# **Waves Summary Notes**

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| Waves transfer energy  The higher the amplitude the greater the energy of the wave.  *f*=no. of waves produced per second  T= 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 travel  Particle 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. | | | | | normal  angle of refraction  angle of incidence  light ray  glass block  air | | | |
|  | | | | waves  barrier | | | 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. | | | |

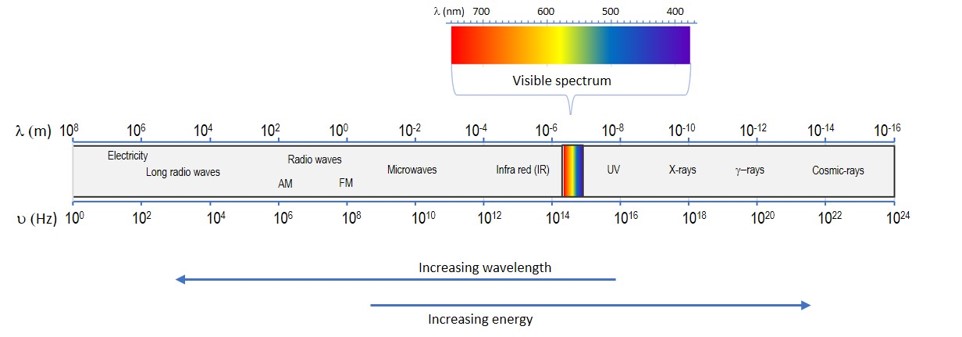
All members of EM-spectrum are transverse waves and travel at 3 × 108 m s-1 in straight lines in air. EM spectrum waves can be **refracted, reflected and diffracted**.

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