SNS COLLEGE OF TECHNOLOGY

(AN AUTONOMOUS INSTITUTION)

Approved by AICTE & Affiliated to Anna University
Accredited by NBA & Accrediated by NAAC with 'A++' Grade,
Recognized by UGC saravanampatti (post), Coimbatore-641035.

Department of Biomedical Engineering

Course Name: 19BME301 – Medical Physics

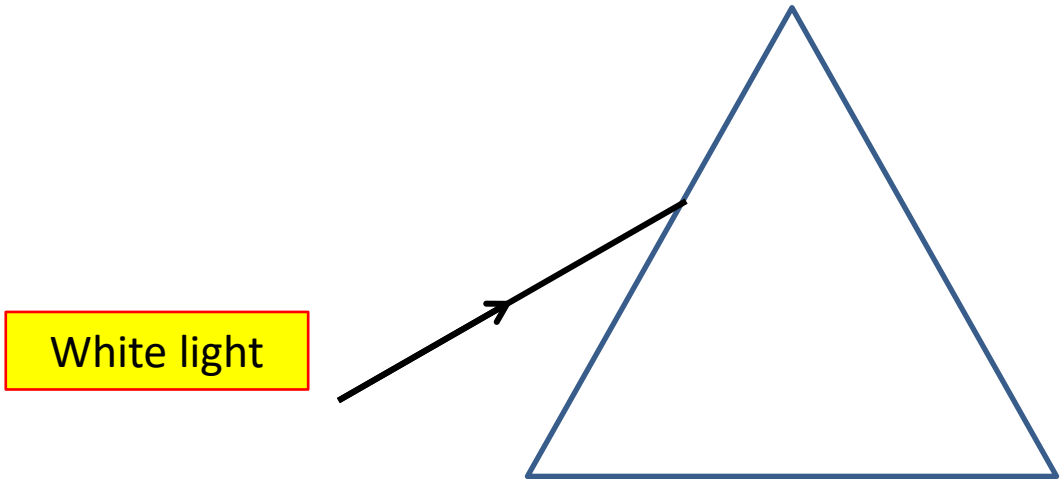
III Year : V Semester

Unit I –RADIATION AND RADIOACTIVE DECAY

Topic : Electromagnetic spectrum – sources

19BME301-MEDICAL PHYSICS – Electromagnetic Spectrum

Refraction of light by a prism.



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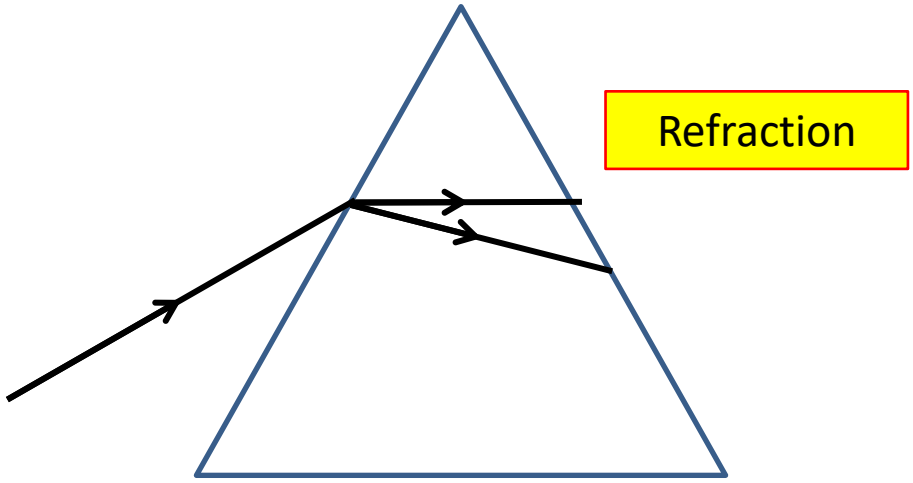

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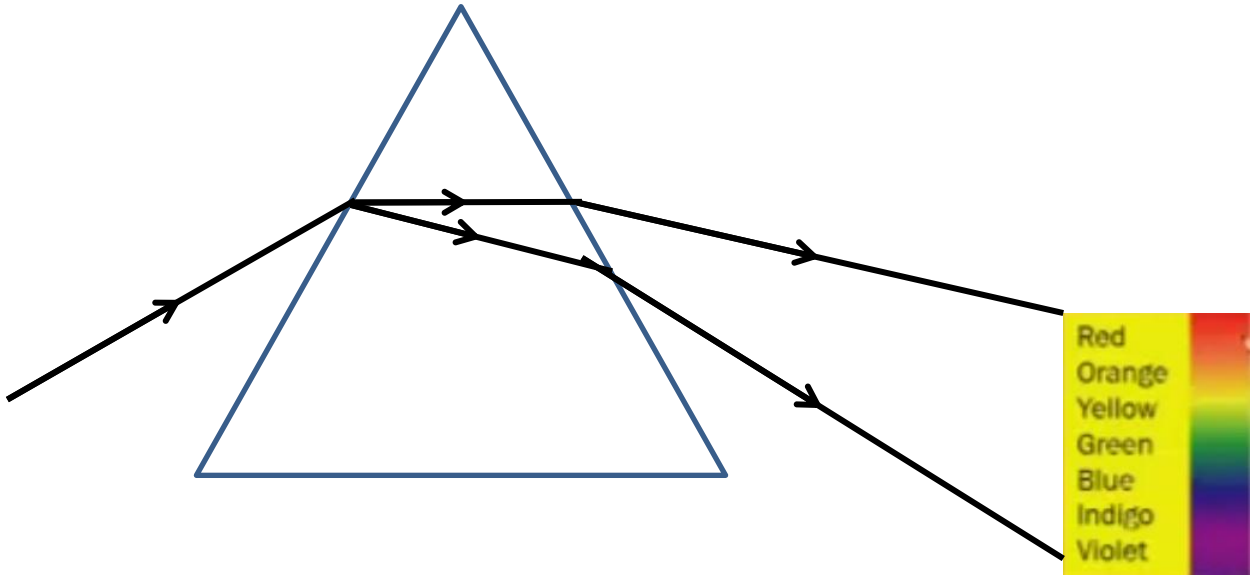

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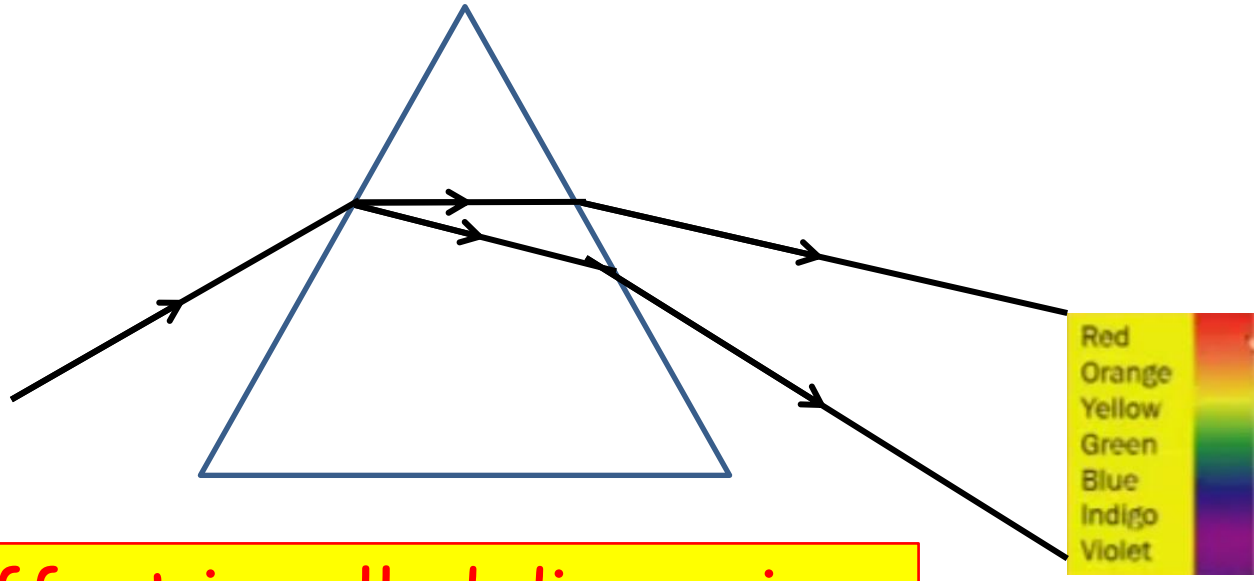

