

What is Electromagnetic Radiation And Electromagnetic Spectrum?

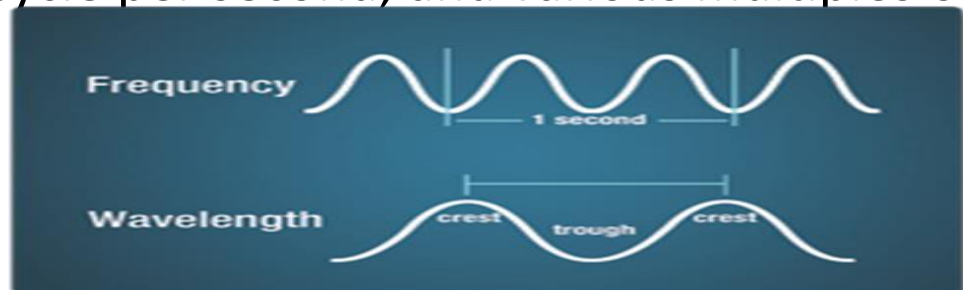
- The **first requirement** for remote sensing is to have an **energy source** to illuminate the target This energy is in the form of electromagnetic radiation (EMR).
- Different properties of the earth surface reflects, emits or scatters a portion of electromagnetic energy in the form of wavelength, which is defined as EMR
- EMR is a dynamic form of energy.
- While electromagnetic spectrum is the ordering of the radiation according to wavelength, frequency of energy and used to identify and classify objects.

Characteristics of EMR

- Two characteristics of electromagnetic radiation are particularly important for understanding remote sensing. These are the
 1. Wavelength and
 2. Frequency.

What is Wavelength and Frequency

- The **wavelength** is the **length of one wave cycle**, which can be measured as the distance between successive wave crests.
- **Wavelength** is usually **represented** by the **Greek letter lambda (λ)**.
- **Wavelength** is measured in **metres (m)** or some factor of metres such as **nanometres (nm, 10^{-9} metres)**, **micrometres (μm , 10^{-6} metres)** (μm , 10^{-6} metres) or **centimetres (cm, 10^{-2} metres)**.
- **Frequency** refers to the **number of cycles of a wave passing a fixed point per unit of time**. Frequency is normally measured in hertz (Hz), equivalent to one cycle per second, and various multiples of hertz.



