## Reflection and Refraction of Waves.

When sound waves are incident on a boundary between two media, a part of incident wave's returns back into the initial medium (reflection) while the remaining is partly absorbed and partly transmitted into the second medium (refraction) In case of reflection and refraction of sound
(1) The frequency of the wave remains unchanged that means

$$
\omega \mathrm{i}=\omega \mathrm{r}=\omega \mathrm{t}=\omega=\text { constant }
$$

(2) The incident ray, reflected ray, normal and refracted ray all lie in the same plane.

(3) For reflection angle of incidence (i) = Angle of reflection (r)
(4) For refraction $\frac{\sin i}{\sin t}=\frac{v_{i}}{v_{t}}$
(5) In reflection from a denser medium or rigid support, phase changes by $180^{\circ}$ and direction reverses if incident wave is $y=A 1 \sin (\omega t-k x)$ then reflected wave becomes $y=A r \sin$ ( $\omega t+k x+\pi)=-\operatorname{Ar} \sin (\omega t+k x)$.
(6) In reflection from a rarer medium or free end, phase does not change and direction reverses
if incident wave is $\mathrm{y}=\mathrm{AI} \sin \left({ }^{\omega t-k x}\right)$ then reflected wave becomes $\mathrm{y}=\mathrm{Ar} \sin$ ( $\omega t+k x$ )
(7) Echo is an example of reflection.


If there is a sound reflector at a distance d from the source then time interval between original sound and its echo at the site of source will be $t=\frac{2 d}{v}$

