# **Waves Summary Notes**

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| Waves transfer energyThe higher the amplitude the greater the energy of the wave.*f*=no. of waves produced per secondT= time for 1 wave to pass a point |  |
| Transverse Wave: The particles of the medium transmitting the wave travel at right angles to the direction of energy travel. e.g. E.M. waves | Longitudinal Wave: The particles of the medium carrying the wave move parallel to the direction of energy travel. e.g. sound |
| direction of energy travelParticle motion | **direction of energy travel** direction of energy travel**particle motion** |
| Properties of waves = reflection, refraction, diffraction |
| 1*f*T | *d**v**t**v**f*λ | wave speed = frequency × wavelength*v* = *f λ*  |
| Law of reflection, angle of incidence = angle of reflection where all angles are measured from the normal |  |
| N*t**f*d*N*λ |  |
| Refraction occurs when light enters a material which is more optically dense the wave speed and wavelength reduce but frequency remains the same. Usually this is accompanied by a change in direction of the wave.Diffraction –bending of waves passing through a gap or around a barrier, when waves diffract there is no change to the wavelength. | normalangle of refractionangle of incidencelight rayglass blockair |
|   | wavesbarrier | Long waves diffract more than short waves. |
| When waves diffract through a large gap only the edges of the waves change bend | Through a narrow gap, smaller than 1λ the waves emerge as semi-circles | Long waves diffract more than short waves which is why long wave radio signals can be detected at the bottom of a hill, but shorter wavelength signals cannot be detected. |

All members of EM-spectrum are transverse waves and travel at 3 × 108 m s-1 in straight lines in air. EM spectrum waves can be **refracted, reflected and diffracted**.

Light colours, red, orange, yellow, green, blue, indigo, and violet;

**red light long λ and low *f*****blue light short λ and high *f*.**

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| **Type of EM Waves** | **Application** | **Detector** | **Source** |
| **Radio & TV** | communication (under the sea, in space, radio and TV)Watching TV programmes, films, listening to the news,  | Aerial | transmitter, outer space, electronic circuits |
| **Microwaves** | Heating food through microwave ovens, communications | Aerial | electronic circuits magnetron, transmitters, outer space |
| **Infra Red** | detector in security lighting, remote controls (e.g. TV) | Photodiode,thermocouple, thermistor, heat-sensitive papers, black-bulb thermometer | warm objects, sun,  |
| **Visible** | humans vision, photography, laser surgery,  | Photodiode / photographic film/ diode/ CCD | Stars , candles, light bulbs, electronic devices (eg LED), sun |
| **Ultra violet** | detecting forged bank notes, causing white shirts to look cleaner? Sterilising medical instruments | Human skin / causes fluorescence (glowing) in some objects/ fluorescent materials | Fluorescent tubes, very hot objects, sun, gas discharge, lamps |
| **X-Ray** | detecting broken bones, checking suitcases at the airport, | Photodiode / photographic film | X-ray machines, stars, very fast electrons hitting a metal target |
| **Gamma** **Rays** | medical tracers to detect cancer, killing bacteria, sterilizing instruments, detecting broken pipes underground | / photographic film / Geiger Muller Tube and counter/ Photodiode | Radioactive nuclei, outer space (colliding neutron stars) |

<https://www.youtube.com/watch?v=bjOGNVH3D4Y>

Low Energy

Low frequency

Long wavelength

High Energy

High frequency

Short wavelength