ST. ANTHONY'S SR. SEC. SCHOOL UDAIPUR

~English Project~

SESSION : 2024-25

A project report on
""EXTRACURRICULAR ACTIVITY"""

Submitted by- Rishika Alawat
Class-XII (PCM)
Roll no:

Under the guidance of
Mrs. Alpa Shamra

ACKNOWLEDGEMENT

I would like to express my sincere gratitude to all those who supported me throughout the preparation of this project.

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Lastly, I appreciate my family for their constant encouragement and belief in my abilities, which motivated me to complete this project successfully.

Thank you all for your contributions!

Rishika Alawat
XII--PCM

CERTIFICATE

This is to certify that Rishika Alawat ***of class XII -(pcm) has successfully completed the Physics project titled "Extracurricular activity" as part of the Class 12 curriculum during the academic year 2024-25. The project was undertaken under the guidance of Mrs.Alpa Shamra .***

The project demonstrates a thorough understanding of the principles of physics and reflects commendable effort and creativity.

Date:_____

Signature:_____

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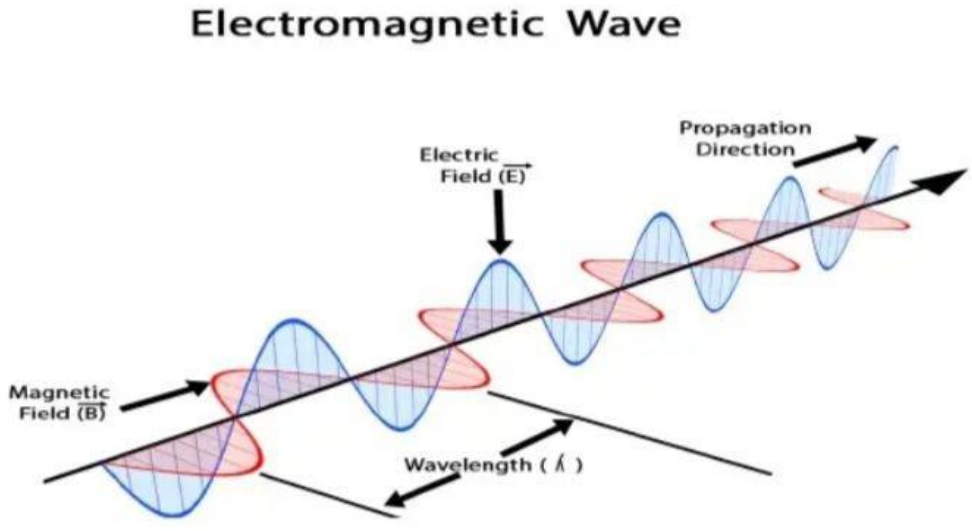
What are EM Waves?

EM waves are **waves** that are created as a result of vibrations between an electric field and a magnetic field. In other words, **EM waves** are composed of oscillating magnetic and electric fields.

Electromagnetic waves differ from mechanical **waves** in that they **do** not require a medium to propagate. This means that **electromagnetic waves** can travel not only through air and solid materials, but also through the vacuum of space.



Uses of EM Waves

Introduction

- Wavelength of the ElectroMagnetic spectrum continually changes
- high frequency = short wavelength
- high frequency = high energy
- high energy = more dangerous

Radio Waves (communications)

- TV and FM radio (short wavelength)
- Direct line of sight with transmitter (do not diffract)
- Medium wavelength – travel further because they reflect from layers in the atmosphere

Satellite signals (Microwaves)

- Frequency of microwaves pass easily through atmosphere and clouds

Cooking (Microwaves)

- Microwaves are absorbed by water molecules.
- These water molecules become heated > heat food
- **Dangers**: microwaves are absorbed by living tissue Internal heating will damage or kill cells

Infrared Radiation (remote controls, toasters)

- Any object that radiates heat radiates Infrared Radiation
- Infrared Radiation is absorbed by all materials and causes heating
- It is used for night vision and security cameras as Infrared Radiation is visible in daytime or night-time

- Police use it to catch criminals, army use it to detect enemy
- **Dangers**: damage to cells (burns)

Ultraviolet

Dangers:

- over-exposure to UVA and B damages surface cells and eyes and can cause cancer.
- There is a problem with current sunscreens which protect against skin burning from high UVB but give inadequate protection against free radical damage caused by UVA.
- Dark skins are not necessarily safer from harm.
- Sun exposure for the skin is best restricted to before 11am and after 3pm in the UK in summer months.