This effect is called dispersion

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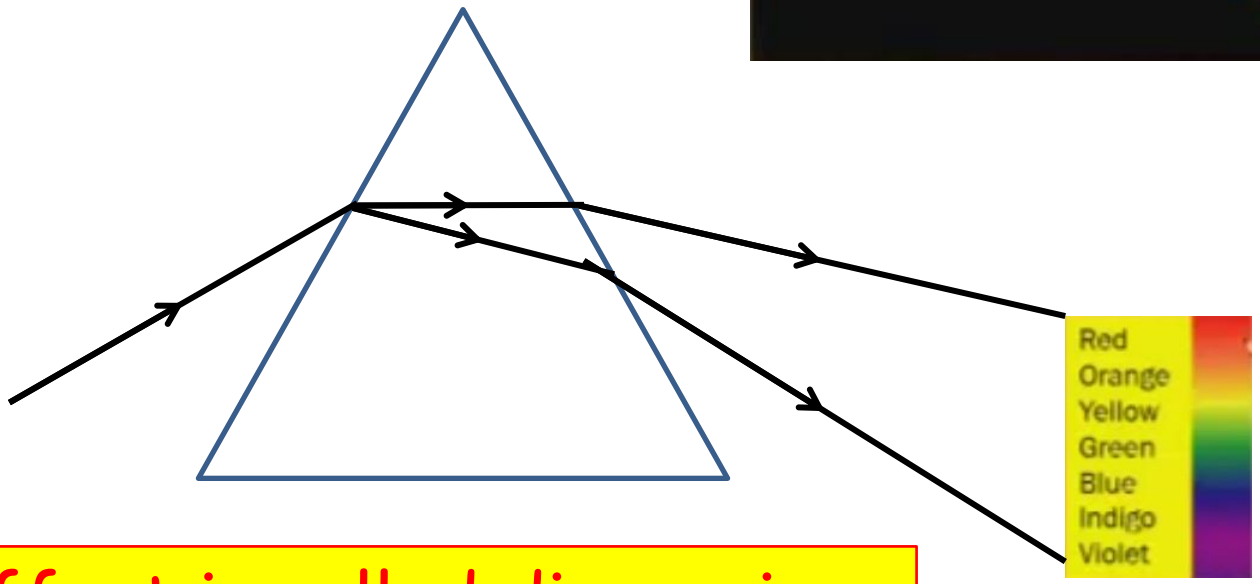

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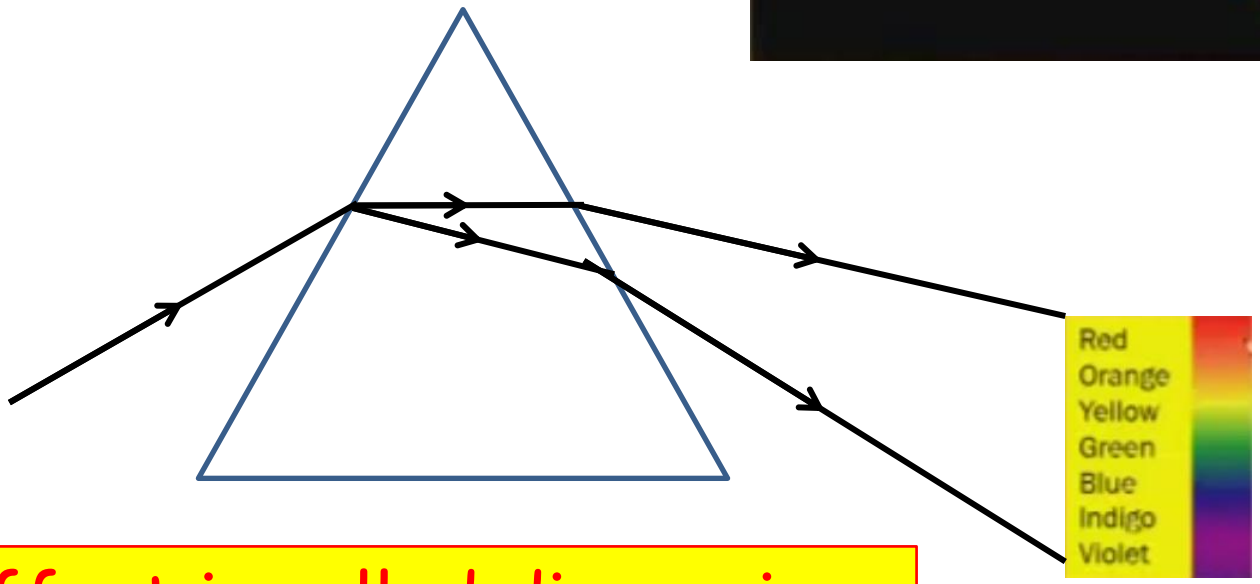
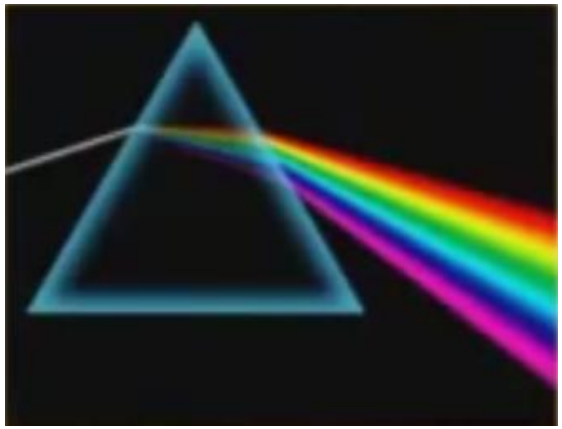


This effect is called dispersion

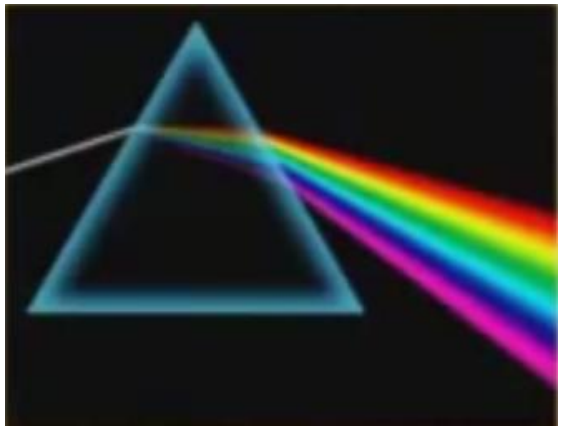
It happens because white is a mixture of all the colours in the rainbow

Wavelength and colour



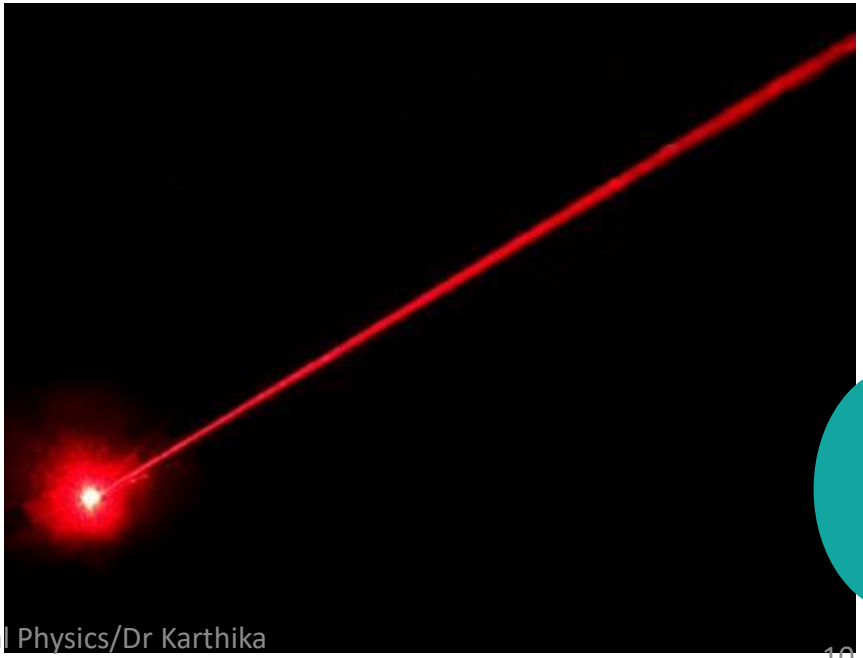
White light is made up of different colours with wavelengths ranging from 0.0004mm (violet) to 0.0007mm (red).

Wavelength and colour



White light is made up of different colours with wavelengths ranging from 0.0004mm (violet) to 0.0007mm (red).

Lasers, however, only emit light of a single colour and wavelength.
This type of light is known as **monochromatic** light.



The Electromagnetic Spectrum

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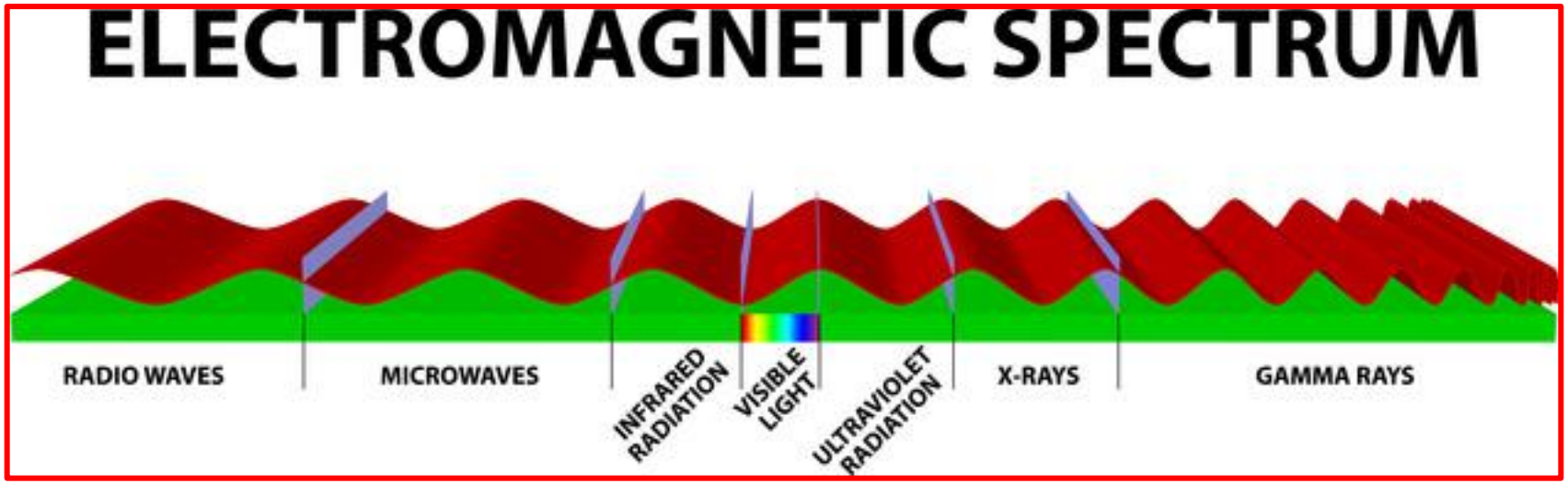

