Higher Waves Answers

1. a) Reflection, Refraction, Diffraction and Interference.

b) I**nterference**.

c) **Amplitude** of the wave.

d) Total energy of a water wave decreases as it spreads out.

e) Two sources will be **'coherent'** if they have the same frequency, amplitude and are in-phase with one another.

2. a) i) When the points on the circular waves **overlap** with one another.

ii) When points on the circular waves **do not overlap** with one another.

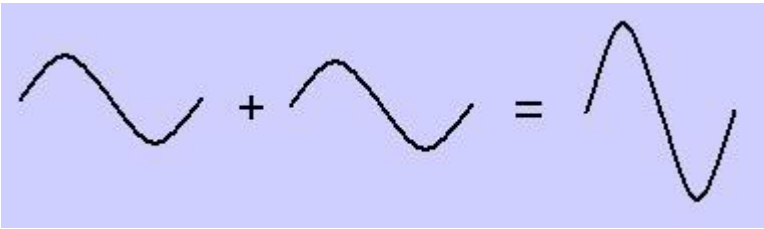
b) In **Constructive** Interference the **amplitude** of the waves **increases**.

In **Destructive** Interference the **amplitude** of the waves **decreases**.

3. a) i) Path Difference = m λ **ALL LENGTHS IN METRES!!!**

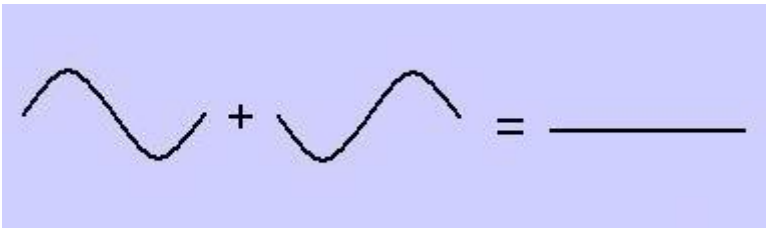
ii) Path Difference = (m + 0.5) λ

b) i) When two sets of waves meet in phase the crests and troughs meet to produce crests and troughs of **greater amplitude.**



ii) When two sets of waves meet **out of phase** the crests and troughs meet to have a cancelling out effect on each other, with resultant waves of **low amplitude**.

If the waves meet **180° out of phase** with each other and have the **same amplitude** they will completely cancel each other out. The **resultant wave** will have **zero amplitude**.



4. a) λ = **0.028m**.

b) Path Difference = **0.07m**.

5. λ = **0.04m**.

6. Path Difference = 0.17m. λ = 0.34m. **=>** Path difference = 0.5 λ **=> Destructive Interference**.

The **amplitude** of the sound will **decrease** due to **destructive interference**.

7. i) **Maxima** => Waves meet **in phase** and so **Constructive Interference** takes place.

Minima => Waves meet **out of phase** and so **Destructive Interference** takes place.

ii) λ = **0.028m**.

8. a) i) **Maxima** => Waves meet **in phase** and so **Constructive Interference** takes place.

Minima => Waves meet **out of phase** and so **Destructive Interference** takes place.

ii) λ = **0.80m**.

b) i) As frequency increases **wavelength decreases**.

ii) As **λ decreases** and the **path difference stays constant** and so the maximas and minimas will be **closer together**. This gives rise to more maximas and minimas at Q.

9. a) λ = **0.68m**.

b) The **amplitude** of the sound at Y will **increase**, as destructive interference will no longer be taking place at this point.

10. λ = **690nm**.

11. a) i) λ **= 605nm**.

ii) As the **distance between the slits decreases** the **distance** between the **bright fringes** will **increase**. This will reduce the uncertainty in reading the distance between the bright fringes. This then produces a **smaller % reading uncertainty**.

b) i) The light will **not have diffracted** at the central maximum and so **white light will not split** into the seven colours of the visible spectrum.

ii) The white light will have diffracted through the grating with **longer wavelengths diffracting more** than the short wavelength waves.

12. a) **625 lines per mm**.

b) **20.6°.**

c) The **maximas** will be **closer together** i.e Fringe separation would be smaller.

13. a) **3.29×10^{-6}m**.

b) 3.29×10^{-6}m -> 1 line

1m -> $1 \div 3.29 \times 10^{-6}$ = **3.04×10^{5} lines per metre**

c) 3.04×10^{5} lines per metre - 2% = **2.98×10^{5} lines per mm**.

This is **inside the limits** and so the technician and manufacturer are in agreement.

14. a) White.

b) i) **Violet 24.2°.**

ii) **Red 43.6°.**

15. a) i) **Minima** => Waves meet **out of phase** and so **Destructive Interference** takes place.

ii) S_2P = 704mm.

b) 5 x 2 = 10 + Central order maxima = **11 maximas**.