PHYSICS
FORM 5
INTRODUCTION TO WAVES

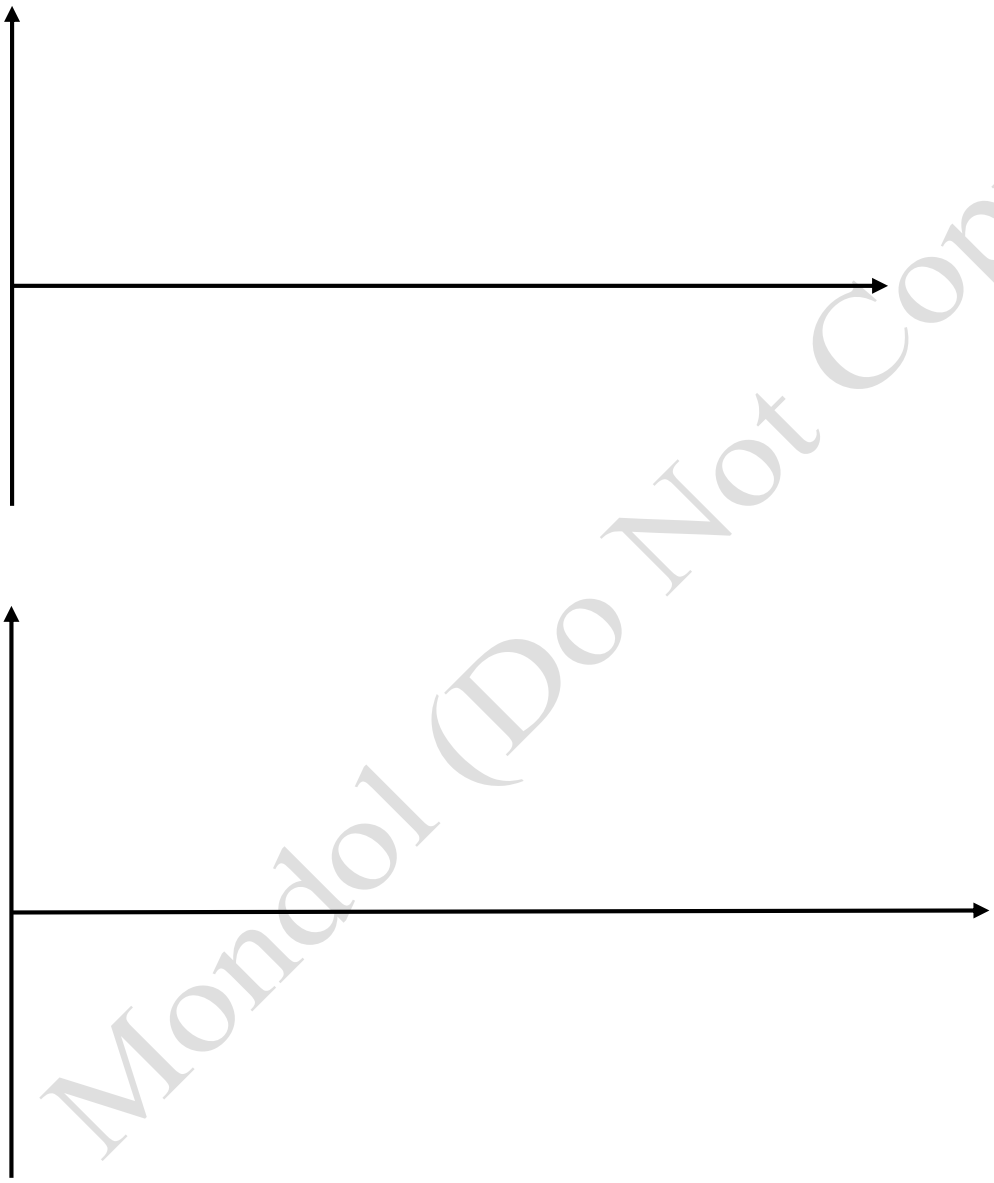
This is the regular disturbance/motion of particles of a medium that transports energy away from the source of motion.

Ex. The sun, loudspeaker, etc.