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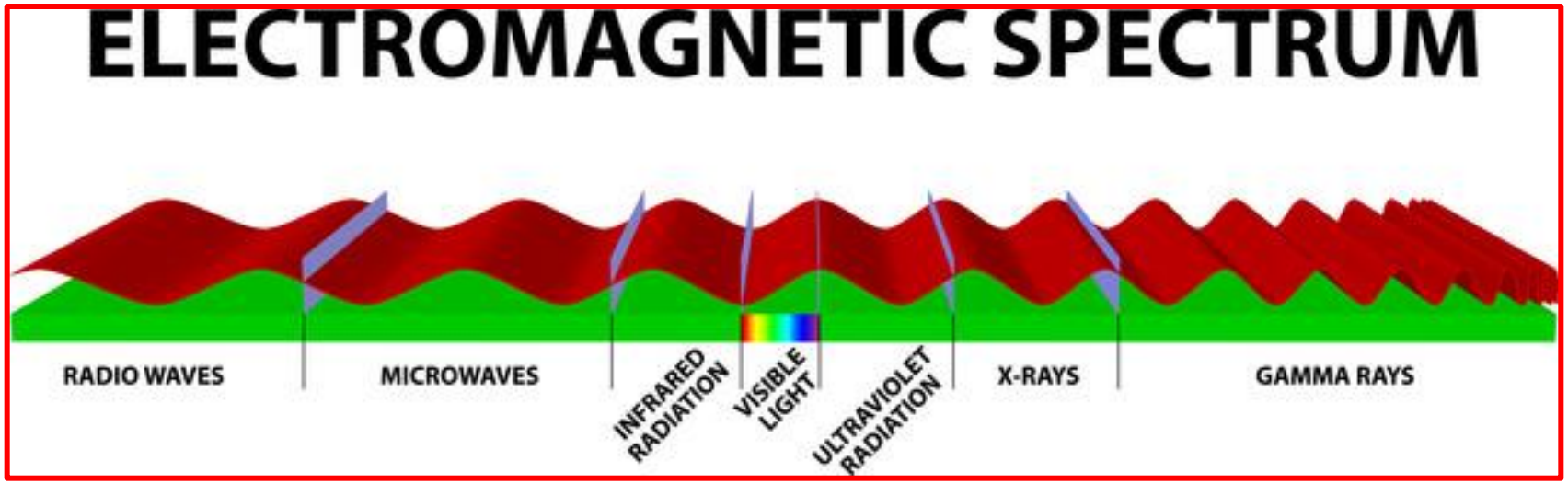

Features of the electromagnetic spectrum

1. They can travel through a vacuum (eg. Space)

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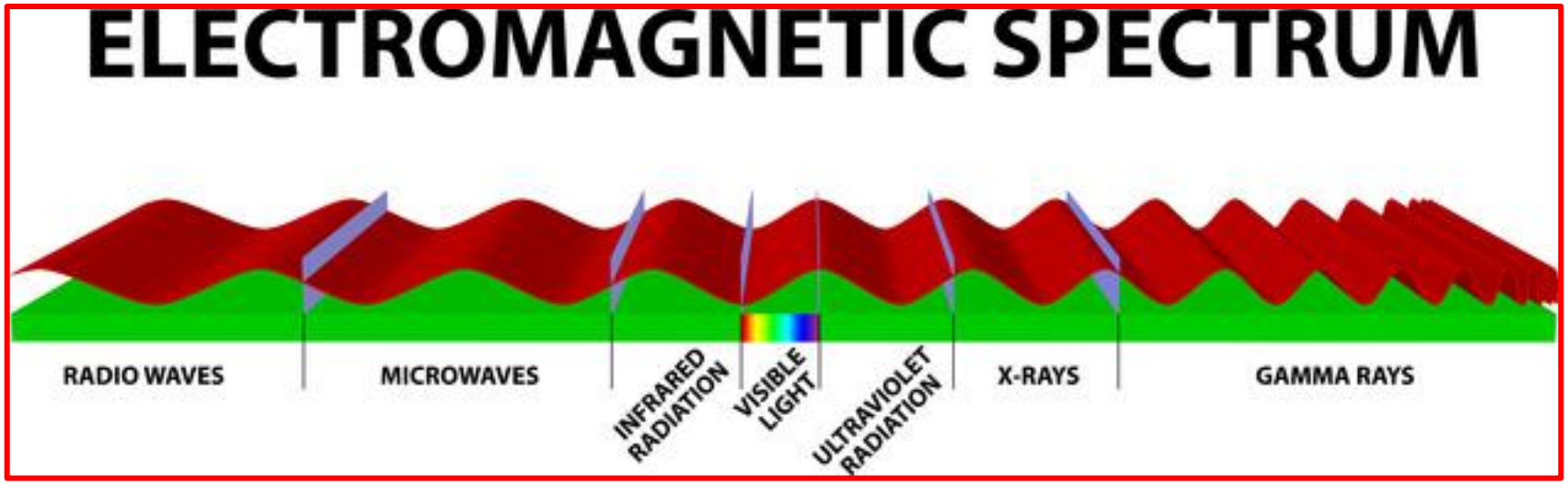

Features of the electromagnetic spectrum

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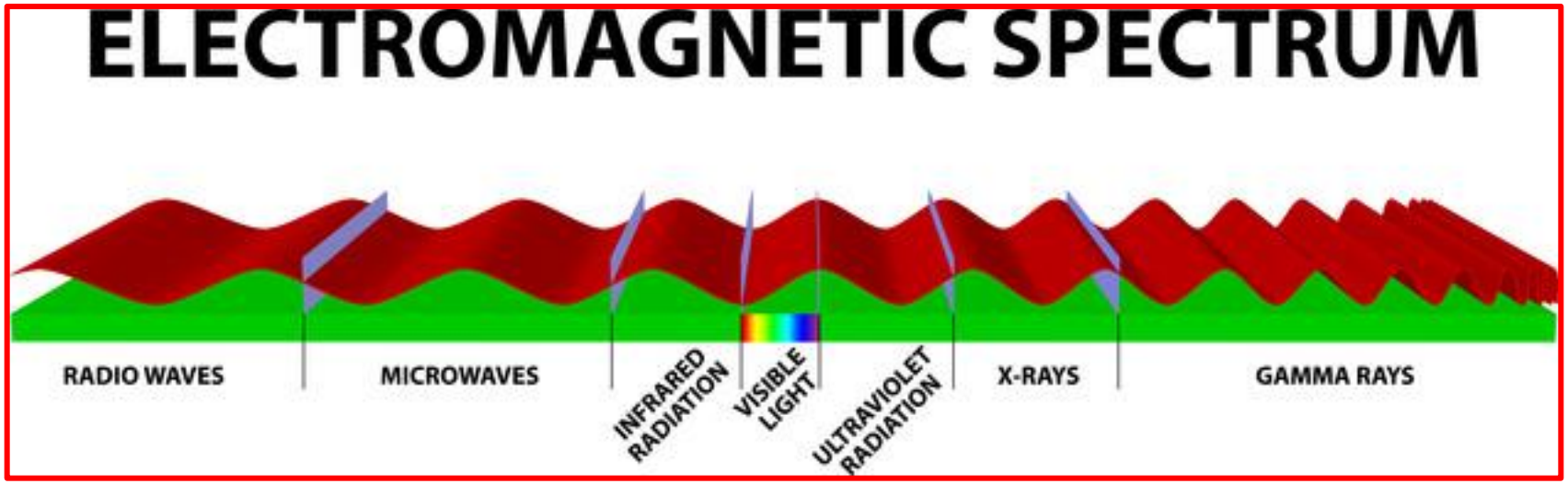

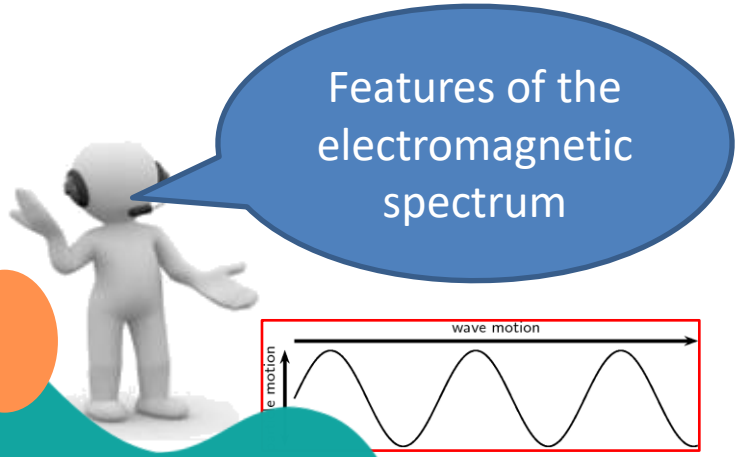

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3. They are all transverse waves, with oscillations at right angles to the direction travel.

