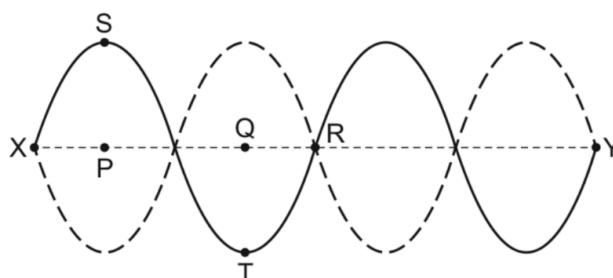


1.

The diagram shows a string stretched between fixed points X and Y. There is a stationary wave on the string.



The solid curve shows the string at a position of maximum displacement. The dashed curve shows the other position of maximum displacement. The straight central dashed line shows the mean position of the string. Point S on the string is directly above point P. Point T on the string is directly below point Q.

Which statement is correct?

- A** A short time later, point R on the string will be displaced.
- B** Points S and T on the string move in opposite directions.
- C** The distance between P and Q is one wavelength.
- D** Two points on the string that are equal distances from point R vibrate in phase.

Ans: B

2.

Two progressive waves meet at a point.

Which condition must be met for superposition of the waves to occur?

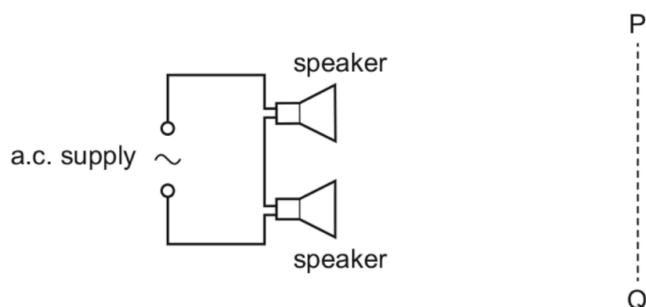
- A** The waves must be coherent.
- B** The waves must be of the same type.
- C** The waves must be travelling in opposite directions.
- D** The waves must meet in phase.

Ans: B

- Coherence is for interference patterns - not A.
- Opposite direction is to produce stationary waves - not C.
- Phase difference doesn't matter for superposition - not D.
- Sound waves cannot superpose with light waves, etc – must be of same type.

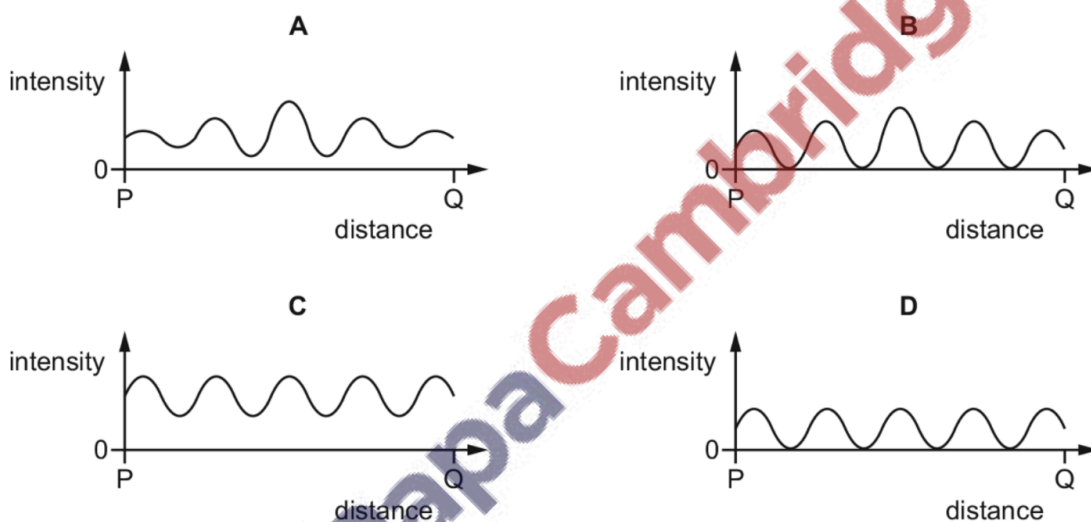
3.

