Year 9 Physics: EM Spectrum Knowledge Organiser

End Point 1: The structure of the Electromagnetic Spectrum

Electromagnetic Spectrum	The collective name for **all types of EM radiation**. They are all **transverse waves** that travel at **300,000,000 m/s**.
Ionising	**High energy radiation** which can **remove electrons** leaving **ions**. If this happens **in DNA** it can cause a **mutation** that could lead to **cancer**.
Production	**Gamma rays** are produced from the **decay** of an **unstable nucleus**. **Radio waves** are produced by **oscillations** in **electrical circuits.**

Long wavelength → Short wavelength

Radio waves	Microwaves	Infrared	Visible light	Ultraviolet	X-rays	Gamma rays

Low frequency → High frequency

End Point 1: Properties of EM waves

Property	EM Wave	Sound Wave
Speed	300,000,000 m/s	Much slower (around 330 m/s)
Medium it can travel through	Can travel through anything, even a vacuum (space).	Solids, liquids, gases
Type of wave	Transverse	Longitudinal
Wavelength	Very short	Longer

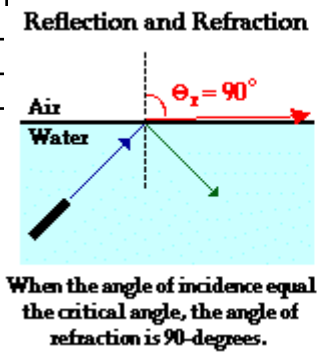
End Point M & O: Calculating wave speed

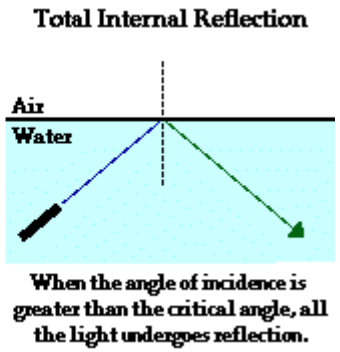
Calculation	Equation	Symbol equation	Units
Wave speed	Wave speed = frequency x wavelength	$v = f \lambda$	Wave speed - metres per second (m/s) Frequency - hertz (Hz) Wavelength - metres (m)

End Points B-D, F, H-J

EM Wave	Use	Why it's suitable	Risks
Radio Waves	**Television** and **radio**	**Reflected** by **ionosphere** so can broadcast over **long distances**.	
Microwaves	**Satellite communications, cooking food**	Able to **pass through the atmosphere** to **satellites**. Has a **heating** effect.	
Infrared	**Electrical heaters, cooking food, infrared cameras**	Has a **heating** effect. **Emitted by objects** so can be **detected**.	
Visible Light	**Fibre optic communications**	Able to **pass along a cable** by **total internal reflection**.	
Ultraviolet	**Energy efficient lamps, sun tanning**	**Increases** amount of **melanin** (brown pigment) in **skin**.	**Premature skin ageing**, increase **risk of skin cancer** (some can **ionize**)
X-Rays	**Medical imaging and treatments**	**Absorbed by bone** but **transmitted through soft tissue.**	**Ionizing** – can cause **mutation of genes** and **cancer**
Gamma Rays	**Medical imaging and treatments**	Able to **pass out of body** and be **detected by gamma cameras**. Can **kill cancerous cells**.	**Ionizing** – can cause **mutation of genes** and **cancer**

End Point G: Total Internal Reflection





End Point G: Total Internal Reflection

The safety precautions are:

- keep exposure times as short as possible
- monitor exposure with a film dose badge
- label radioactive sources clearly
- store radioactive sources in shielded containers
- wear protective clothing
- use tongs or a robotic arm to handle radioactive materials.

Optical fibres