Benefits:

- sanitary and therapeutic properties have a marked effect on architecture, engineering and public health and have done so throughout history.
- UVC is germicidal, destroying bacteria, viruses and moulds in the air, in water and on surfaces.
- UV synthesises vitamin D in skin, controls the endocrine system and is a painkiller.
- Used in state of the art air-handling units, personal air purifiers and swimming pool technology.
- Used to detect forged bank notes: they fluoresce in UV light; real bank notes don't. Used to

identify items outside visible spectrum areas, known as 'black lighting'.

X-rays

- X-rays detect bone breaks
- X-rays pass through flesh but not dense material like bones
- **Dangers**: X-rays damage cells and cause cancers. Radiographer precautions include wearing lead aprons and standing behind a lead screen to minimise exposure

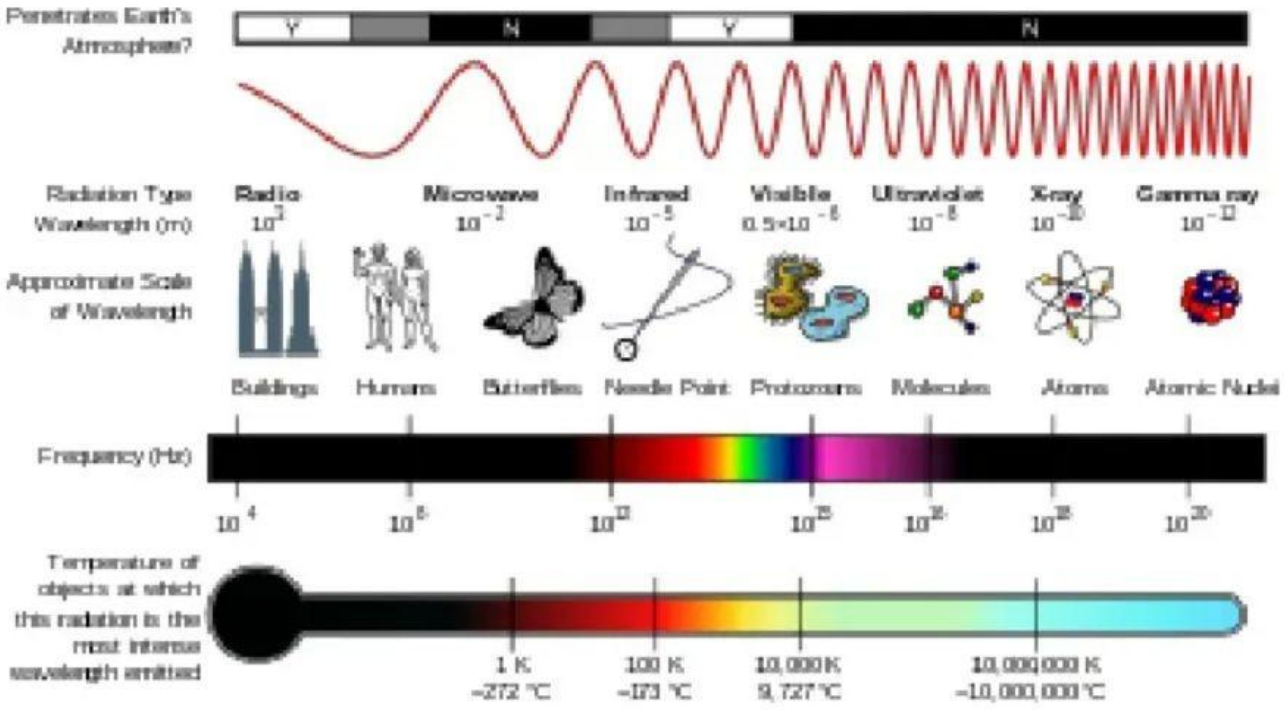
Gamma Rays

- Gamma Rays cause and treat cancers
- In high doses, gamma can kill normal cells and cause cancers
- Gamma can be used to kill mutated cells though too.