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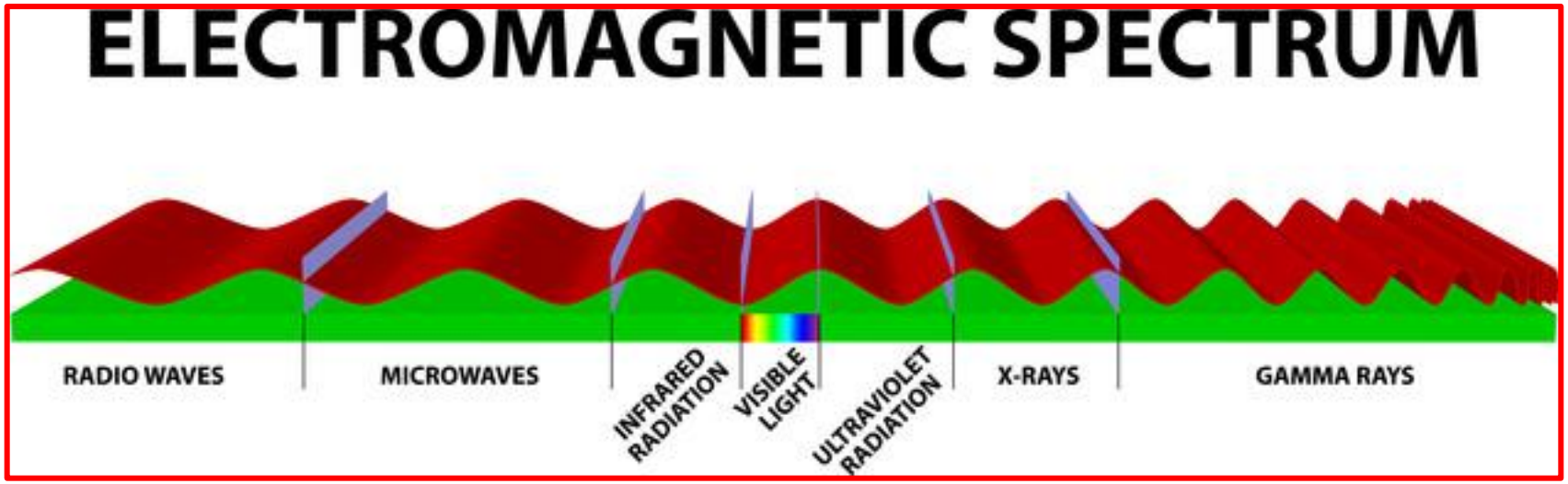

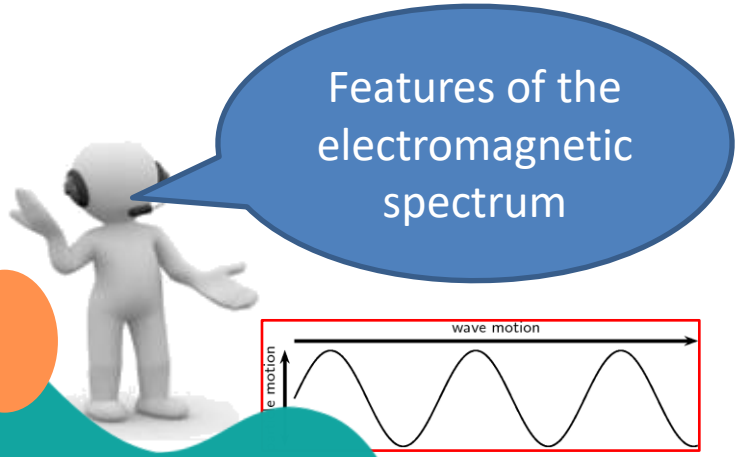

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4. Electromagnetic waves transfer energy.

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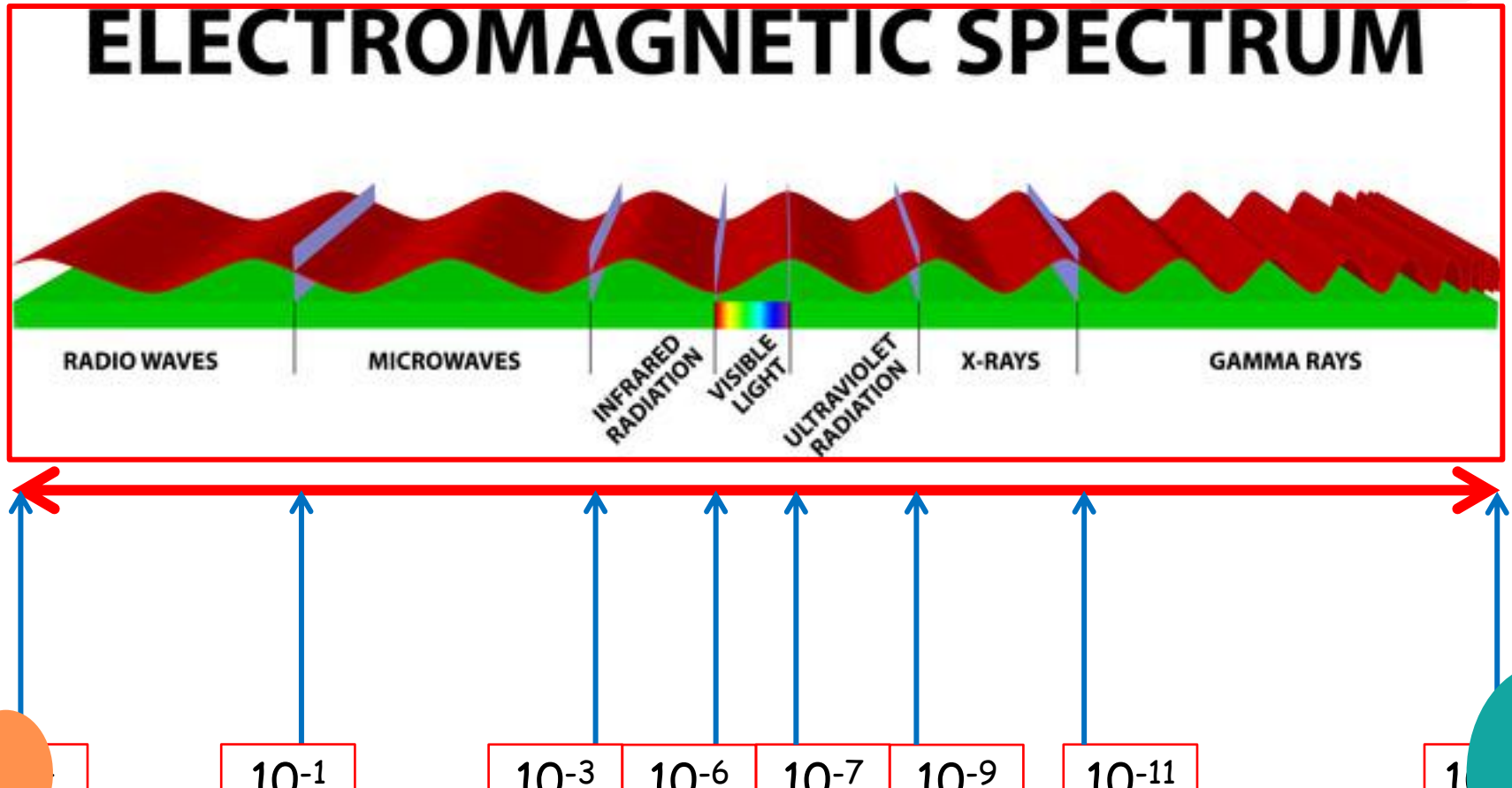