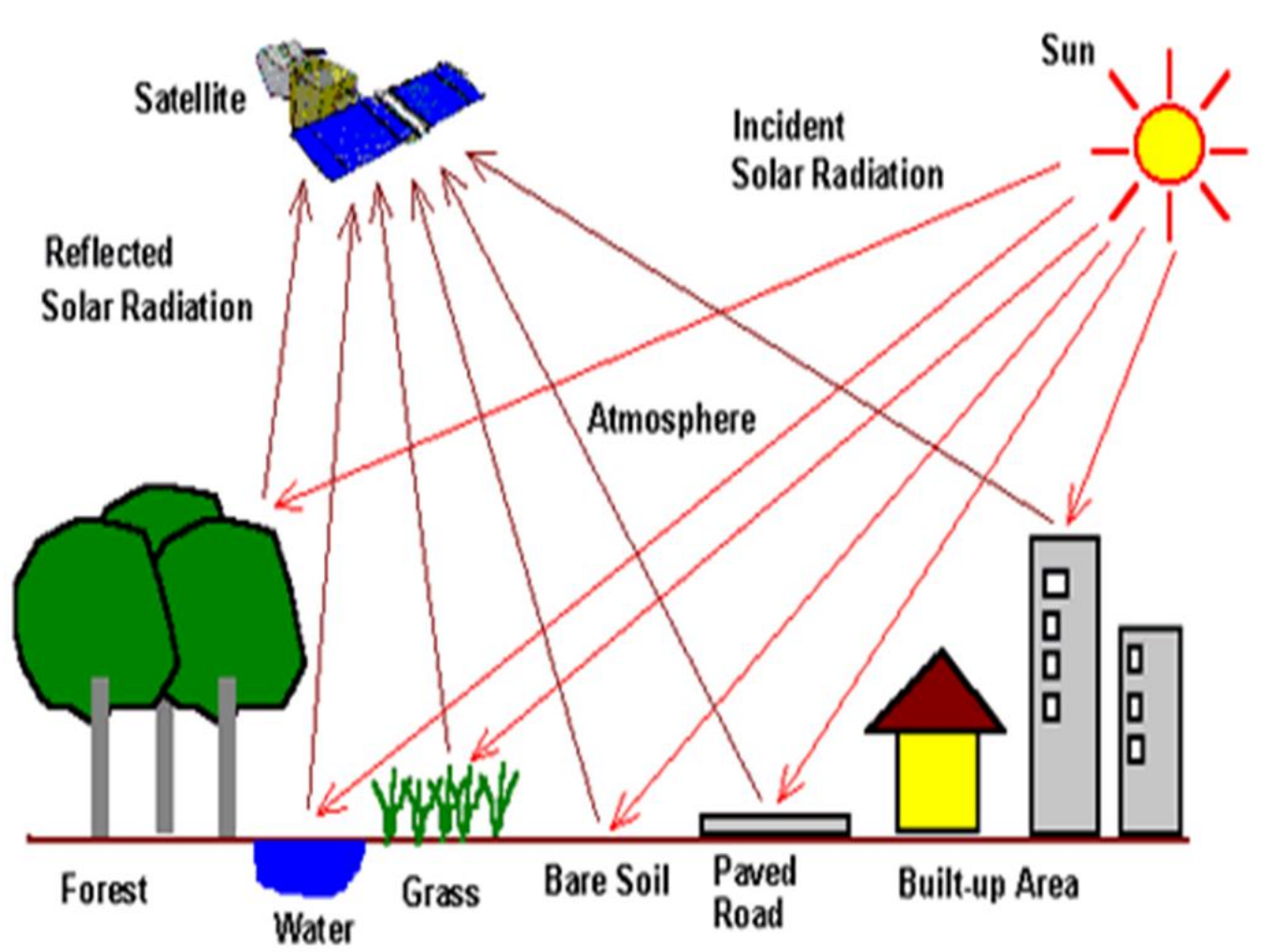
Principles

- The two are inversely related to each other.
- The shorter the wavelength, the higher the frequency. The longer the wavelength, the lower the frequency.

Energy Interaction with the Earth's Surface

- The **proportion of energy reflected, absorbed and transmitted** will vary **depending** on the **surface material** and condition
- The proportion of energy reflected, absorbed and transmitted will also vary at different wavelength
- **Absorption (A)** occurs when **radiation** (energy) is **absorbed** into the target
- **Transmission (T)** occurs when **radiation passes** through a target.
- **Reflection (R)** occurs when **radiation "bounces"** off the target and is redirected

Electromagnetic Radiation



What is Electromagnetic Spectrum?

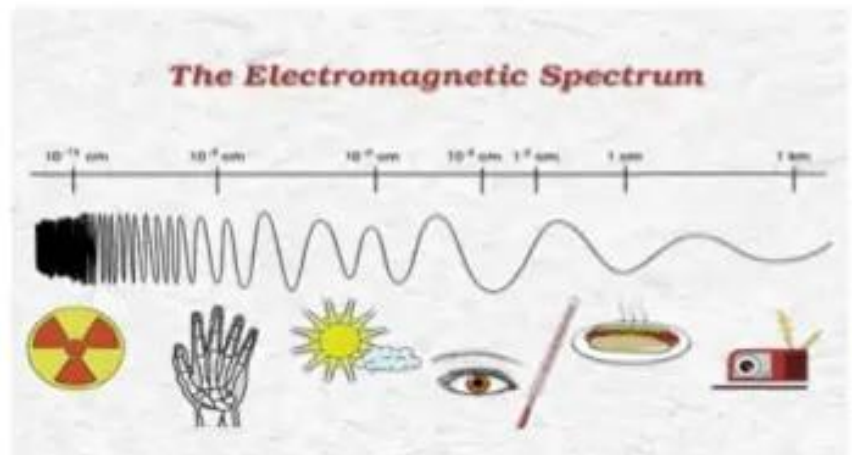
What is Light spectrum?

It is a range of colours of light.



