Definitions and Concepts for WJEC (Eduqas) Physics AS-level

Component 2: Electricity and Light

Ammeter: A device that measures the current in the loop of the circuit that it is connected in series with. An ideal ammeter is modelled to have zero resistance.

Amperes: The unit of current.

Amplitude: A wave's maximum displacement from its equilibrium position.

Antinode: A position of maximum displacement in a stationary wave.

Antiphase: If two waves are in antiphase, they have a phase difference of π/2 radians (180°).

Bright Fringe: When coherent constructively interfere, creating a wave of the sum of their amplitudes that is a 'bright' spot in the interference pattern.

Cells in Series: When cells are connected end to end, one after another.

Charge: A property of matter that causes it to experience force when placed in an electromagnetic field. It can be positive or negative.

Coherent Source: Sources are coherent if they have the same wavelength and frequency, as well as there being a fixed phase difference between them.

Conductor: A material that allows the flow of electrical charge. Good conductors have a larger amount of free charge carriers to carry a current.

Conservation of Charge: The total charge in a system cannot change.

Conservation of Energy: Energy cannot be created or destroyed - it can only be transferred into different forms.

Coulomb: The unit of charge.

Critical Angle: The angle of incidence beyond which a wave will be totally internally reflected.

Current Law: The sum of the currents entering a junction must always equal the sum of the currents leaving the junction. It is a consequence of the conservation of charge.

Dark Fringe: When coherent waves destructively interfere, cancelling each other's amplitude

and creating a 'dark' spot in the interference pattern.

Diffraction Grating: A grating with hundreds of slits per millimetre, that results in sharper interference patterns when a wave passes through it. They are used to calculate atomic spacing and to analyse elements.

Diffraction: The spreading of a wave as it passes through a gap, or around an obstacle, of a similar magnitude to its wavelength.

Displacement: The direct distance between an object's starting and ending positions. It is a vector quantity and so has both a direction and a magnitude.

Electric Current: The rate of flow of charge in a circuit.

Electromagnetic Waves: Waves that consist of perpendicular electric and magnetic oscillations.

Electromagnetic Spectrum: The spectrum of electromagnetic waves, consisting of Gamma Rays, X-Rays, Ultraviolet, Visible Light, Infrared, Microwaves and Radiowaves.

Electromotive Force: The amount of energy transferred by a source, to each unit of charge that passes through it. The energy is transferred into electrical energy.

Electron Diffraction: The spreading of electrons as they pass through a gap similar to the magnitude of their de Broglie wavelength. It is evidence of the wave-like properties of particles.

Elementary Charge: The smallest possible charge, equal to the charge of an electron.

Energy Levels: Defined and distinct energies at which electrons can exist in an atom. An electron cannot exist between energy levels.

Energy of a Photon: The energy of a single photon, given by $E = hf$ where h is Planck's constant and f is the frequency of the light.

Filament Lamp: A light emitting component consisting of an enclosed metal filament. Its resistance increases as the filament's temperature increases.

Free Electrons: Electrons that are not constrained to atoms within a metal and can move freely - creating an electric current.

Frequency: The number of waves that pass a point in a unit time period. It is the inverse of the time period.

Fringe Spacing: The distance between two adjacent bright fringes or two adjacent dark fringes.

In Phase: If two waves are in phase, they have a phase difference of zero or π radians (360°).

Intensity: The power transferred per unit area. It is proportional to the square of a wave's amplitude.

Internal Resistance: The resistance to the flow of charge within a source. Internal resistance results in energy being dissipated within the source.

Internodal Distance: The distance between two nodes in stationary waves. Equal to the wavelength divided by two.

Ionisation Energies: The amount of energy required to remove an electron from an atom thereby ionising it.

Ions: An atom that is positively or negatively charged.

Laser: : A light source that produces a collimated and coherent beam.

Light-Dependent Resistor (LDR): A light sensitive semiconductor whose resistance increases when light intensity decreases.

Longitudinal Wave: A wave with oscillations that are parallel to the direction of energy propagation. Sound waves are an example of a longitudinal wave.

Mean Drift Velocity: The average velocity of an electron passing through an object. It is proportional to the current, and inversely proportional to the number of charge carriers and the cross-sectional area of the object.

Monomode Optical Fibre: Optical fibres which have only a single mode which is parallel to the wire (through the centre).

Modal Dispersion: Waves enter an optical fibre at slightly different angles, meaning the distance each beam has to travel is slightly different. This leads to the beams reaching the end at different times and so causes pulse broadening.

MRI Scanners: A type of scanner that uses strong magnetic fields and radio waves to produce detailed images of inside the body.

Multimode Dispersion: When the different paths of light in multimode fibres reach the end at different times and create distortion.

Multimode Optical Fibre: Fibres that have multiple paths of light travelling through it.

Node: A position of minimum displacement in a stationary wave.