Two identical loudspeakers are connected in series to an a.c. supply, as shown.



A microphone is moved along the line PQ.

Which graph best shows the variation with distance from P of the intensity of the sound detected by the microphone?



Ans: A

- Because this is interference, you get soft-loud-soft – maxima and minima; Intensity should decrease away from centre.
- Intensity cannot drop to 0, because this is sound; intensity of sound can never be 0!! Background noise.

4.

Light of a single wavelength is incident normally on a diffraction grating.

The resulting diffraction pattern is displayed on a screen.

Which change makes the first orders of intensity maxima further apart from each other on the screen?

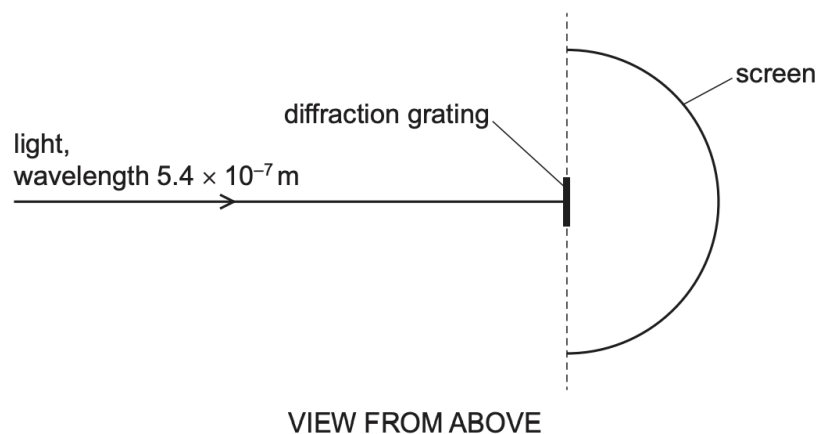
- A** placing the screen closer to the diffraction grating
- B** using a diffraction grating with less separation between adjacent slits
- C** using a diffraction grating with more slits but keeping the same separation between adjacent slits
- D** using light with a shorter wavelength

Ans: B

5.

Light of wavelength $5.4 \times 10^{-7} \text{ m}$ is incident normally on a diffraction grating.

The separation between adjacent lines in the grating is $2.0 \times 10^{-6} \text{ m}$. The light that emerges from the grating falls on a semicircular screen, as shown in the view from above.



The grating is at the centre of the semicircle, and the lines of the grating are vertical.

How many bright dots are formed on the screen?

- A** 3
- B** 4
- C** 6
- D** 7

Ans: D

- $\theta = 90^\circ$
- n is calculated as 3.07. This has to be multiplied by 2, for both sides. This gives 7.

6.

A musical instrument is made using a long tube with a mouthpiece at one end. The other end is open and flared, as shown.



A musician maintains stationary sound waves with a node at the mouthpiece and an antinode at the other end. The lowest frequency of sound that the instrument can produce is 92 Hz.

Which different frequencies of sound can be produced by the instrument?

- A** 92 Hz, 138 Hz, 184 Hz, 230 Hz
- B** 92 Hz, 184 Hz, 276 Hz, 368 Hz
- C** 92 Hz, 276 Hz, 460 Hz, 644 Hz
- D** 92 Hz, 276 Hz, 828 Hz, 1288 Hz

Ans: C

7.

Two waves of equal frequency and amplitude are travelling in opposite directions along a stretched string. When they meet, they form a stationary wave with three nodes and two antinodes.

The frequency of both waves is doubled and a new stationary wave is formed.

How many antinodes are there in the new stationary wave?

- A** 1
- B** 2
- C** 3
- D** 4

Ans: D

8.

Two progressive waves meet at a point.

Which condition must be met for superposition of the waves to occur?

- A** The waves must be coherent.
- B** The waves must be of the same type.
- C** The waves must be travelling in opposite directions.
- D** The waves must meet in phase.

Ans: B

Coherence is only needed for an observable interference pattern. Its not needed for superposition to occur.

For superposition, waves need to be of the same type!!