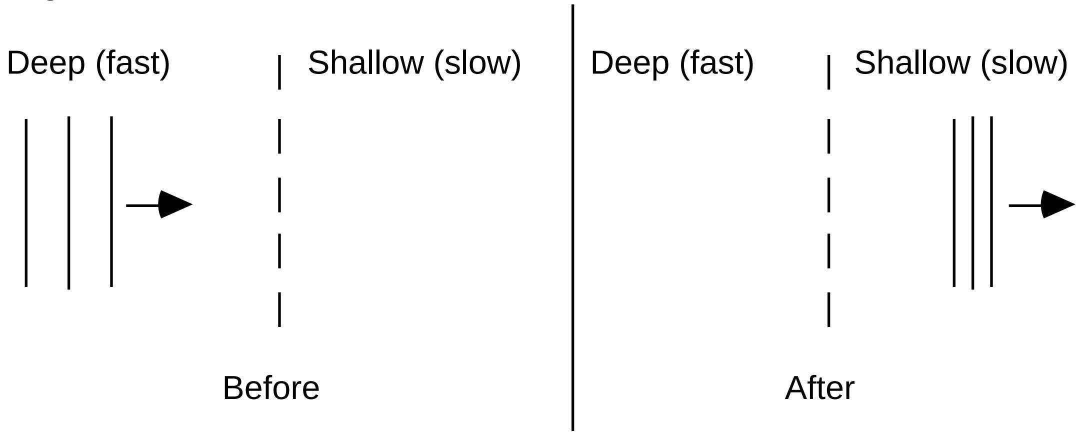
Waves : Notes - 40

Water waves: The speed of water waves depends on the depth of the water. Water waves slow down when they enter shallow water, or speed up when they enter deeper water. The situation is seen in the diagram below.



The frequency of the waves cannot change as the number of waves passing a point per unit time cannot change. But the waves slow down, and the wavelength decreases. The opposite happens when waves move from shallow to deep water. Since V = f x λ, and $f_{fast} = f_{slow}$, we have the formula:

$$\frac{V_f}{V_s} = \frac{\lambda_f}{\lambda_s}$$

Sound waves: The speed of sound in air depends on the Celsius temperature. The formula given below gives the speed of sound in m/s at a temperature T and a pressure of 1.0 atmospheres.

$$V_{sound} = 332 + 0.60\,T$$

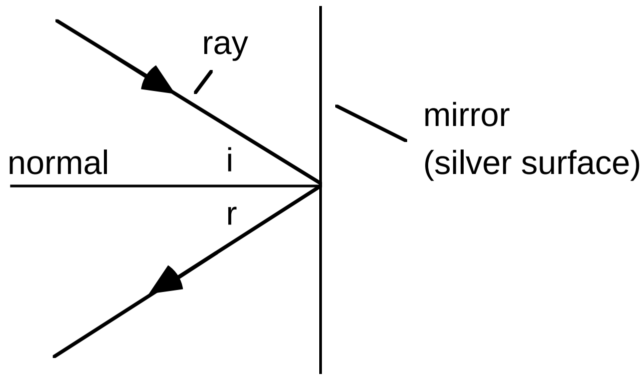
Sound waves can be reflected, refracted, and diffracted, like water waves.

Light waves and other electromagnetic waves (radio, microwave, X-rays, infrared ....) travel with a speed of 3.0×10^8 m/s (symbol c) in a vacuum or air. The laws for light are similar to those for water.

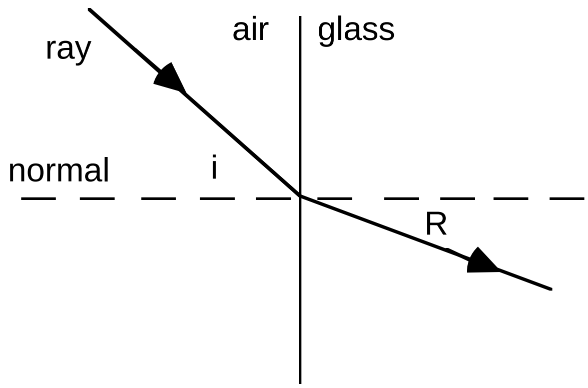
Reflection: There are two main rules for the reflection of light.

1) Light travels in a straight line. This is shown as a line with an arrow called a ray.

2) When light is reflected, the angle of incidence equals the angle of reflection.



Light will slow down when it enters water, plastic or glass. In the diagram below, light enters glass from air.



When light enters a transparent substance, the speed decreases, and the light ray bends toward the normal. The opposite happens when the ray enters a substance where the speed is greater.

For a vacuum or air the **index of refraction** (n) is equal to 1.0.

For a transparent medium, the index of refraction is greater than 1.0. In general:

$$n = \frac{V_{vacuum}}{V_{medium}}$$