Numericals

1) A bat can hear sound of frequencies up to 120 kHz. determine the minimum wavelength of sound which it can hear. Take speed of sound in air to be 344 m/s.

Solution :→ $f = 120\,kHz = 120 \times 10^3\,Hz$ ($\because 1\,kHz = 10^3\,Hz$)

$V = 344\,m/s$, $\lambda = ?$

from relation $\boxed{V = f\lambda}$ λ - Wavelength

$$\boxed{\frac{V}{f} = \lambda}$$

So $\lambda = \frac{344}{120 \times 10^3} = \frac{344}{120} \times 10^{-3} = \frac{43}{15} \times 10^{-3}$

$= 2.87 \times 10^{-3}\,m$

2) A wave pulse of frequency 200 Hz, on a string moves a distance 8 m in 0.05 sec. Calculate: (a) the velocity of the wave pulse (b) the wavelength of the wave on string.

Solution :→ (a) $f = 200\,Hz$, distance (d) = 8 m

time (t) = 0.05 sec.

Velocity of wave pulse = $\frac{\text{distance}}{\text{time}} = \frac{8}{0.05} = \frac{8 \times 100}{5}$

$= 160\,m/s$

(b) Wavelength = ?

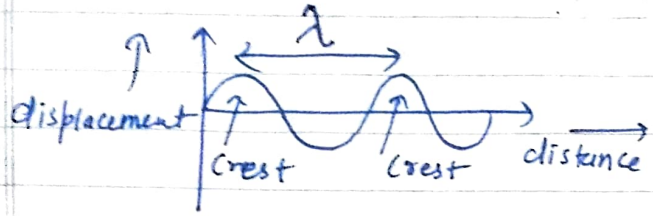
So, using relation $V = f\lambda$, $V = 160\,m/s$

or $\frac{V}{f} = \lambda$ $f = 200\,Hz$

$= \frac{160}{200} = \frac{16}{20} = 0.8\,m$

(3) The separation b/w the two Consecutive crests in a transverse wave is 100 m. If wave velocity is 20 m/s. find the frequency of wave.

Solution :→ $\lambda = 100\,m$ (as separation b/w two Consecutive crests is a wavelength (λ))



$V = 20\,m/s$

$f = ?$

So using relation ; $V = f\lambda$

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

$$\Rightarrow \frac{20}{100} = 0.2 = f$$

$f = 0.2\,Hz$ Ans

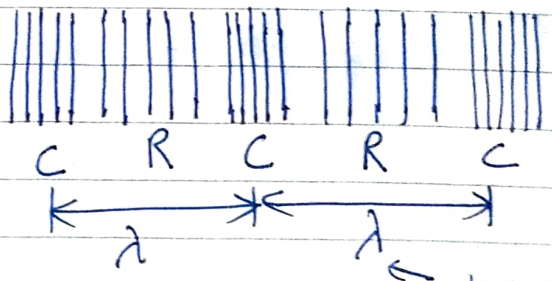
(4) A longitudnal wave travels at a speed of 0.3 m/s. frequency of the wave is 20 Hz. find the Separation between two Consecutive Compressions.

Solution :— $V = 0.3\,m/s$

$f = 20\,Hz$

$\lambda = ?$

[separation b/w two Consecutive Compressions is wave length λ.



So $\boxed{V = f\lambda}$

$$\lambda = \frac{V}{f} = \frac{0.3}{20}$$

$$= \frac{3}{200} = \frac{3}{2} \times \frac{1}{100}$$

or ↓ $\boxed{1.5 \times 10^{-2}\,m}$

(5) The heart of a man beats 75 times a minute. what is its (a) frequency (b) time period ?

Solution :→ Time period = $\frac{1}{\text{Beat per second}}$

i.e $\frac{60}{75} \div 15 = \frac{4}{5} = 0.8$ second

$\boxed{\text{Frequency} = \frac{1}{T}} = \frac{1}{0.8} = \frac{10}{8} = 1.25\,sec^{-1}$

Ch-8 (Sound)

→ 8(b) (Infrasonic, sonic and ultrasonic frequencies)

Qu 1:→ How do bats locate the obstacles and prey in their way explain.

Ans:→ Bats can produce and hear ultrasonics frequencies. When they produce ultrasound, after reflection from the obstacle the ultrasound returns. By hearing the reflected ultrasound, bats judge the direction of obstacle in their way. Also, from the time interval b/w the production and receival of sound, they can judge the distance of the obstacle.

Q2:→ What is supersonic. Give an example.

Ans Supersonic is used for objects which travel with a speed greater than the speed of sound in air.
for e.g. fighter planes.

Q3:→ State two applications of ultrasound.

Ans:→ (a) ultrasound is used for the human organs imaging. It is used to obtain the images of patient's organs (such as liver, gall bladder, uterus, etc.).

(b) Ultrasound is used for drilling holes or making cuts of desired shapes in materials like glass.

Q4:→ What is 'SONAR'. Write its use.

Ans:→ 'SONAR' is "Sound navigation and ranging". It uses ultrasonic waves to detect and to find the distance of objects under water.

Q5:→ State two properties of ultrasound that make it useful to us.

Ans:→ (1) Highly energetic
(2) It does not bend much at the edges of an obstacle, it is highly directional.

End →