Physics 6: Waves

Section 1: Transverse and Longitudinal Waves

1 Transverse Waves	Oscillations (vibrations) are perpendicular to the direction of travel and energy transfer.
2 Longitudinal Wave	Oscillations (vibrations) are parallel to the direction of travel and energy transfer.
3 Wave Speed	The speed at which energy is transferred.

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$v = f \cdot \lambda$

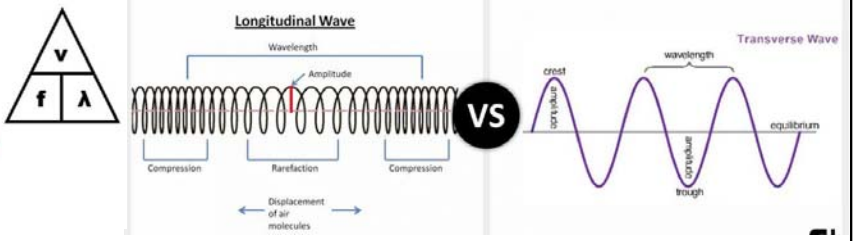
$f = v / \lambda$

$\lambda = v / f$

UNITS: λ = meters (m)

f = Hertz (Hz)

v = m/s



Section 2: Properties of waves

5 Amplitude	The wave height/ **maximum displacement** of the wave from its **undisturbed position**.
6 Wavelength	The distance between the same points on two adjacent waves e.g. trough to trough or peak to peak.
7 Frequency	The number of complete waves passing a fixed point every second. Measured in Hz (Hertz)
8 Hz (Hertz)	Number of waves per second (unit of frequency)

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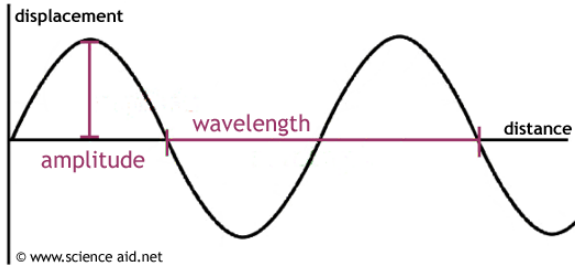

Section 3: Types of electromagnetic waves- The EM Spectrum

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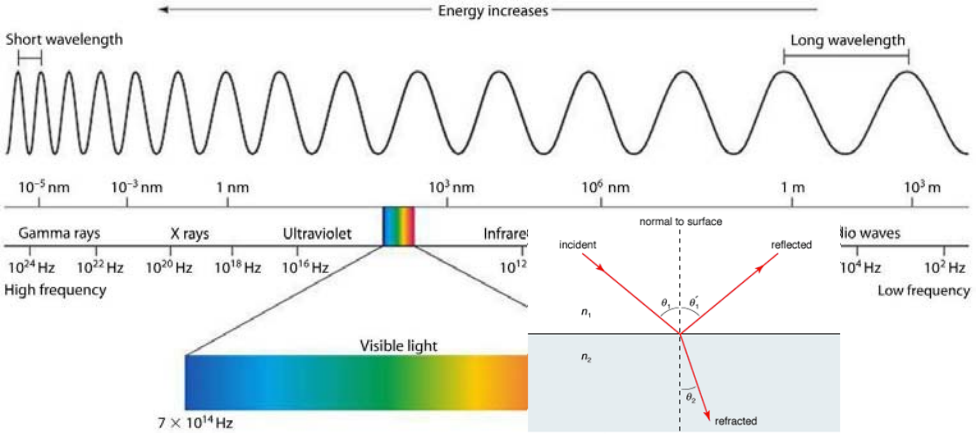

As wavelength increases, energy decreases. EM waves travel at the same speed through air or a vacuum. There are 7 basic types of wave which merge to form a continuous spectrum of waves.

Section 4: Properties of electromagnetic waves

11 Refraction	Change in direction of a wave at a **boundary** due to a change in speed caused by density differences.
12 Boundary	The junction between two different mediums e.g. air and glass.
13 Reflection	The bouncing off of a wave from a barrier.
14 Law of reflection	The angle of incidence always equals the angle of the reflected ray (either side of the normal)

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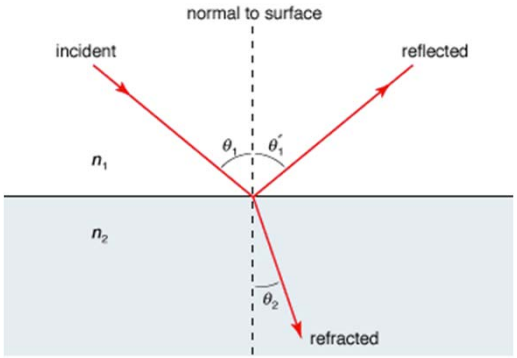
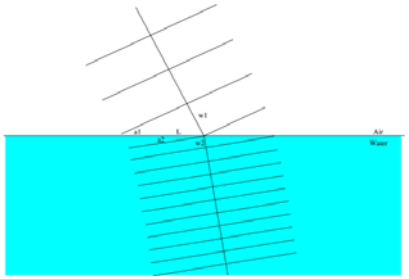