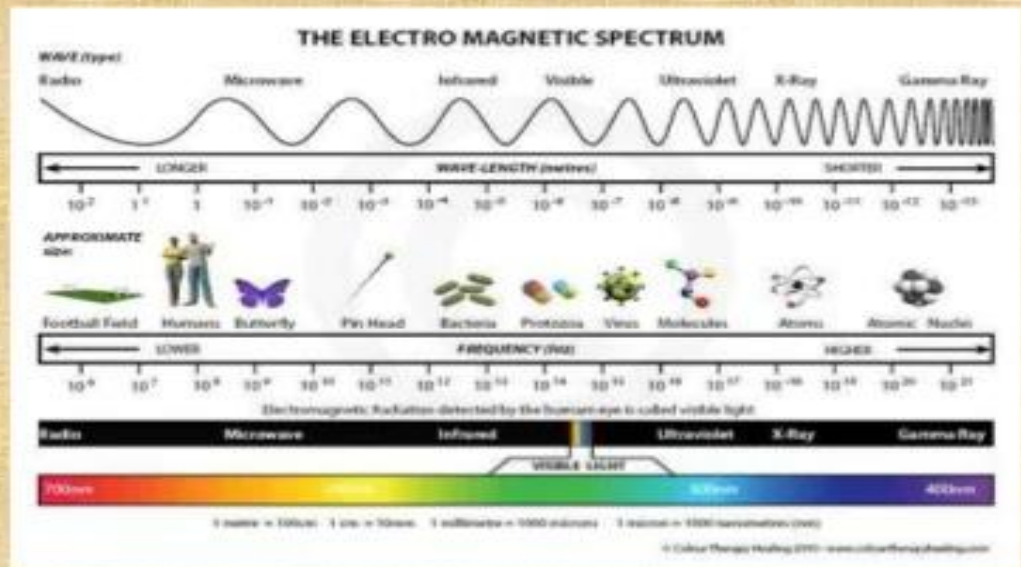
What is Electromagnetic spectrum?

It is a range of radiation.

