PUNJAB GROUP OF COLLEGES
FAISALABAD

Chapter # 08

Chapter Name ,, Waves

(Short Answers and Numericals)

Notice By ,

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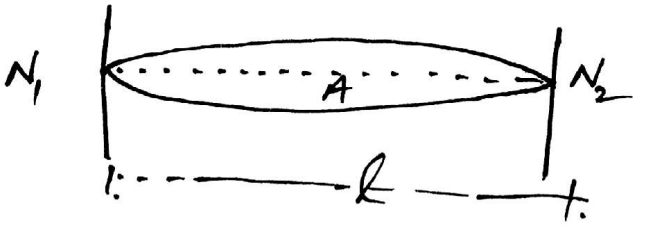
CH # 08

Short Answers

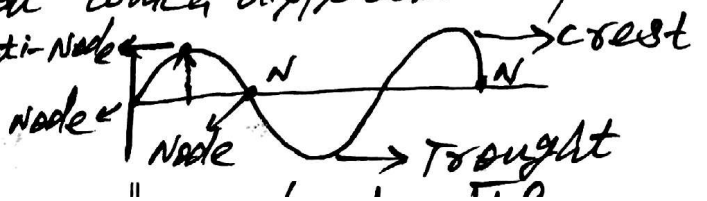
8.1. Ans:-
(i) Both are Mechanical waves.
(ii) Both satisfy the equation $v = f\lambda$.
(iii). Both Transport energy from one place to another but not Matter.
(iv) Both have Amplitude.

8.3. Ans:- It is not possible for the two identical waves traveling along the same direction to form stationary wave.
Stationary wave is a result of superposition of two identical waves having opposite direction.

8.4:- It is a stationary wave and points where the particles show permanently zero displacement are known as Node.



8.5 Crest:- It is a portion of Transverse wave, which is above the Mean Position.
Trough:- The portion of Transverse waves below the Mean Position.
Node:- The points at which displacement of stationary waves is zero.
Anti-Node:- The points at which displacement of stationary waves is Maximum.



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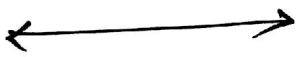
(8.6) Ans:
The speed of Sound in a Medium is,

$$V = \sqrt{\frac{E}{\rho}}$$

and $V \propto \sqrt{E}$

Although the density of Solids is Greater than the density of Gases, and the Modulus of Elasticity "E" for Solids is much Greater as compared to Gases.

Hence, Sound travel faster in Solids than in Gases.



(8.7) Ans:-
Beats are useful in tuning musical instruments such as Piano or Villon by beating (Producing Sound) a note against note of Known frequency.

The String can be adjusted to the desired frequency by tightening or loosing it until no beats are hear.

(8.8) Ans:- Sound Travels faster in Solids than in Gases. Due to this fact an observer sense a Ground tremor first through the Ground which is Solid and then hears the explosion later through air. This causes the time difference.

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8.10 Ans :- As, $V \propto \frac{1}{\sqrt{\rho}}$

As the density of warm air is lesser than that of cold air. Therefore, sound travels faster in warm air than in cold air.

$V_{\text{warm air.}} > V_{\text{cold air.}}$ $\because V$ = velocity of sound

and: $\rho_{\text{warm air.}} < \rho_{\text{cold air.}}$ $\because \rho$ = Density.

8.11 :- Ans (1) If source of sound moves in circular path with observer, at centre of circular path, then the distance between the observer and the source does not change.

(2) :- When observer and source moves with same velocity in same direction.

