Dangers of EM waves

- **Excessive exposure** to electromagnetic radiation has **harmful effects** on people.As the frequency of the electromagnetic (EM) waves increases, so does their energy
- Beyond the visible part of the spectrum (ultraviolet waves, X-rays and gamma rays), the energy is large enough to **ionise** atoms
- The **higher** the **frequency**, the more **ionising** the radiation.The effects of ionization also depend on the **type of radiation** and the **size** of the **dose.**

Harmful effects of EM radiation

Wave	Danger
Radio	No known danger
Microwaves	Internal heating of body cells
Infrared	Skin burns
Ultraviolet	Damage to surface cells and eyes leads to skin cancer and eye conditions
X-rays and gamma rays	Mutation or damage to cells in the body

Harmful effects of excessive microwave exposure

- Certain frequencies of microwaves are absorbed by **water molecules**
- Humans contain a lot of water, so there is a risk of **internal heating** from microwaves
- Microwaves used for **communications** (including mobile phones) emit very small amounts of energy which are not known to cause any harm
- Microwave ovens, on the other hand, emit very large amounts of energy, however, that energy is **prevented** from escaping the oven by the metal walls and metal grid in the glass door

Harmful effects of excessive ultraviolet exposure

- Ultraviolet is similar to visible light, except it is invisible to the human eye and carries a much higher energy
- If eyes are exposed to high levels of UV it can cause **severe** eye damage.Good quality sunglasses will absorb ultraviolet, preventing it from entering the eyes
- Ultraviolet can kill cells or cause them to malfunction.This can cause **premature aging**, and diseases such as **skin cancer. To Avoid this malfunctioning use Sunscreen** which absorbs ultraviolet light, preventing it from damaging the skin

Harmful effects of excessive X-ray and gamma-ray exposure

- X-rays and gamma rays are the most ionising types of EM waves
- They can penetrate the body and cause **internal** damage
- They can cause the **mutation** of DNA, causing **cancer**

Summary of Electromagnetic Wave

Type of waves	Production	Uses	Danger
Radio	AC current flowing in a coil of wire	Communication, radio station as they can travel very long distances (kilometres)	Eye cancer and other ill-nesses
Micro	Photons of light with right frequency	Heating water and fat molecules, communication (phone and mobile services, bluetooth), CMBR images (Cosmic background radiation, explained later in the course)	Skin burns, it can mutate cells and cause cancer
Infrared	Anything that has a temperature (above absolute zero) emits them	To heat up the environment, communication, thermal camera, tv-remotes and lasers	Skin burns, it can mutate cells and cause cancer
Visible	Anything that has a lot of energy that wants to come out, mostly from the Sun's radiation	It is literally everywhere, it lets us see	It can cause blindness and cause eye cancer
UV	Stars and Sun will emit UV	Forging of bank notes, secret messages encoding, sterilise objects	It can ionise and mutate cells, causes skin cancer
X-ray	Hot gases emit x-ray or high speed electrons striking a metal surface	x-ray imaging, CT or CAT scans	Ionising and mutate cells, causes cancer
γ-rays	Radioactive materials, particle accelerators	Radiotherapy, sterilise medical equipment	Mutates DNA and cells in body, causes cancer