Required Practical

see practical sheet for detail

**Infra Red Radiation**Given out by **all** objects. **Hotter** objects give out **more**.

IR cameras can detect IR radiation to monitor temperature. An image can be displayed where the brighter the object the hotter it is.

Food is cooked by **absorbing** IR, eg. from a toaster

**Black** objects are **good absorbers** of IR so heat up easily.
**Silver** objects are poor absorbers but **good reflectors** of IR.

**Microwaves**Used to communicate with satellites (eg. TV, mobile phones). The signal is sent from a transmitter into space, received by a satellite orbiting the Earth which transmits the signal back to Earth to a satellite dish. Due to long distances there is a time delay.

Microwave ovens use microwaves that are absorbed by water in food. Their energy is transferred to the water molecules in the food, heating it up. This is transferred to the rest of the food by heating.

All EM waves travel at the same speed through a vacuum.

**X-Rays and Gamma Rays**

**Visible Light
Optical fibres** can transmit visible light over long distances. The light bounces along the cable and is used to transmit data. Very little light is absorbed or scattered.

X-Rays pass through flesh but are absorbed by the more dense bone.
Gamm rays can be used as a **tracer** a gamma source is injected and its path through the body can be detected. Both are used to **treat cancer** as they kill cells.

**Ultraviolet Radiation**Fluorescent lights produce UV which is absorbed by phosphorus on the bulb and re-emitted as visible light.
Security pens can be used to mark property. The ink is only visible when viewed under UV.

**Dangers of EM Waves**UV can damage surface cells, causing sunburn and increasing the risk of cancer.
X-rays and gamma rays are ionising, meaning they can knock electrons off atoms. This can lead to mutations in DNA, destroy cells and cause cancer.
Radiation dose is measured in Sieverts (Sv), a measure of the risk of harm. This risk depends on on the total amount of radiation absorbed and how harmful it is. This can be different for different body parts.

**Radio Waves**Made using an **AC** supply – this creates oscillating electric and magnetic fields (EM waves). The frequency of the wave depends on the frequency of the alternating current. Once transmitted the radio wave is absorbed by a receiver. The energy in the wave is transferred to the **electrons** in the receiver, causing them to oscillate. These in turn cause electrons in a circuit to oscillate at the **same frequency** as the wave.

Radio waves are used for **communication**:
 - **Long wave** radio (1 to 10K wavelength) can be transmitted around the world because they diffract around the earths surface and hills.
 - **Short wave** radio (10m – 100m wavelength) are reflected off the ionosphere in the atmosphere so can also be transmitted long distances.

Short wavelength
High Frequency

Long wavelength
Low Frequency

Wavelength

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Radio waves | Micro waves | Infra Red | Visible Light | Ultra Violet | X-Rays | Gamma Rays |
| 1–104m | 10-2m | 10-5m | 10-7m | 10-8m | 10-10m | 10-15m |

**Electromagnetic Spectrum**