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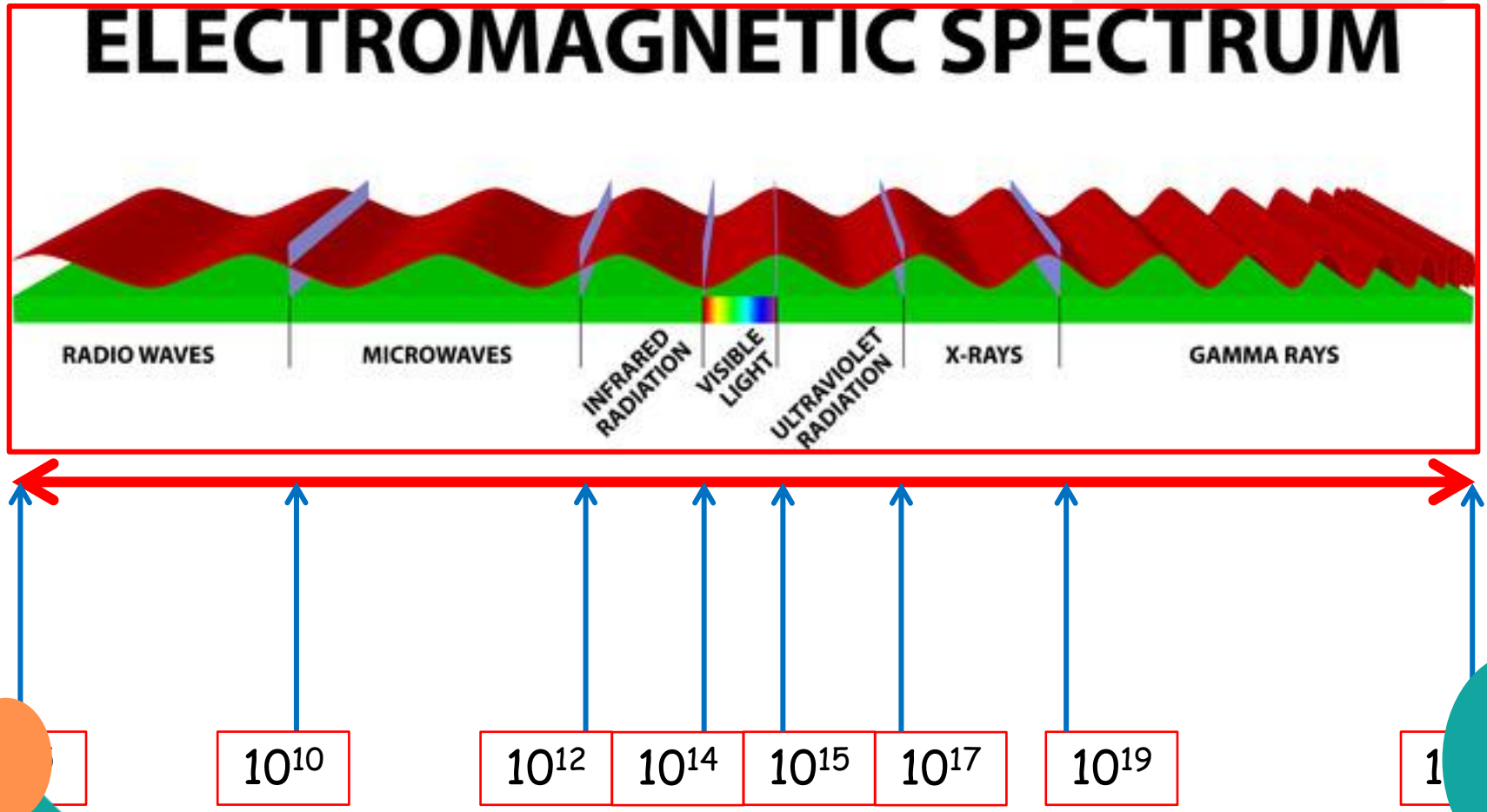
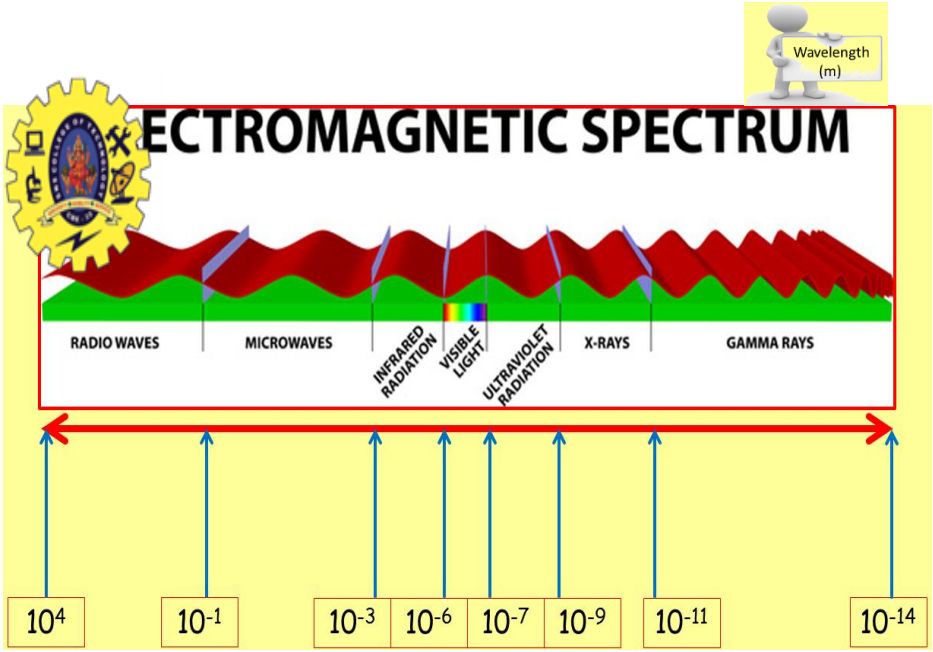
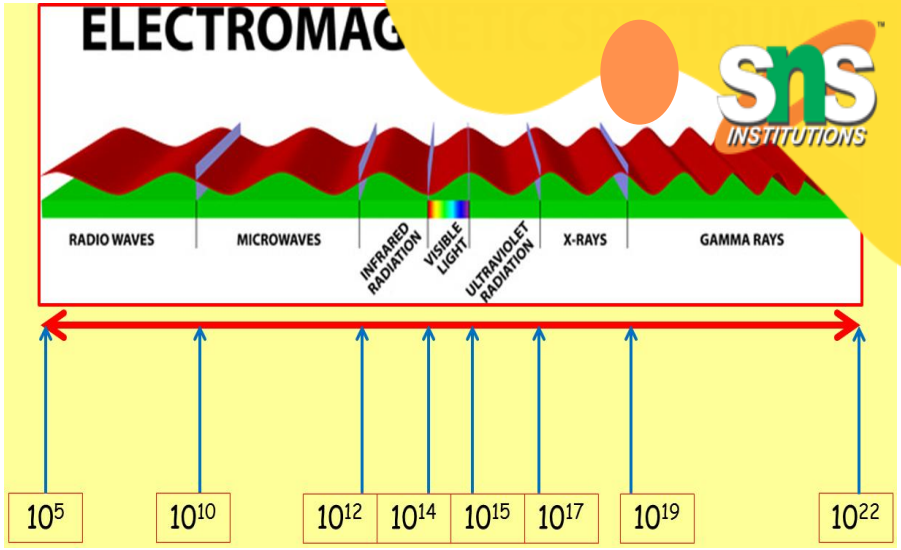




Wavelengths decrease going along the EM spectrum from radio waves to gamma rays.



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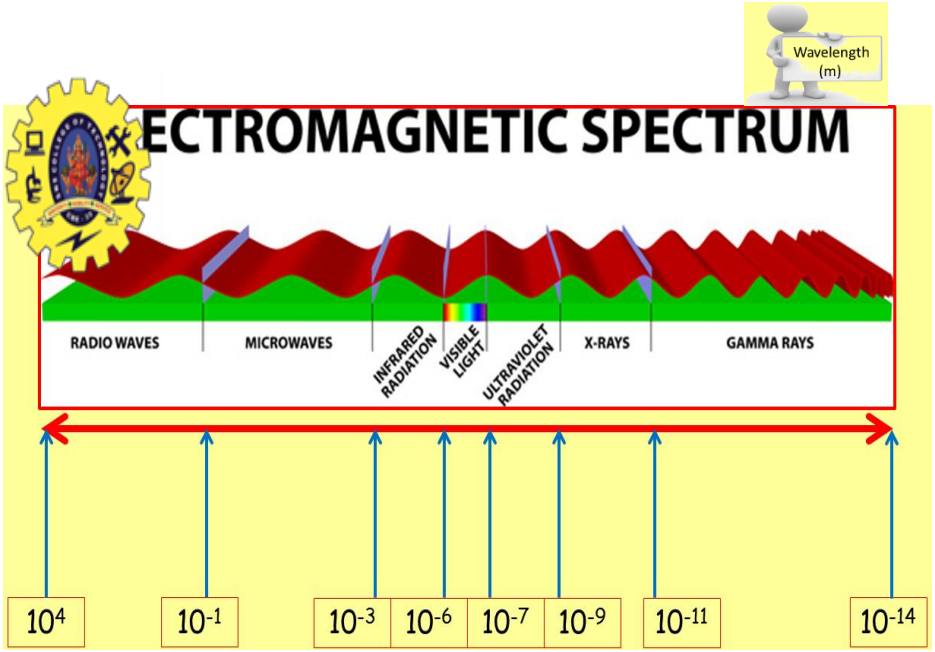

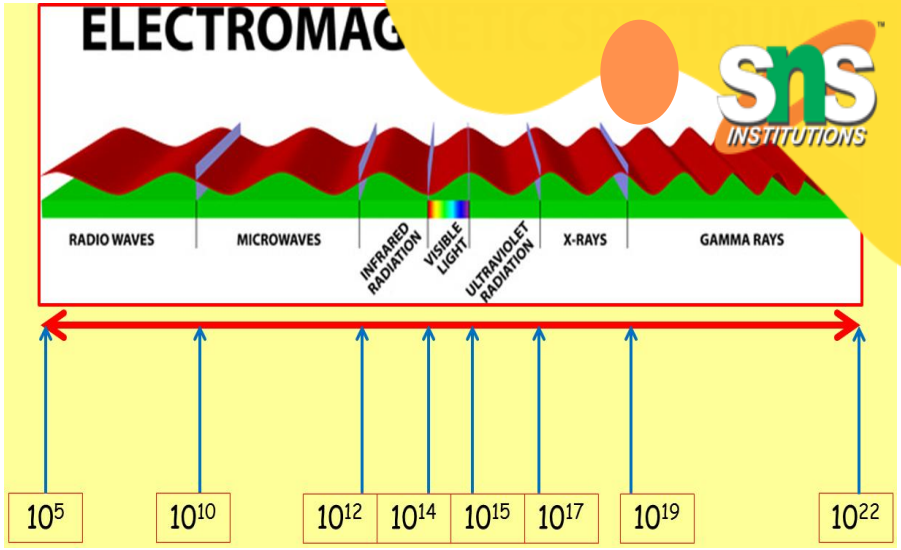

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Radio wave photons have the **lowest frequency** and the **least energy**, and **gamma ray** photons have the **highest frequency** and the **most energy**.

The Electromagnetic Spectrum

Intensity and distance

Whenever radiation is absorbed by matter, photons transfer their energy to the matter.

