

Assignment

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QUESTION:

Q23) A narrow sound pulse (for example, a short pip by a whistle) is sent across a medium.

(a) Does the pulse have a definite (i) frequency, (ii) wavelength, (iii) speed of propagation?

(b) If the pulse rate is 1 after every 20 s, (that is the whistle is blown for a split of second after every 20 s), is the frequency of note produced by whistle equal to $1/20$ or 0.05 Hz ?

SOLUTION:

Table of Parameters

Parameter	Name of Parameter
M	Molecular Weight of gas
γ	Adiabatic Constant of gas
T	Temperature of gas
V	velocity of gas
R	Universal Gas Constant
ν	Frequency of Sound wave
λ	Wavelength of Sound wave
A	Amplitude of Sound wave
x,y	Co-ordinates of point on wave
k	wave number
ω	Angular Frequency of wave
t	time

(a) Let us assume, sound pulse produced in medium of gas as per parameters, Then velocity V of sound pulse is given by:

$$V = \sqrt{\left(\frac{\gamma RT}{M}\right)} \quad (1)$$

Hence from (1) the velocity V of sound wave remains constant but not frequency ν and wavelength λ

(b) We know that for a sound pulse travelling in a medium

The general equation of a point on the wave is given by:

$$y = A.\sin(kx + \omega t) \quad (2)$$

And we know the relation that:

$$\nu = \frac{\omega}{2\pi} \quad (3)$$

Hence, The frequency of the note ν produced will not be equal to 0.05 Hz or $\frac{1}{20}$ Hz