Ohms: The unit of resistance.

Ohmic Conductor: A conductor for which the current flow is directly proportional to the potential difference across it, when under constant physical conditions.

Ohm's Law: The current and potential difference through an ohmic conductor held under constant physical conditions are directly proportional, with the constant of proportionality being resistance.

Parallel: Lines/planes that have a continuous distance between them and as a result never meet.

Path Difference: A measure of how far ahead a wave is compared to another wave, usually expressed in terms of the wavelength.

Period: The time it takes for one complete wave to pass a given point. It is the inverse of frequency.

Phase: A measure of how far through the wave's cycle a given point on the wave is.

Phase Difference: The difference in phase between two points on a wave. It is usually expressed in radians.

Photoelectric Effect: The emission of electrons from a metal surface when light above a certain frequency is shone on it.

Photon: A packet of energy.

Planck's Constant: A constant relating the energy of a photon to its frequency.

Polarisation: The restriction of a wave so that it can only oscillate in a single plane. This can only occur for transverse waves.

Population Inversion: When there are more electrons in the upper level than the lower level.

Potential Difference: The difference in electrical potential between two points in a circuit. It is also the work done per coulomb to move a charge from the lower potential point to the higher potential point. It is measured in Volts.

Potential Divider: A method of splitting a potential difference, by connecting resistors in series. The total potential difference is split in the ratio of their resistances.

Power: The rate of energy transfer in a circuit. It can be calculated as the product of the current and the potential difference between two points. It is measured in Watts.

Progressive Waves: A wave that transfers energy from one point to another, without the transfer of matter.

Refraction: The changing of speed of a wave when it enters a different medium. The frequency of a wave remains constant during refraction.

Refractive Index: A material property that is equal to the ratio between the speed of light in a vacuum, and the speed of light in a given material.

Resistance: A measure of how difficult it is for current to flow through a material.

Resistivity: A measure of how difficult it is for charge to travel through a material. It is proportional to the object's resistance and cross-sectional area, and inversely proportional to the object's length. It is measured in Ohm metres.

Resistors in Parallel: When resistors are connected in parallel. The total resistance is given by $\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2} + ...$

Resistors in Series: When resistors are connected in series. The total resistance is given by $R_{total} = R_1 + R_2 + ...$

Semiconductor Laser: A laser where the amplifying medium is a semiconductor.

Series: When electrical components in a circuit are connected one after the other.

Snell's Law: A law linking a wave's angle of incidence to its angle of refraction, with the use of the refractive indexes of the mediums involved.

Speed of Light in a Vacuum: $c = 299\,792\,458\ ms^{-1}$ often quoted as $c = 3 \times 10^8\ ms^{-1}$

Stationary Wave: A wave that stores, but does not transfer, energy.

Stimulated Emission: This is the process by which lasers produce light. It occurs when an electron is already in an excited state. If a photon has an energy equal to the energy difference between the electrons excited level and the level below, it can stimulate the electron to drop down to that lower level releasing a photon of equal energy to the incoming photon.

Superconductor: A material which has zero resistivity when the temperature is decreased to, or below, the material's transition temperature. Superconductors can be used to produce strong magnetic fields and reduce energy loss when transmitting electric power.

Superposition of Waves: When two waves meet at the same point in space their displacements combine and the total displacement at that point becomes the sum of the individual displacements at that point.

Terminal Potential Difference: The potential difference across the terminals of a power source. It is equal to the source's emf minus any voltage drop over the source's internal resistance.

Thermistor: A temperature sensitive semiconductor whose resistance increases when temperature decreases.

Total Internal Reflection: An effect that occurs in optical fibres, where full reflection occurs at the inside boundary of the fibre, meaning no radiation passes out.

Transition Temperature: The temperature below which a superconductor has zero resistivity.

Transverse Waves: A wave with oscillations that are perpendicular to the direction of energy propagation. Electromagnetic waves are examples of transverse waves.

Two Source Interference: Interference caused by the interference of two sources of waves.

Vacuum Photocell: A device which can be used to measure the maximum kinetic energy of electrons.

Velocity of a Wave: The velocity at which energy is transferred through a medium. It is equal to the product of the wave's wavelength and frequency.

Visible Spectrum: The portion of the electromagnetic spectrum that is visible to the human eye

Volt: The unit of potential difference.

Voltage Law: The sum of the emfs around a closed loop must always equal the sum of the potential differences around the same loop. This is a consequence of the conservation of energy.

Wavefront: An imaginary surface representing points of a wave that oscillate in phase. The direction of propagation is perpendicular to the wavefronts.

Wavelength: The distance between two identical positions on two adjacent waves. It is commonly measured from peak to peak or trough to trough.

Young's Double Slit: An experiment that demonstrates the diffraction of light by passing monochromatic light across two narrow slits and observing the resulting pattern of bright and dark fringes.