Types of EM Waves…

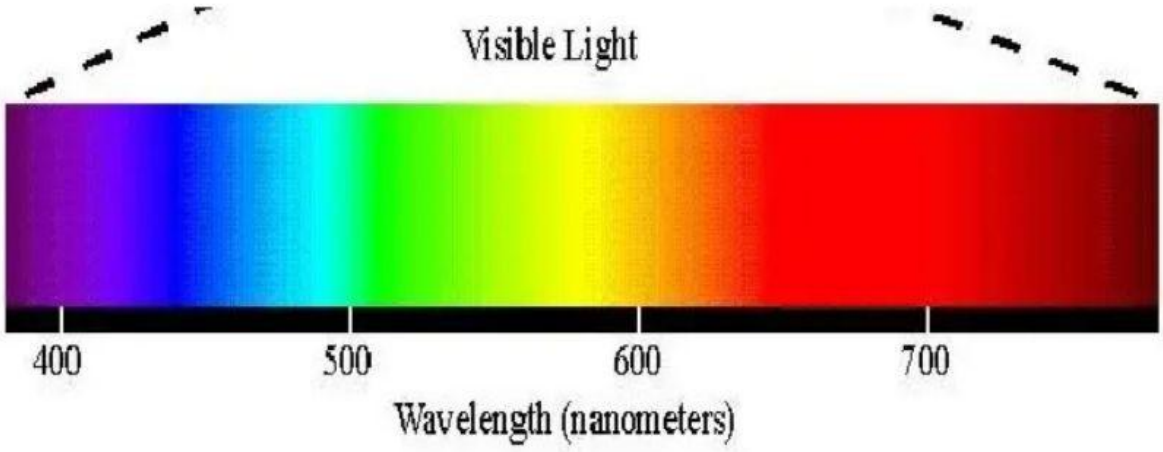
Though the sciences generally classify EM waves into seven basic types, all are manifestations of the same phenomenon.

- Radio Waves: Instant Communication.
- Microwaves: Data and Heat.
- Infrared Waves: Invisible Heat.
- Visible Light Rays: Light.
- Ultraviolet Waves: Energetic Light.
- X-rays: Penetrating Radiation.
- Gamma Rays: Nuclear Energy.



Electromagnetic Spectrum

- Once light was determined to have a wave nature, experimenters looked to find and confirm the wavelength of visible light. The wavelengths at which the human retina is sensitive to are extremely small and not easily detectable. The unit used for these wavelengths is the nanometer (nm), where 1 nm = 10^{-9} meters. Experiments determined that visible light has wavelengths covering the range from about 400 nm for violet light to 700 nm for red light. (Some scientists prefer to measure wavelengths in Angstroms, where one Angstrom is 10^{-10} meters. This project will use nanometers)



- Maxwell realized his equations did not place any limits on the wavelength, and hence frequency, of electromagnetic radiation: Electromagnetic waves could exist with wavelengths both longer and shorter than the range of visible light.
- Consequently, researchers started to look for ***invisible light***. The range of all wavelengths, including both visible and invisible light, is now called the electromagnetic spectrum.
- The most important characteristic of all these waves is their speed - it is the same as the speed of light! Mathematically, using *c* for the speed of electromagnetic waves in the equation for the speed of a wave, $v=\lambda f$, we can write:

$$c=\lambda f$$

(speed of light = wavelength x frequency)

CHARECTERISTICS OF EM WAVES

- Electromagnetic waves are transverse in nature as they propagate by varying the electric and magnetic fields such that the two fields are perpendicular to each other.
- Accelerated charges are responsible to produce electromagnetic waves.
- Electromagnetic waves have constant velocity in vacuum and it is nearly equal to 3×10^8 ms−1 which is denoted by $C = 1/\sqrt{\mu_o \epsilon_o}$.
- Electromagnetic wave propagation does not require any material medium to travel.
- The inherent characteristic of an electromagnetic wave is its frequency. Their frequencies remain unchanged but its wavelength changes when the wave travels from one medium to another.
- The refractive index of a material is given by: $n = \sqrt{\mu_r \epsilon_r}$

- Electromagnetic wave follows the principle of superposition.
- The light vector (also known as the electric vector) is the reason for the optical effects due to an electromagnetic wave
- In an electromagnetic wave, the oscillating electric and magnetic fields are in the same phase and their magnitudes have a constant ratio. The ratio of the amplitudes of electric and magnetic fields is equal to the velocity of the electromagnetic wave. $C = E_0B_0$
- The energy is carried by the electric and magnetic fields of electromagnetic waves are equal, i.e. the electric energy (U_E) and the magnetic energy (U_M) are equal; $U_E = U_M$.

BIBLIOGRAPHY

. NCERT
. STUDY.COM
. WWW.BRITANNICA.COM
. WWW.VEDANTU.COM
. GOOGLE
. GOOGLE IMAGES