

Definitions and Concepts for WJEC (Wales) Physics A-level

Unit 4: Fields and Options

Capacitance: The charge stored per unit pd in a capacitor.

Capacitors in Parallel: When capacitors are connected in parallel, their individual capacitances are summed to give the total capacitance.

Capacitors in Series: When capacitors are connected in series, the total capacitance is equal to the inverse of the sum of the inverses of the individual capacitances.

Charging Capacitor: When charge builds up on the plates of a capacitor.

Coulomb's Law: The size of the force that acts between two point charges is proportional to the product of their charges and inversely proportional to the square of their separation. It is attractive for opposite charges and repulsive for like charges.

Critical Density: The density of the universe such that the expansion of the universe will eventually halt.

Current-Carrying Wire: A wire that carries a current.

Cyclotron: A particle accelerator made up of two D shaped electrodes positioned opposite each other. The electric field changes direction each time a particle moves from one electrode to the other, causing the particle to accelerate.

Dark Matter: Certain observations of galaxies and their dynamics shows that they are far more massive than they appear to be with just the matter we can observe. This has led to the theory of dark matter to make up the rest of the unobservable mass.

Dielectric: An insulating material placed between the two plates of a capacitor in order to increase the amount of charge it can store.

Discharging Capacitor: When a capacitor is discharging charge stored on the plates

Doppler Effect: The apparent change in the wavelength of a wave as the source moves relative to an observer. For a source moving away the wavelength increases (red shift), for a source moving towards the observer the wavelength decreases (blue shift).

Doppler Relationship: The equation describing the doppler effect. $\frac{\Delta\lambda}{\lambda} = \frac{v}{c}$

Electric Field Lines: Lines that represent the direction and strength of an electric field. The

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density of the lines indicates the strength of the field and their direction shows the direction in which a positive charge would experience a force.

Electric Field: A region surrounding a charged object which causes a non-contact force to be exerted on any charged object placed within the field.

Electric Potential: The work done per unit charge on a positive test charge in bringing it from infinity to a chosen point in the field.

Electrical Field Strength: The force per unit positive charge exerted on a charged object placed at a chosen point in the field.

Energy Stored in a Capacitor: The energy stored by a capacitor.

$$E = \frac{QV}{2} = \frac{CV^2}{2} = \frac{Q^2}{2C}$$

Equipotential Surfaces: A surface of constant potential. No work is done by the field when an object moves along an equipotential.

Exo-Planet: A planet that orbits a star other than our Sun.

Faraday's Law: The magnitude of an induced emf is equal to the rate of change of flux linkage through the circuit.

Force Field: A region where an object will experience a non-contact force.

Gravitational Field Strength: The force per unit mass exerted on a small test mass placed within the field.

Gravitational Field: A region surrounding a mass in which any other object with mass will experience an attractive non-contact force.

Gravitational Potential: The work done per unit mass required to move a small test mass from infinity to a chosen point in a gravitational field.

Hall Probe: A device used to measure a magnetic field, making use of the hall effect.

Higgs Boson: A boson in the standard model of particle physics, giving particles mass.

Hubble's Law: The speed of a galaxy moving away from ours is proportional to its distance away from us. The constant of proportionality is Hubble's constant.

Kepler's First Law: All planets travel in elliptical orbits, centred around the sun.

Kepler's Second Law: All planets sweep out the same area in a given period of time.

Kepler's Third Law: The square of an object's orbital period (T) is directly proportional to the



cube of its orbital radius (r) – $T^2 \propto r^3$.

Lenz's Law: An induced current is always in a direction so as to oppose the change that caused it.

Linear Accelerator: Particle accelerator where ions are accelerated using an alternating p.d. The acceleration occurs between the drift tubes.

Magnetic Field Lines: Lines that represent the direction and strength of a magnetic field. The density of the lines indicates the strength of the field and their direction points from North to South.

Magnetic Field: A region surrounding a magnet or current-carrying wire that will exert a force on any other magnet, magnetic material or current-carrying wire placed within it.

Magnetic Flux Density: The force per unit current per unit length on a current-carrying wire placed at 90° to the field lines. Sometimes also referred to as the magnetic field strength.

Magnetic Flux: A value which describes the magnetic field or field lines passing through an area. It is the product of magnetic flux density and the perpendicular area it passes through.

Newton's Law of Gravitation: The gravitational force acting between two objects is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centres.

Orbital Speeds: The speed of an orbiting object.

Parallel Plate Capacitor: A capacitor consisting of two parallel conducting plates with an insulator between them (dielectric). The field lines within the plates are uniform and parallel.

Solenoid: A wire wrapped into the shape of a coil, that has a strong and uniform magnetic field inside of it. The solenoid's magnetic field strength can be increased by adding an iron core.

Spiral Galaxies: A class of galaxies where the stars/mass are concentrated into spiral arms.

Star's Radial Velocity: The velocity of the star along the line connecting the center of the Earth and the star.

Synchrotron: A particle accelerator that accelerates ions by passing them through alternating electric fields situated at intervals in the beam pipe. The ions are kept in place by magnetic fields that must alter as the ion's velocity increases.

Time Constant: The time taken for a capacitor to discharge to 37% (e^{-1}) of its initial charge. The time constant is equal to the product of the capacitance and the resistance of the fixed resistor (that the capacitor is being discharged through).



Vacuum: A region in which there is no matter.

