

1. A sound wave has frequency f and wavelength λ .
What is the frequency of another sound wave with wavelength 2λ ?

A $2f$ B $\sqrt{2}f$ C $\frac{f}{2}$

2. A first harmonic stationary wave is produced on a string. The frequency is 150 Hz. Calculate the frequency of the first harmonic when each of the following changes are controlled.

- (a) The tension in the string is doubled.
(b) The mass per unit length of the string is doubled.
(c) The frequency of the system is increased until the third harmonic is produced. Copy and complete Fig. 1 to show the pattern observed in the

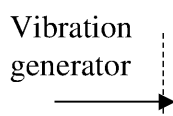


Fig. 1

3. Describe **five** differences in the oscillations between sound waves and light waves.
4. Light from a laser is incident normally on a diffraction grating. A screen is placed parallel to the plane of the grating, to produce a diffraction pattern.

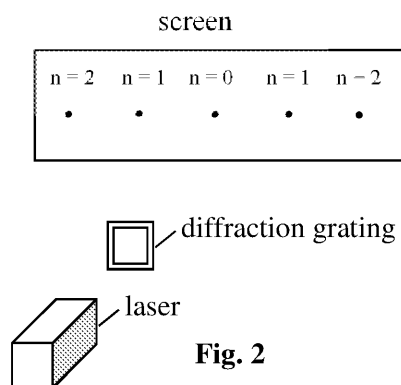


Fig. 2

- (a) Explain how the wavelength of the laser affects the maximum distance between the spots on the screen.
(b) White paper is used for the screen so that the screen can be moved away from the diffraction grating. Explain how to align the screen for the measurements to be made from the observations shown in Fig. 2.

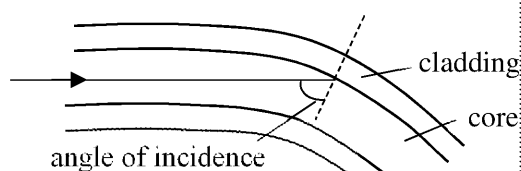


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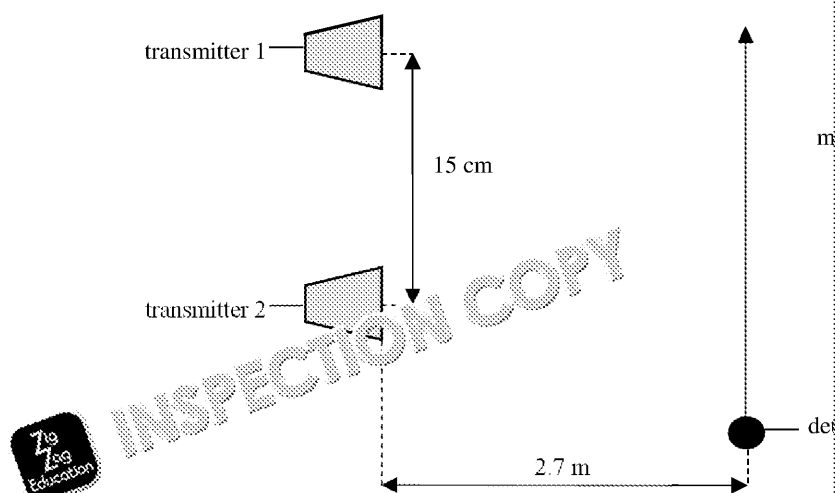


5. The diagram shows part of an optical fibre. A ray of light is shown



- (a) The minimum angle of incidence required for the ray of light to undergo total internal reflection is 41° . The refractive index of the core is 1.58. Calculate the refractive index of the cladding.
- (b) The signal transmitted in this cable is affected by modal dispersion. Explain what causes modal dispersion.
- (i) State the effect that modal dispersion has on the signal.

6. Two microwave transmitters are set to produce interference. A microwave detector is placed on a straight line in front of the transmitters as shown in the diagram.



- (a) Explain how the first experiments of this type furthered our understanding of electromagnetic radiation.
- (b) The waves from transmitters 1 and 2 are both vertically polarised.
- (c) When the detector is moved, the distance between two adjacent maxima is 1.2 m. Use this and the information in the diagram to calculate the frequency of the microwaves.

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