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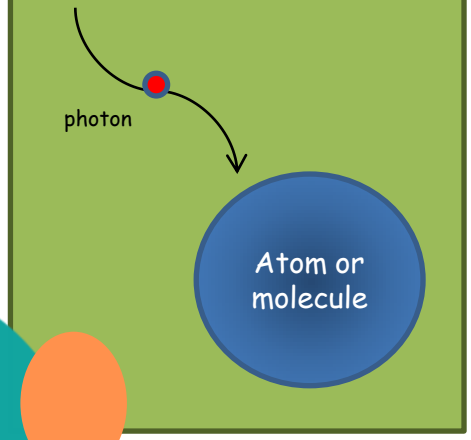

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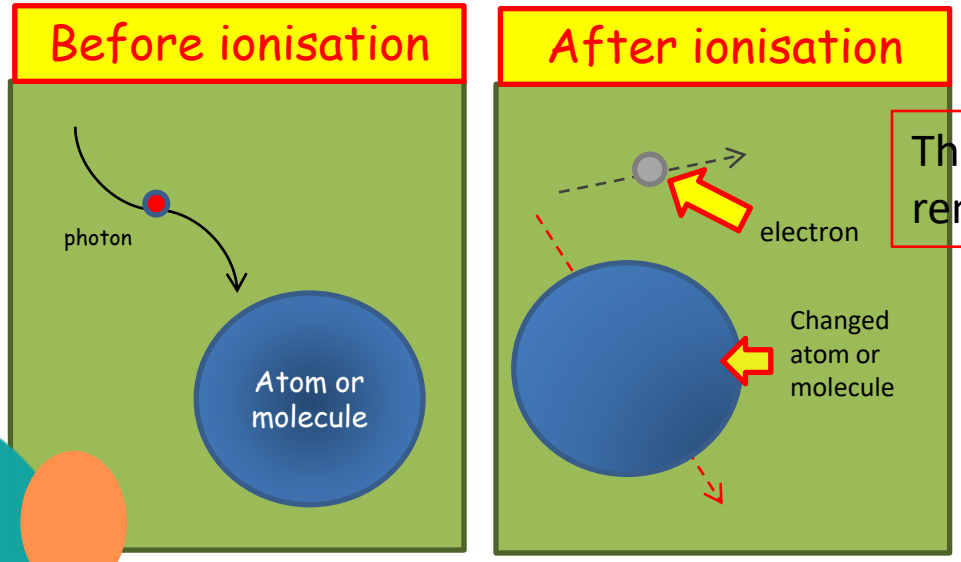

The **photon** hits the atom or molecule, and removes an **electron**.

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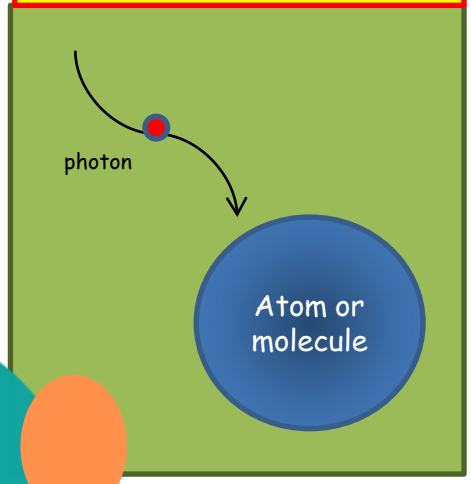

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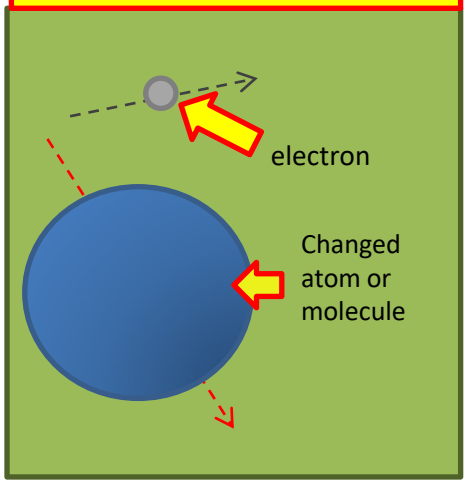


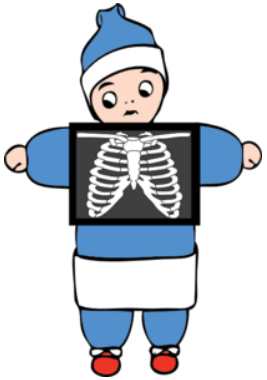
If cells are exposed to **ionising radiation**, they can damage the **DNA** in the nucleus of the cell. This can cause **mutations**, and the cells **divide constantly** without control – this is **cancer**.

Very high doses of ionising radiation can **kill** cells.

Excessive exposure to **UV** radia can lead to **sunburn** or even **skin cancer**.

Increased exposure = more damage

The Electromagnetic Spectrum



X - rays

.... and dangers

X-rays are used by **radiographers** in hospitals to check for broken bones.
X-rays **pass easily** through flesh, but are **absorbed** by **denser materials** like bone and metal.
X-ray imaging is also used in **airports** to check the **contents** of **bags**.

Precautions: radiograhers wear **lead aprons** or stand **behind concrete** to protect themselves.

The Electromagnetic Spectrum

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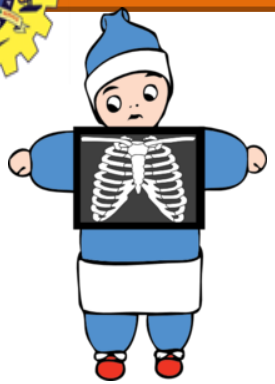

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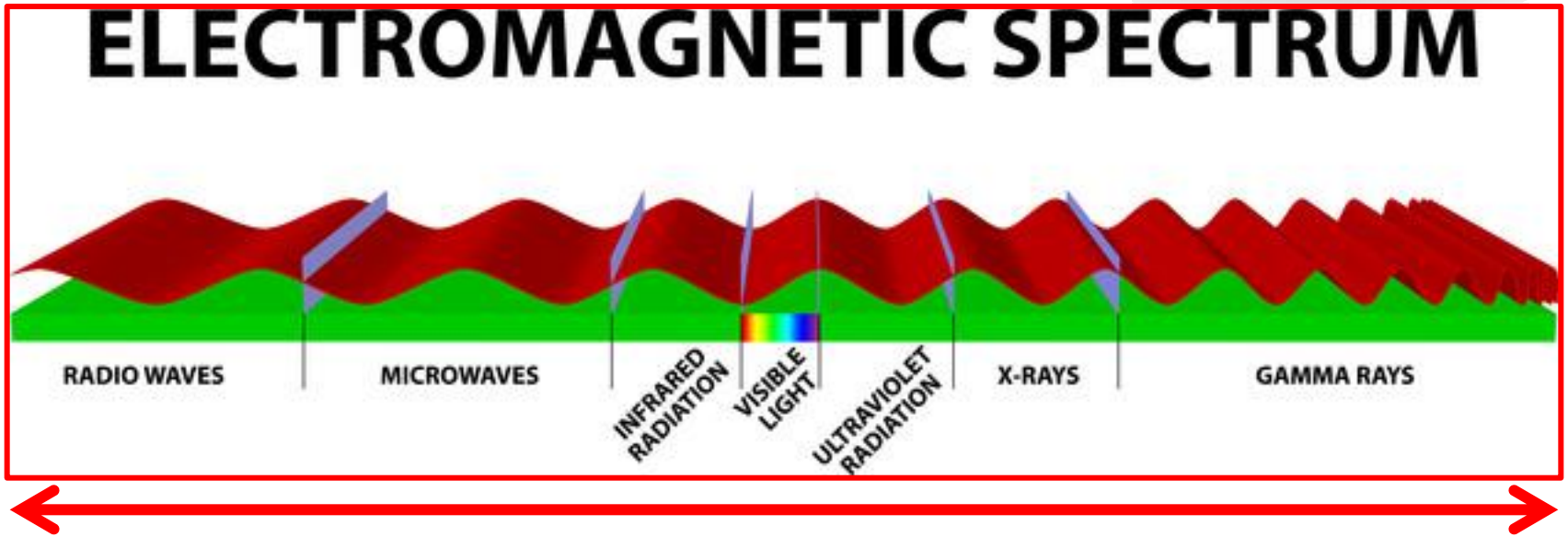
Microwaves

Microwaves are used to **send signals** between **mobile phones** and **mobile phone masts.**
When you make calls on your mobile, your phone **emits** microwave radiation.
Some of this is **absorbed** by your body and may cause **heating** of body tissues.
This heating could result in medical conditions, possibly including **cancer**, but there is no **conclusive evidence**.

Precaution: limit the **amount of time** you spend talking on a mobile phone!

