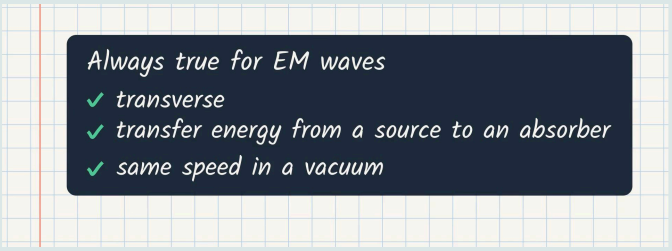
The EM spectrum

One family of waves

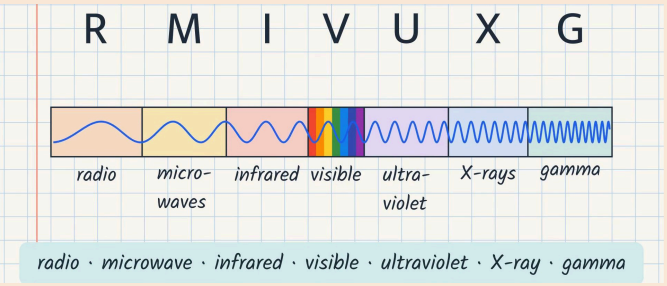
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Summary sheet

1 What they share



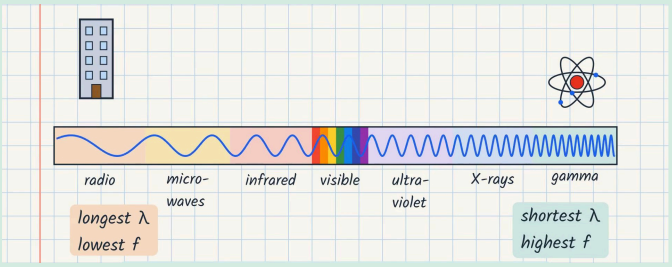
- All **EM waves** are **transverse** and **transfer energy** from a source to an absorber.
- They all travel at the **same speed in a vacuum** (or air): about 3 × 10^8 m/s.

2 The seven groups



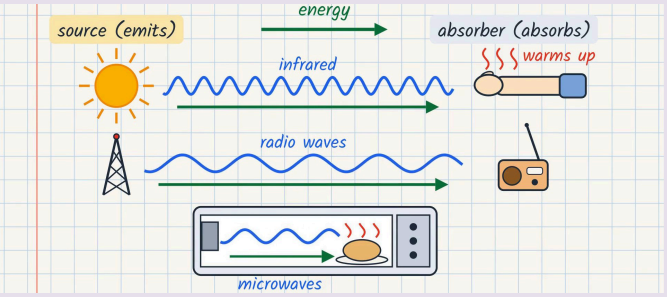
- One **continuous spectrum**, split into seven groups: radio, microwaves, infrared, visible light, ultraviolet, X-rays, gamma rays.
- Mnemonic: Rich Men In Vegas Use eXpensive Gadgets. **Visible light** (red to violet) is the only part our eyes detect.

3 Wavelength and frequency



- Same speed for all, so from **v = f λ** a shorter wavelength means a higher frequency.
- Radio: **longest wavelength, lowest frequency**. Gamma: **shortest wavelength, highest frequency**.

4 Source to absorber



- EM waves carry energy from a **source** (emitter) to an **absorber**.
- Sun → skin (warms up); radio mast → aerial; microwave oven → food.

$$v = f \lambda$$

wave speed = frequency × wavelength

Exam tip

If asked how two EM waves are the same, give a property of all EM waves: "Both travel at the same speed in a vacuum."

Check yourself

1. Which group sits between visible light and X-rays?
2. Higher frequency: microwaves or infrared?

Answers: 1. Ultraviolet 2. Infrared