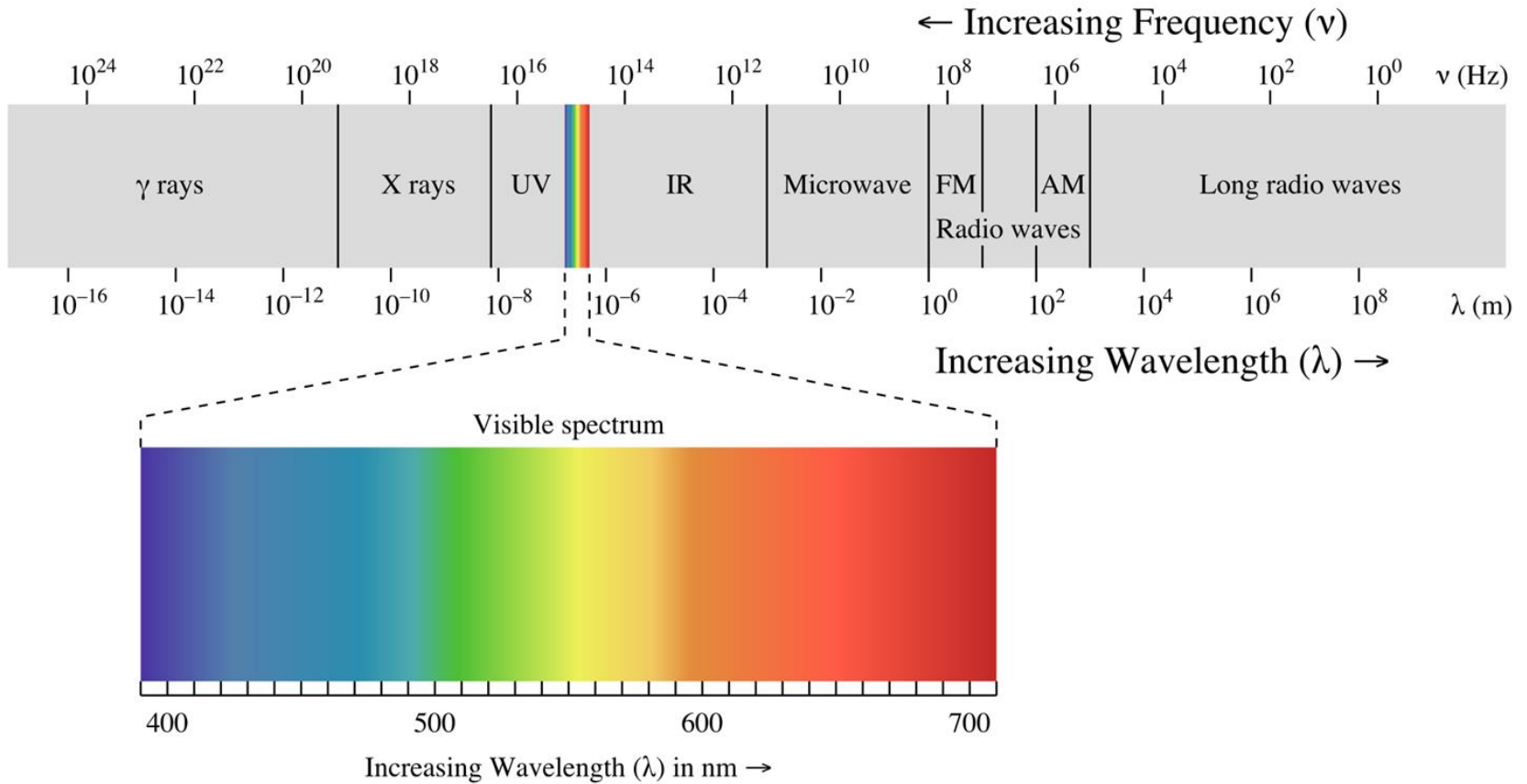


Electromagnetic Spectrum

- Includes the following types of waves
 - ▣ Radio
 - ▣ Microwaves
 - ▣ Radar
 - ▣ Infrared
 - ▣ Visible Light
 - ▣ Ultraviolet
 - ▣ X-Rays
 - ▣ Gamma Rays



The Electromagnetic Spectrum



From the TV station to your living room

That is the work of radio waves

Heating food in just seconds

Microwaves do that

Red orange yellow green blue indigo violet

That is the only part of the spectrum

That can be seen by us

Heat treatment for illness

Take pictures in the dark

They are even in your remote control

Infrared radiation

The suntan on your skin

Kill bacteria and viruses

Used to detect forgery

That is ultraviolet

See your broken bones

and my hidden bombs

That is the work of x rays

Kill cancer cells and sterilize

Dangerous gamma rays do that

Q: Which one has the highest level of energy?

Radio waves

- It is also used for broadcasting i.e. **television transmission.**

- The antennae on your television set receive the signal, in the form of **electromagnetic waves**, that is broadcasted from the television station.



Radio waves

- Radio waves are used for **radio communication.**
- A **radio tuner** is necessary to tune in to a particular **frequency** to receive certain signals.



Microwaves

- Microwaves are used in oven to heat up food.
- Water molecules in food absorb the microwave radiation, thereby heat up.



Microwaves

- Microwaves are also used in telecommunication such as satellite
- For example, it is used in satellite TV and weather forecast.



Infrared

- Infrared radiation is used in **remote controller**, commonly for devices such as TVs, DVDs, Home theater systems etc.



Infrared

- It is also used in **thermal imaging**
- The **amount of radiation** emitted by an object increases with **temperature**; therefore, this technique allows one to see **variations in temperature**.





Visible light

- Visible light is also used in other **imaging** technologies such as **microscopes, laser and fiber optics.**



Ultraviolet

- Ultraviolet could be used to **detect** **forgery.**



Ultraviolet

- It is also used in the hospital to **sterilise** **surgical tools** i.e. to kill bacteria/viruses.



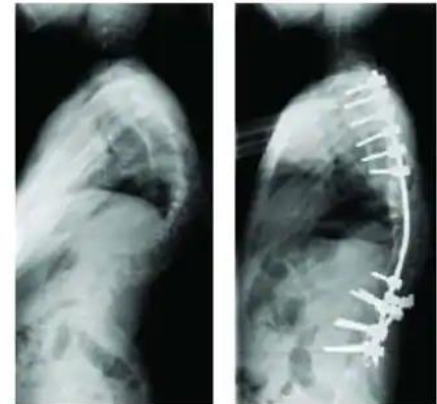
Dangers of UV light



- Besides being damaging to eyes, **over-exposure** might also cause skin cancer.
- Therefore, it is important to protect ourselves from over-exposure of UV radiation.

X ray

- **Medical imaging** is the technique and process used to create **images** of the human body for clinical purposes
- X-ray is often used for this purpose.



Gamma radiation

- Gamma radiation, is electromagnetic radiation of **high** frequency.
- Therefore, it is **highly damaging** to our cells.
- Despite their **cancer-causing** properties, gamma rays are also used to **treat some types of cancer**.



THANK YOU