The Electromagnetic Spectrum



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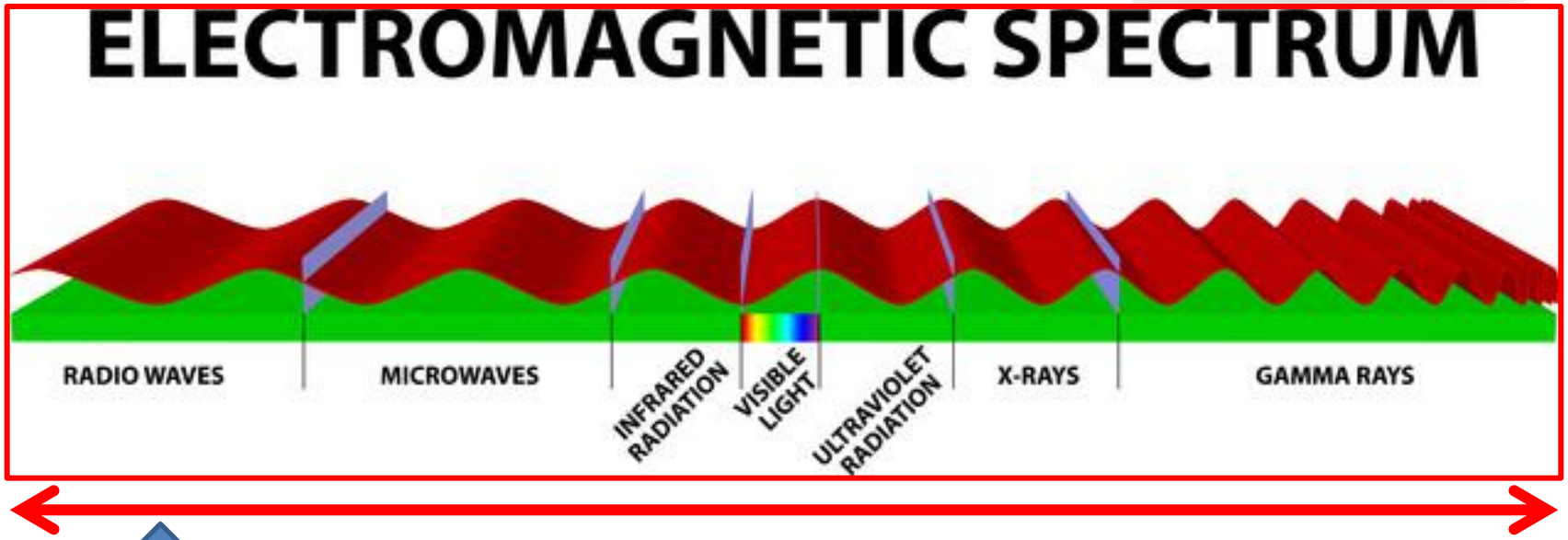
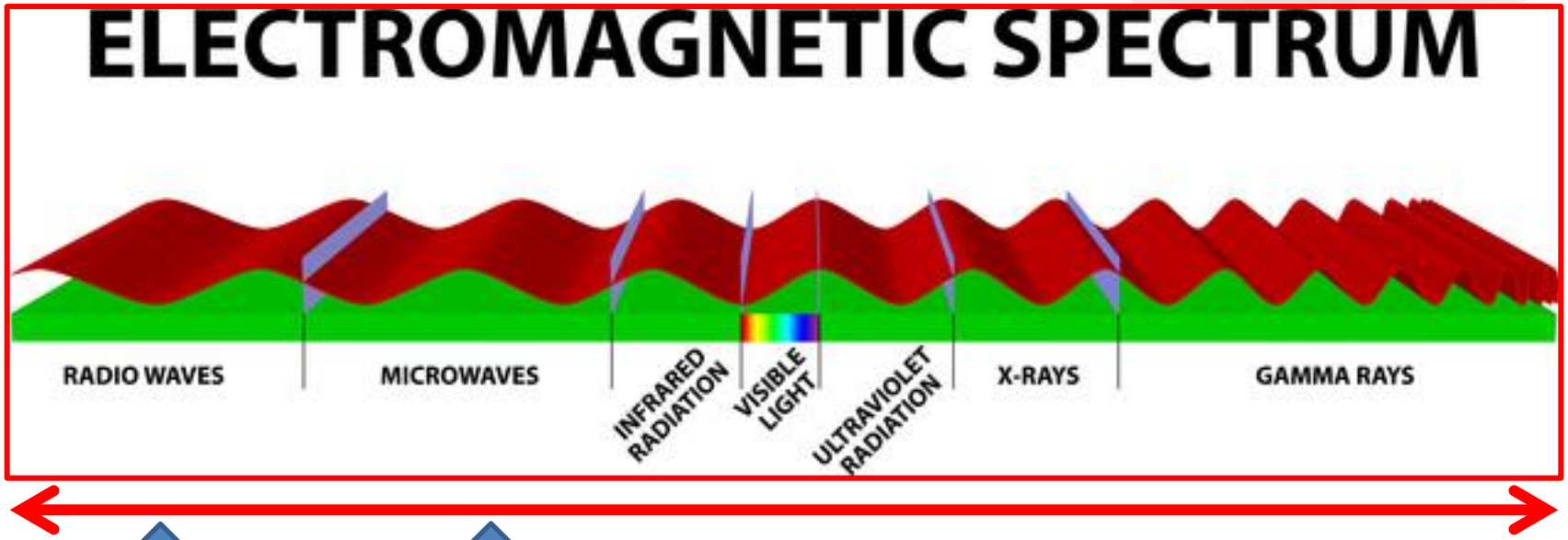


Broadcasting Communications, Satellite transmissions

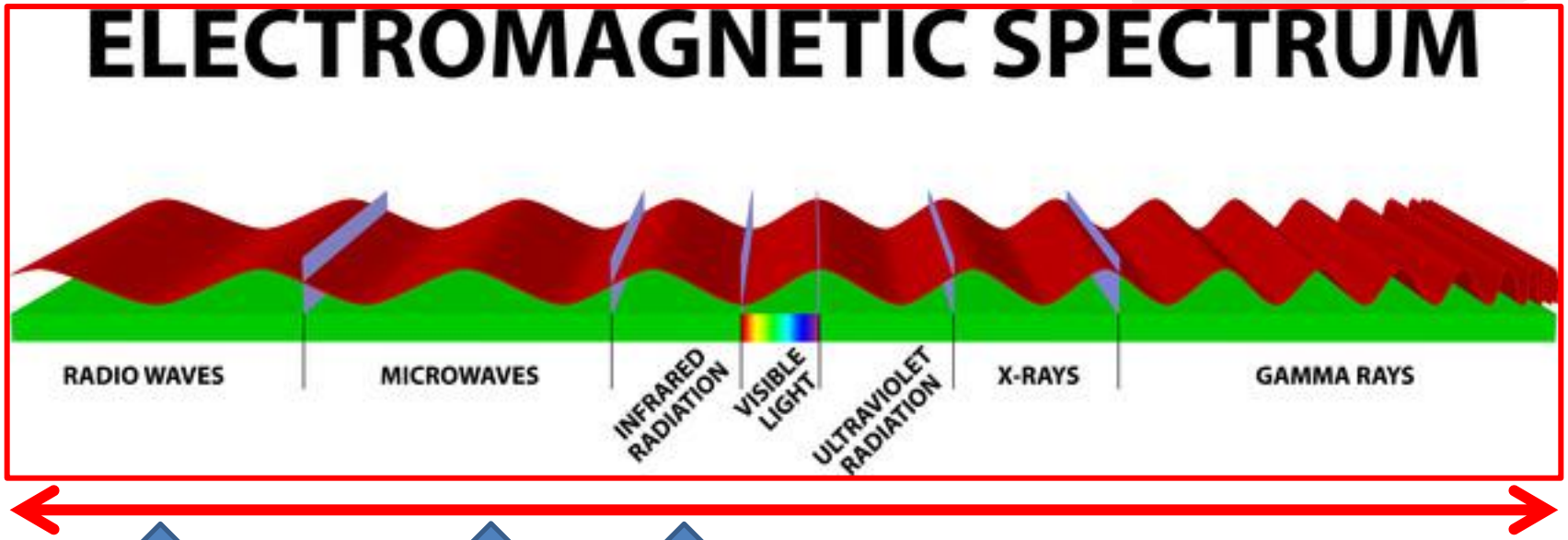
The Electromagnetic Spectrum



Broadcasting Communications, Satellite transmissions

Cooking, Communications, Satellite transmissions

The Electromagnetic Spectrum



Broadcasting Communications, Satellite transmissions

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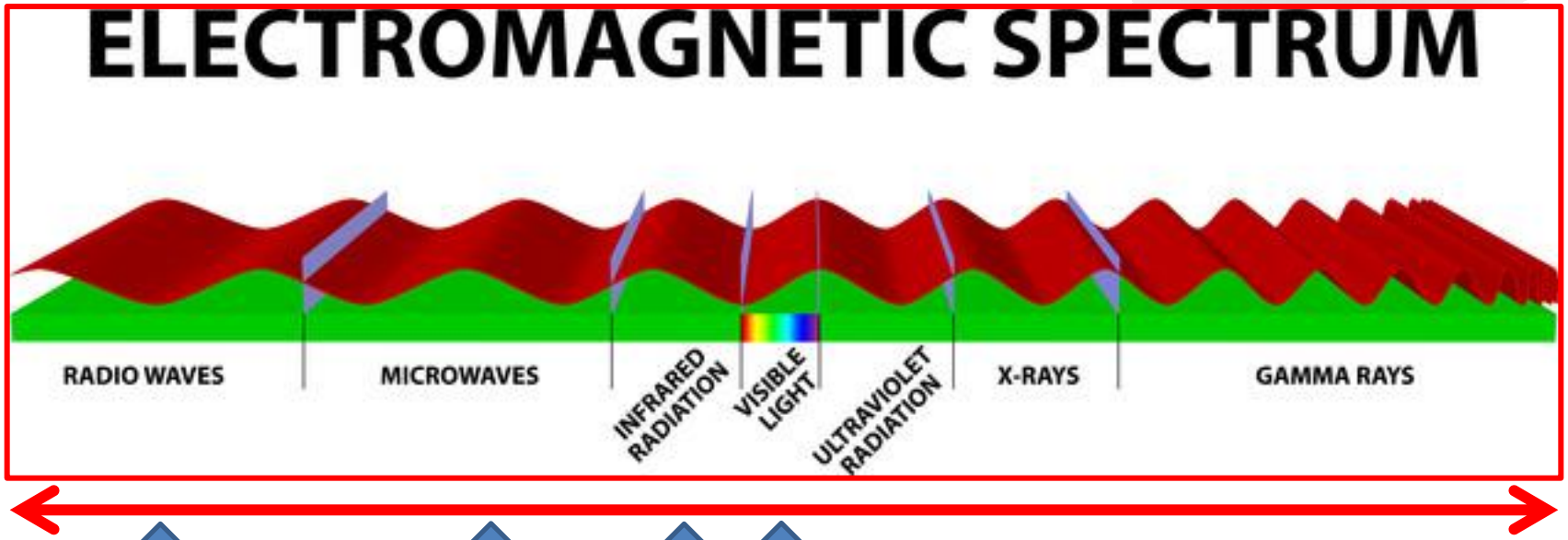
Cooking, thermal imaging, short range communications, optical fibres, TV remote controls, security systems.

