* Waves *

Q-1) What is a wave?

> A wave is a disturbance which travels without change of form.

Mechanical	Electromagnetic
- require medium for propagation.	- don't require medium for propagation
- can't travel in a vacuum.	- can travel in a vacuum
- eg: Sound waves, waves on a rope, waves on water.	- eg: em radiation (RMIVUXG)

Waves that move through a material (or a vacuum) are called progressive waves. Progressive waves transfer energy from one position to another.

* **Displacement**: distance of a point on a wave from its undisturbed position.

* **Amplitude**: maximum displacement of a point from its undisturbed position.

* **Wavelength**: distance from one point to next exactly similar point (crest - crest eg)

* **Time period**: time taken for a point on a wave to complete one oscillation.

* **Frequency**: no. of oscillations in one second.

Q-2) What are transverse and longitudinal waves?

> In longitudinal waves, the particles vibrate parallel to the direction of the wave.
eg: sound waves.

> In transverse waves, the particles vibrate perpendicular to the direction of the wave.
eg: EM radiation.

Q-3) What is intensity?

> Intensity is the energy transferred per unit cross-sectional area.

$$\text{Intensity} = \frac{\text{power}}{\text{cross-sectional area}}.$$

As distance away from the source increases, the intensity decreases because:

- the wave may spread out
- the wave may be absorbed or scattered.

* $I \propto a^2$ (intensity is proportional to amplitude^2)

$\therefore I = ka^2$

* ↑/↓ I by x, then multiply a by $\sqrt{x}$.
↑/↓ a by x, then multiply I by x^2

Q-4) What is wave speed?

> Wave speed is the speed at which energy is transmitted by a wave.

$$\text{speed } (v) = \frac{\text{distance}}{\text{time}}.$$

$$v = \frac{\lambda}{T} \Rightarrow \lambda \times \frac{1}{T} \rightarrow \frac{1}{T} = f$$

(λ: wavelength, T: time period, f: frequency)

$\therefore v = \lambda \times f$

Q-5) Wavelengths of waves. (EM spectrum)

> When light travels in a vacuum, its speed decreases, but its frequency stays the same $\therefore$ the wavelength decreases.

speed of light = 3×10^8 m/s.
↳ All EM Radiations.

Radio waves	=	$10^6 - 10^{-1}$ m
Microwaves	=	$10^{-1} - 10^{-3}$ m
Infra-red	=	$10^{-3} - 7 \times 10^{-7}$ m
Visible light	=	$7 \times 10^{-7} - 4 \times 10^{-7}$ m
Ultra-violet	=	$4 \times 10^{-7} - 10^{-8}$ m
X-rays	=	$10^{-8} - 10^{-13}$ m
Gamma-rays	=	$10^{-10} - 10^{-16}$ m

Violet / Indigo	=	400 - 450 nm
Blue	=	450 - 500 nm
Green	=	500 - 570 nm
Yellow	=	570 - 590 nm
Orange	=	590 - 610 nm
Red	=	610 - 700 nm

Q-6) Electromagnetic waves?

> A magnetic field is created by a moving charged particle (eg: electrons).
An electric current gives rise to a magnetic field, and a changing magnetic field will induce a current in a nearby conductor.

-> An electromagnetic wave is a disturbance in the electric and magnetic fields in space.
The electric field and the magnetic field oscillate at right angles to each other and to the direction of the wave.
This shows that electromagnetic waves are transverse.