If the amplitude of the 2 waves is the same:
  - bright spots will be maximum bright
  - dark spots will be completely dark.

* Use a laser because
  - it's highly monochromatic (focused - doesn't scatter).
    ∴ bands will be brighter & clearer.
    & more no. of fringes will form
  - distance 'D' can be increased
    ∴ band width will increase so it can be measured more accurately.

Q-5) What is diffraction?

> Diffraction is the bending of waves around the corners of obstacles and the spreading of waves into regions of geometric shadows.
For maximum diffraction, the size of obstacle/ width of slit should be comparable to the wavelength of the wave.

Q-6) What is a diffraction grating?

> A diffraction grating consists of a glass slide with many equally spaced lines to diffract light.
-> The fringes are also known as maxima.
  * the first is called zeroth-order maximum.
  the next one first-order maximum and so on...

distance of adjacent grating lines.

$$d \sin\theta = n\lambda$$

angle of diffraction; order of diffraction.

* for maximum 'n' the angle is 90°.
* no. of lines observed = $2n+1$.