Definitions:

1. Pulse – A single, short lived wave motion.
2. Wave train – A continuous group of waves with features which repeat regularly.
3. Transverse Wave – These are waves in which the displacement of the particles is at right angles to the direction of travel of the wave motion.
4. Longitudinal Wave – These are waves in which the displacement of the particles is parallel to the direction of travel of the wave motion.
5. Progressive Wave – This is the movement of a disturbance which carries energy away from a source.
6. Wavelength (λ) – This is the distance between two successive particles which are at exactly the same points in the paths at the same time and are moving in the same direction.
7. Period (T) – This is the time a particle in the wave train takes to make one complete oscillation.
8. Frequency (f) – This is the number of complete oscillations made in one second by a particle in a wave train.
9. Hertz (Hz) – 1Hz = 1 cycle/second where 1 cycle is one complete oscillation.
10. Amplitude – This is the maximum displacement of the particles in the wavetrain from their resting position.

Displacement-Position Graph



In a displacement-position graph, it is similar to a photograph of a waveform in an instant in time

Information obtained from this graph include:

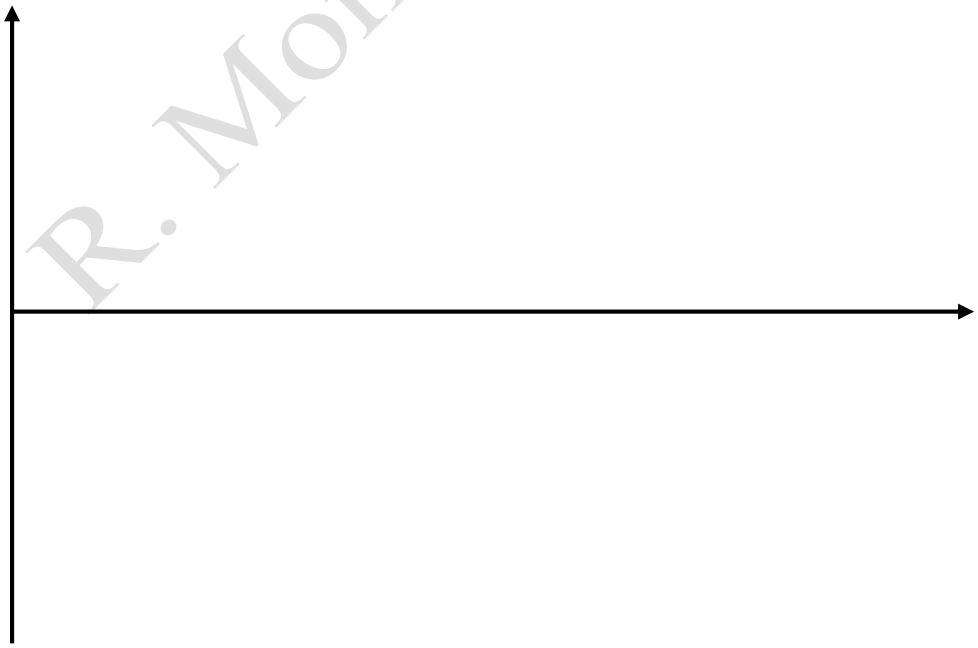
1.

2.

Since time is not part of this graph, then frequency and speed cannot be calculated. Both frequency and speed depend on time.

The particles of this water wave move up and down giving their appearance of the wave travelling in a direction. The particles that occur before the crest move upwards while those after the crest move downwards. In so doing, the position of the crest changes.

The distance between two successive particles that are exactly at the same point in their paths and travelling in the same direction in the displacement-position graph, represents a wavelength.



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The displacement-time graph demonstrates the movement of a single particle as a wave train passes.

Information Obtained:

1.

2.

Period is the time taken for one complete oscillation or the time for one wavelength.

Given the period, one can calculate the frequency:

$$frequency\ (f) = \frac{1}{Period\ (T)}$$

Speed

The speed of a wave is defined as the product of a wavelength and the frequency.

$$Speed = Wavelength \times frequency$$

$$v = f\lambda$$

$$m/s = m \times Hz$$

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Properties of Waves

1. Reflection

2. Refraction

3. Diffraction

Reflection

When waves strike a boundary they are bombarded away from the boundary. This bombardment is called reflection. The incident wave is the wave that travels towards the boundary. The reflected wave is the wave produced after bombardment with the boundary.

The normal refers to an imaginary line that is drawn perpendicular (at 90 degrees) to the boundary at the point of contact between the wave and the boundary.

Angle of incidence refers to the angle formed between the incident wave and the normal.

The angle of reflection refers to the angle formed between the reflected wave and the normal.

For plane boundaries, the angle of incidence is equal to the angle of reflection.

The wavelength of the reflected wave is the same of that of the wavelength of the incident wave. The same applies for the frequency of the wave. The speeds of the reflected wave and the incident wave are therefore the same.

Reflection of Circular Waves

When circular waves are reflected on a plane boundary, the reflected waves are circular and have the same wavelength and frequency.