The Electromagnetic Spectrum



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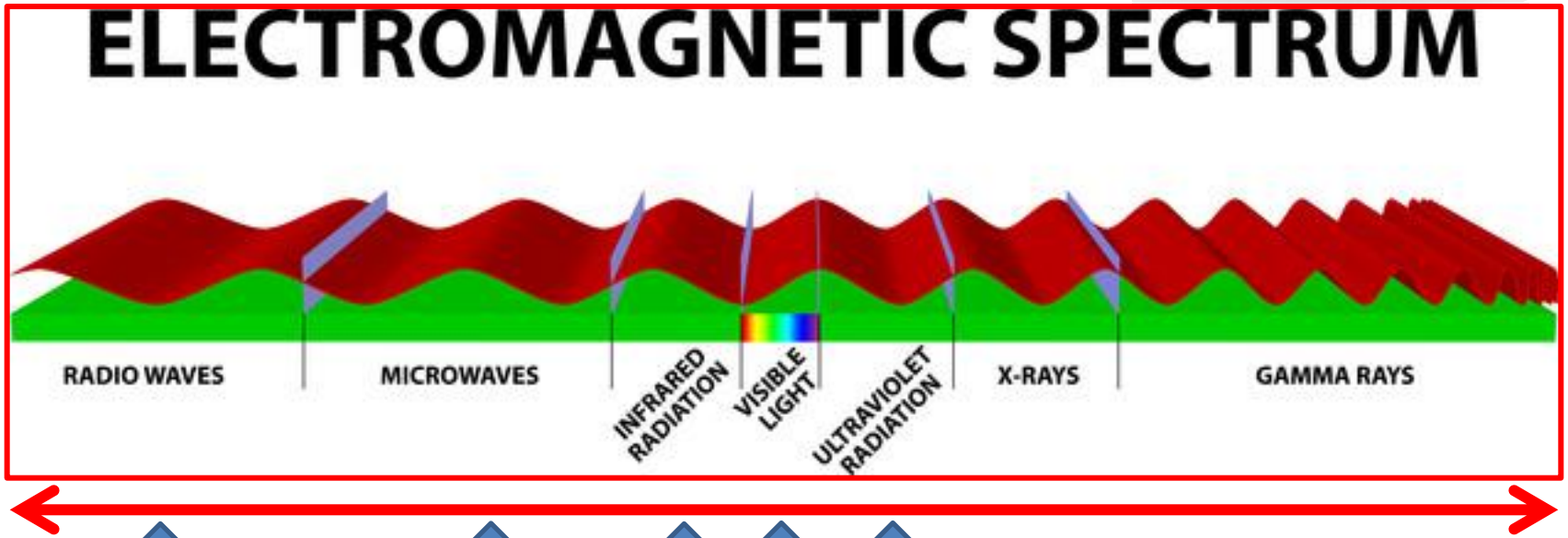

Broadcasting Communications, Satellite transmissions

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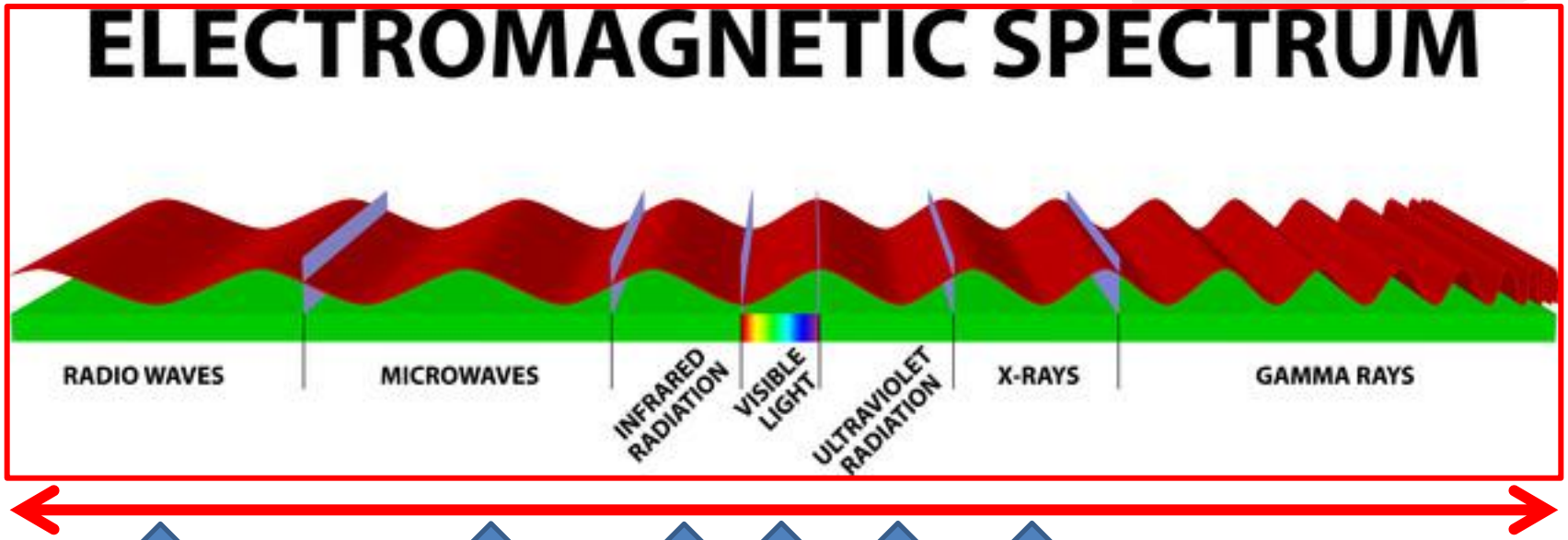
Security marking, Fluorescent lamps, Detecting forged bank notes, Disinfecting water

The Electromagnetic Spectrum



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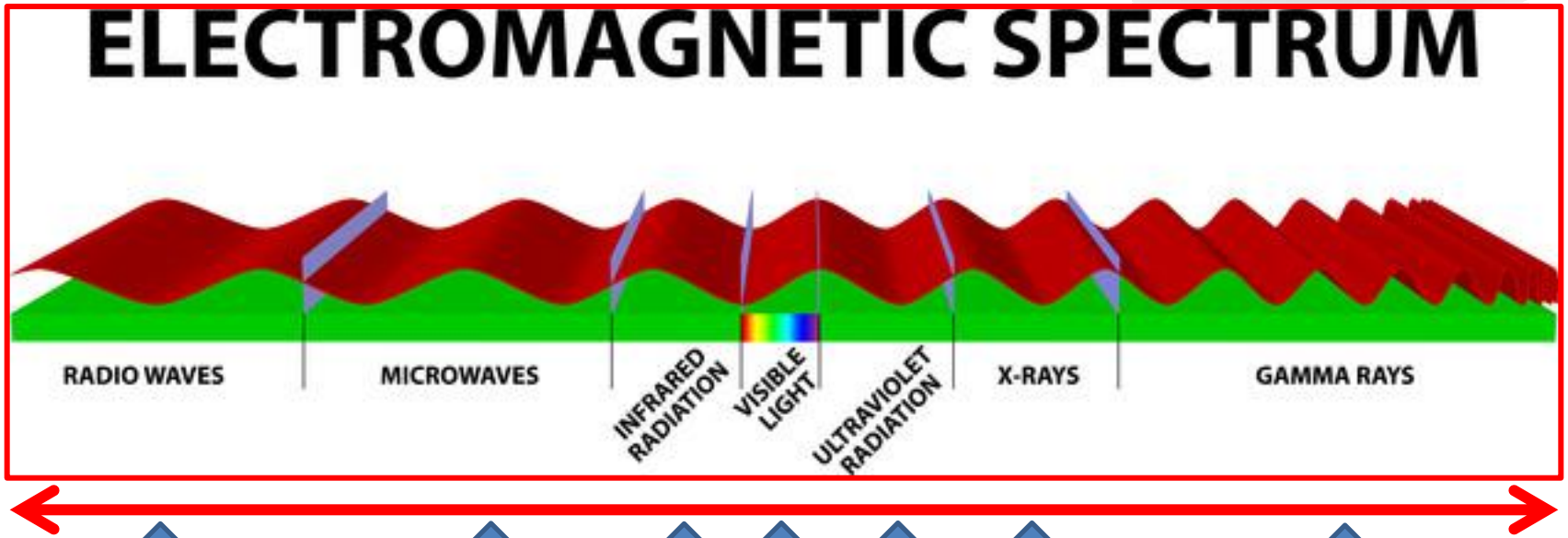
Observing the internal structure of objects, Airport security scanners, Medical X-rays

The Electromagnetic Spectrum



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Observing the internal structure of objects, Airport security scanners, Medical X-rays

Sterilising food and medical equipment, Detection of cancer and its treatment.

Medical PHYSICS – The Electromagnetic Spectrum