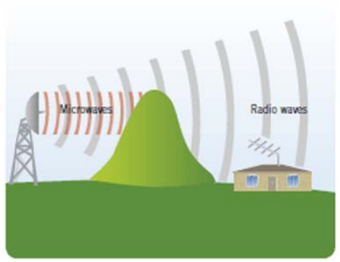
Section 5: Explaining Refraction

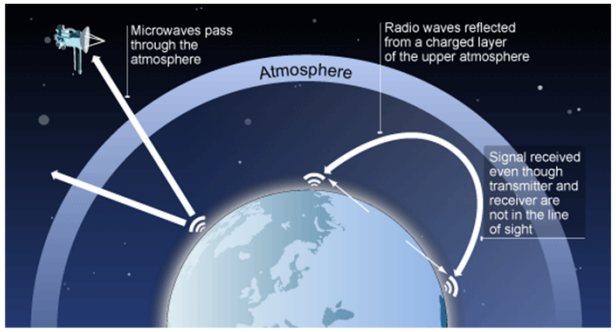
16 When a wave crosses a boundary at an angle, only part of the wave crosses the boundary first. If it is travelling into denser material, then that part travels slower than the rest of the wave front. The changing speed of the wave front as it crosses the boundary causes the wave to bend.	17 

Section 6: Radio Waves

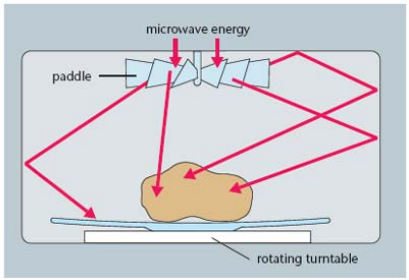
18 Radio waves can be produced by oscillations in electrical circuits.. When radio waves are absorbed they may create an alternating current with the same frequency as the radio wave itself, so radio waves can themselves induce oscillations in an electrical circuit.

19 Long wavelength radio waves do not need line of sight between the transmitter and receiver	Radio waves (long wave lengths) diffract (bend) around the Earth's surface making it possible for radio signals to be received even if the receiver is not in line of sight of the transmitter. Shorter wave radio signals are reflected by the ionosphere (electrically charged layer in the atmosphere).
20 Very short wavelength radio waves need line of sight between the transmitter and receiver	TV and FM radio signals have very short wavelengths. To get signal you must have direct sight of the transmitter (line of sight)
21 Line of sight	Transmitter is in direct sight of the receiver





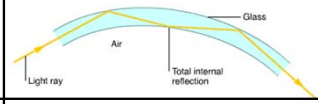
Section 7: Microwaves

23 Microwaves	**Shorter wavelength** than radio waves. Used for Satellite **communications** (long distance). Shorter wavelength means they are **not reflected** by the **ionosphere**.
24 Cooking with microwaves **Quick!**	**Microwaves** penetrate a few centimetres into food before being absorbed. **Energy** is **transferred** to water molecules and fat causing them to heat up. Energy is transferred to the rest of the molecules in the food by **conduction** (heating). (microwave oven)
25 	

Section 8: Infrared

26 Infrared (IR)	**Electromagnetic** radiation given out by all objects. The **hotter** the object the **more IR radiation** given out.
27 Cooking with IR **Slow!**	IR **does not penetrate** food, and is **absorbed** by the surface of food. Energy is **transferred** to the rest of the food by **conduction**. (conventional oven)

Section 9: Other Uses of EM Waves

28 Optic Cables	• **Optic cables** carry data over **long distances** and use **light**. • Unlike in wires, **energy is not lost due to heating** effect so signals can be used for long distance communication. • Relies on total internal reflection
29 Total internal reflection	Energy is not easily scattered or absorbed. 
30 UV Radiation (ultraviolet)	• UV is produced by the sun and fluorescent lighting. Exposure to UV is what gives people a suntan. • Overexposure is dangerous (skin cancer/ DNA mutation) • Uses: fluorescent lighting and security pens
31 X Rays and Gamma Rays	• X rays are used by radiographers in hospitals. They pass easily through flesh but not bone so can be used to form images. • High doses are harmful- can cause cancer/ DNA mutations • Gamma rays used for medical tracers and radiotherapy (cancer treatment