Definitions and Concepts for Edexcel (IAL) Physics A-level

Unit 2: Waves and Electricity

2.1 Waves and Particle Nature of Light

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

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

Atomic Line Spectra: Electrons in an atom are positioned at discrete energy levels. When they move to a lower energy level, they release energy with a frequency directly proportional to the energy difference, where the constant of proportionality is Planck's constant. Viewed on a spectral graph, this will show as a line light at this specific frequency; a spectral line. Each element creates a distinct set of spectral lines.

Coherence: Waves with the same frequency and constant phase difference.

Constructive Interference: The type of interference that occurs when two waves meet in phase. The wave amplitudes are superposed.

Critical Angle: The angle of incidence that results in an angle of refraction of exactly 90^{o}. It is when the refracted ray travels along the boundary line.

De Broglie's Hypothesis: All particles have a wave-like nature and a particle-like nature. The wavelength of a particle is inversely proportional to the particle's momentum.

Diffraction: The spreading of waves as they pass through a gap of a similar magnitude to their wavelength.

Displacement: The distance that a point on a wave is from its equilibrium position.

Destructive Interference: The type of interference that occurs when the two waves are in antiphase. When one wave is at a peak and one is at a trough their addition results in a minimum point.

Electronvolt: A unit of energy.

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

Huygens' Principle: Every point on a wavefront can be treated as a point source of a secondary wavelet.

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

Interference: The superposition of the amplitudes of waves when they meet.

Longitudinal Waves: A wave with oscillations that are parallel to the direction of energy propagation. Sound waves are an example of a longitudinal wave. They cannot travel through a vacuum.

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

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

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 photoelectrons from a metal surface when light above a certain frequency is shone on it.

Photon Model of EM Radiation: EM radiation is made up of photon particles, travelling at the speed of light.

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

Pulse-Echo Technique: An ultrasound technique used for imaging of objects notably in medical imaging. Short pulses of ultrasound are sent through a medium and their reflections recorded.

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.

Snell's Law: The relative refractive index can be found from the ratio of the sines of the angles of incidence and refraction.

Superposition: 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.

Threshold Frequency: The minimum frequency of photons required for photoelectrons to be emitted from the surface of a metal plate through the photoelectric effect. It is equal to the metal's work function divided by Planck's constant.

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. The angle of incidence must be greater than the critical angle for this to occur.

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

Wavefront: The surface made up of all the points of the wave that are in phase with each other.

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

Wave Model of EM Radiation: EM radiation is made up of waves that consist of perpendicular electric and magnetic oscillations.

Wave Period: The time taken for a wave to complete one full cycle.

Wave Speed: The product of a wave's frequency and wavelength

Work Function: The minimum energy required to just liberate an electron from the surface of a metal.

2.2 Electrical Circuits

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.

Charge Conservation: The total charge in a system cannot change. Means that the total current entering a junction must equal the total current leaving it.

Conduction Electrons: Electrons in a conductor that are not bound to any nucleus or molecule. They can flow slowly through the conductor, creating a flow of charge.

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

Current-Potential Difference Graph: Plots of current against voltage, that show how different components behave.

Diode: A component that allows current through in one direction only. In the correct direction, diodes have a threshold voltage (typically 0.6 V) above which current can flow.

Electromotive Force: The energy supplied by a source per unit charge passing through the source, measured in volts.

Energy Conservation: Energy cannot be created or destroyed - it can only be transferred into different forms. Means that the sum of the voltages in any closed loop must equal zero.

Internal Resistance: The resistance to the flow of charge within a source. Internal

resistance results in energy being dissipated within the source.

Lattice Vibrations: The lattice (atomic structure) of a conductor vibrates more when the temperature is higher, as the atoms have more kinetic energy. This makes it harder for conduction electrons to flow, thereby increasing the resistance.

Light Dependent Resistor: When these components are illuminated with light their resistance goes down. As light intensity increases resistance decreases.

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.

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

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 Circuit: A method of splitting a potential difference, by connecting two 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.

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

Resistors in Parallel: The potential difference across resistors connected in parallel is identical for each resistor. The current is split between the resistors. The total resistance is equal to the inverse of the sum of the inverses of the resistances of the resistors.

Resistors in Series: The current through resistors connected in series is identical for each resistor. The potential difference is split in the ratio of their resistances. The total resistance is equal to the sum of the resistances of the resistors.

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.

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: When these components are heated up their resistance goes down. As temperature increases resistance decreases.

Voltmeter: A device used to measure the potential difference between two points on a circuit, ideally it has infinite resistance so no current passes through it.