

1) A laser emits light of wavelength 650nm . Calculate the frequency of the emitted light.

Soln:- $\lambda = 650\text{nm}$

$$f = \frac{c}{\lambda}$$

$$f = \frac{3 \times 10^8}{650 \times 10^{-9}} = 4.61 \times 10^{14} \text{ Hz} \\ = 461 \times 10^{12} \text{ Hz} \\ = 461 \text{ THz}$$

2) A positive test charge of $q_0 = 4\text{C}$ experiences a force $F = 20\text{N}$ when placed in an electric field. What is the magnitude of the electric field at that point?

Soln:- $q_0 = 4\text{C}$, $F = 20\text{N}$

$$E = \frac{F}{q_0} = \frac{20}{4} = 5\text{N/C}$$

3) A charged particle with charge $q = 2\text{C}$ is moving with a velocity $v = 10\text{m/s}$ perpendicular to a magnetic field of strength $B = 0.5\text{T}$. Calculate the force (F) acting on the charged particle.

<u>Soln.</u>	$q = 2\text{C}$	$\theta = 90^\circ$
	$v = 10\text{m/s}$	$F = qvB \sin \theta$
	$B = 0.5\text{T}$	$= 2 \times 10 \times 0.5 \times \sin(90^\circ)$
		$F = 10\text{N}$

4) The speed of light in a medium is $v = 2.5 \times 10^8 \text{ m/s}$. Calculate the Refractive index of the medium.

Soln $\therefore v = 2.5 \times 10^8 \text{ m/s}$.

We know that

$$c = 3 \times 10^8 \text{ m/s}$$

$$n = \frac{c}{v} = \frac{3 \times 10^8}{2.5 \times 10^8}$$

$$n = 1.2$$

5) A light ray is travelling from Water to air. Calculate the Critical angle for the light ray at the air-water interface.

Soln.

$$n_1 = 1.33 \text{ (water)}$$

$$n_2 = 1 \text{ (air)}$$

$$\theta_c = \sin^{-1} \left(\frac{n_2}{n_1} \right) = \sin^{-1} \left(\frac{1}{1.33} \right)$$

$$\theta_c = 48.75^\circ$$

Spectrum

λ, f

λ - high $f = \frac{c}{\lambda}$

$f \rightarrow$ low

$f =$ low $f =$ high

$\lambda =$ high

Radio waves

$\lambda =$ low.

Gamma Rays

$f \uparrow \rightarrow E \uparrow$

Ionising $\rightarrow$ harmful $\rightarrow$ ionising.

non-ionising $\rightarrow$ harmless

Radio waves $\rightarrow f = > 300 \text{ kHz}$.

$\lambda = 10,000 \text{ Kilom, (mm)}$

RF comm, etc.

Microwaves $\rightarrow 300 \text{ MHz} - 300 \text{ GHz}$.

$\rightarrow 1 \text{ mm} - 1 \text{ m}$.

IR $\rightarrow$

Visible

UV

X-Ray

Gamma Ray.