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(8.1) Given data;

$\lambda_1 = 1500\,m$, $\lambda_2 = ?$

$f_1 = 200\,KHz = 200\times10^3\,Hz$

$f_2 = 1000\,KHz = 1000\times10^3\,Hz$

$V = ??$

As; $V = f_1\lambda_1$

$V = (200\times10^3)(1500)$

$\boxed{V = 3\times10^8\,m/s}$

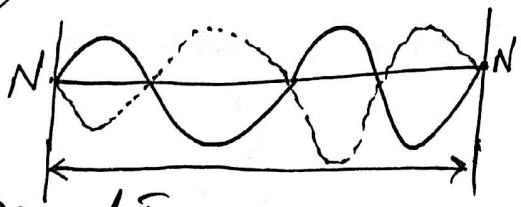
Also; $V = f_2\lambda_2$

$\lambda_2 = \frac{V}{f_2}$

$\lambda_2 = \frac{3\times10^8}{1000\times10^3}$

$\boxed{\lambda_2 = 300\,m}$

(8.3)



Given data;

$l = 120\,Cm = 120\times10^{-2}\,m$

$n = 4$, $f_4 = 120\,Hg$

$\lambda_4 = ??$, $f_1 = ??$

As; $\lambda_n = \frac{2l}{n} = \frac{2\times120\times10^{-2}}{4}$

$\boxed{\lambda_4 = 0.60\,m}$

Also;

$f_n = nf_1$

$f_4 = 4f_1$

$f_1 = \frac{f_4}{4}$

$\boxed{f_1 = \frac{120\,Hg}{4}}$

$\boxed{f_1 = 30\,Hg}$

(8.4) :- (a) Given data;

$f = 300\,Hg$, $f' = ??$

Tension is kept constant;

$\lambda' = \lambda - \frac{\lambda}{3}$

$\lambda' = \frac{3\lambda - \lambda}{3}$

$\lambda' = \frac{2\lambda}{3}$

When the tension is kept constant the speed remains same. So;

$V = V'$ $\quad \because V = f\lambda$

$f\lambda = f'\lambda'$

$f' = \frac{f\lambda}{\lambda'}$

$f' = \frac{300\,Hz \times \lambda}{\frac{2\lambda}{3}}$

$f' = \frac{900\,Hz}{2}$

$\boxed{f' = 450\,Hz}$

(b) Given Data;

$f' = ?$, $f = 300\,Hg$

$f' = f + \frac{f}{3}$

$f' = \frac{3f + f}{3} = \frac{4f}{3}$

As; $f' = \frac{1}{2l}\sqrt{\frac{f'}{m}}$

$f' = \frac{1}{2l}\sqrt{\frac{4f/3}{m}}$

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$$f' = \sqrt{\frac{4}{3}} \times \frac{1}{2l}\sqrt{\frac{F}{m}}$$

$$f' = \sqrt{\frac{4}{3}} \times f$$

$$f' = 1.153 \times 300\ Hz$$

$$\boxed{f' = 346\ Hz}$$

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8.5 :- Given data;

$l = 50\ cm = 50 \times 10^{-2}\ m$

(a) Open at both ends :-

$f_1 = ?\ ,\ f_2 = ?$

$$f_1 = \frac{V}{2l} = \frac{350}{2 \times 50 \times 10^{-2}}$$

$$\boxed{f_1 = 350\ Hz}$$

Also; $f_2 = 2f_1$

$f_2 = 2(350\ Hz)$.

$$\boxed{f_2 = 700\ Hz}$$

(b). When open at one End :-

$$f_1 = \frac{V}{4l}$$

$$f_1 = \frac{350}{4 \times 50 \times 10^{-2}}$$

$$\boxed{f_1 = 175\ Hz}$$

Also; $f_2 = 3f_1$

$f_2 = 3(175\ Hz)$

$$\boxed{f_2 = 525\ Hz}$$

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8.6 :- Given data;

$l_{min.} = 30\ mm = 30 \times 10^{-3}\ m$

$l_{max.} = 4\ m$

$f_{min.} = ?\ ,\ f_{max.} = ?$

For Maximum frequency;

$$f_{max.} = \frac{V}{4 l_{min.}}$$

$$f_{max.} = \frac{340}{4 \times 30 \times 10^{-3}}$$

$$\boxed{f_{max.} = 2833\ Hz}$$

For Minimum frequency;

$$f_{min.} = \frac{V}{4 l_{max.}}$$

$$f_{min.} = \frac{340}{4 \times 4}$$

$$\boxed{f_{min.} = 21\ Hz}$$

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