17.1 Introduction

In every wave, a physical quantity y is made to oscillate at one point and gradually these oscillations of y propagate to other points also without transport of matter. In general, a wave also transports energy and momentum (in addition to oscillations of y).

Thus, in a wave, the following three physical quantities transfer from one point to another point.

(i) oscillations of y

(ii) energy and

(iii) momentum

In different situations, the physical quantity y may be different. For example:

y is displacement of medium particles (between $+A$ and $-A$) from the mean position in case of string wave, where A is the amplitude of oscillations. Similarly, y is electric and magnetic fields for electromagnetic waves and it is displacement, pressure and density which oscillate in longitudinal (or sound) wave. A wave is said to be **travelling** or **progressive** if it travels from one point to another. A **plane wave** is a wave of constant frequency and amplitude with wavefronts that are infinitely long straight lines. Plane waves travel in the perpendicular direction to the wavefronts. Many physical waves are approximate plane waves far from their sources.

17.2 Classification of a Wave

A wave can be classified in the following three manners :

1-D, 2-D and 3-D Wave

In 1-D wave, oscillations of y (or energy and momentum also) transfer in a straight line or we can say that wave travels in a straight line. String wave is the best example of a 1-D wave. In 2-D wave, it travels in a plane. Wave travelling on the surface of water is an example of a 2-D wave. In 3-D wave, it travels in whole space. Sound or light wave produced by a point source is an example of a 3-D wave.

Transverse and Longitudinal Wave

In transverse waves, oscillations of y are perpendicular to wave velocity and wave velocity is the direction in which oscillations (or energy and momentum) transfer from one point to another.

Electromagnetic waves and string waves are transverse in nature.In longitudinal waves, oscillations are along the wave velocity. Sound wave is a longitudinal wave.

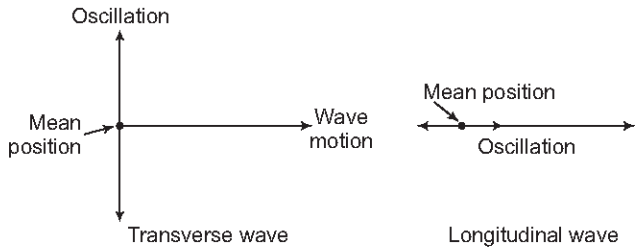

Fig. 17.1