

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

Unit 4: Further Mechanics, Fields and Particles

4.1 Further Mechanics

Angular Displacement: In circular motion, the angle turned through. Measured in radians or degrees.

Angular Velocity: The angular displacement per unit time, measured in radians or degrees per second. It is different from angular speed as it is defined in either a clockwise or anticlockwise direction.

Centripetal Acceleration: The acceleration of an object moving in circular motion. Any object in circular motion must have an acceleration since the direction of the object, and therefore the velocity of the object, is constantly changing.

Centripetal Force: The resultant force responsible for an object moving in circular motion. Centripetal forces always act towards the centre of the object's rotation.

Conservation of Linear Momentum: In a closed system with no external forces the momentum of the system before an event is equal to the momentum of the system after the event.

Elastic Collision: A collision in which the total kinetic energy of the system before the collision is equal to the total kinetic energy of the system after the collision.

Impulse: The change of momentum of an object when a force acts on it. It is equal to the product of the force acting on the object and the length of time over which it acts.

Inelastic Collision: A collision in which the total kinetic energy of the system before the collision is not equal to the kinetic energy of the system after the collision.

Non-relativistic Particle: A particle which travels much slower than the speed of light. When particles travel close to the speed of light, they experience time at a slower rate and their mass increases.

4.2 Electric and Magnetic Fields

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

Capacitor: An electrical component that stores charge. A parallel-plate capacitor is made of two parallel conducting plates with an insulator between them (dielectric).

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

Electric Field Lines: Lines that demonstrate the direction in which a positive charge would feel if placed at that point in the field.

Electric Field Strength: The force per unit positive charge exerted on a charged object placed at that point in the field. This is a vector acting in the same direction as the force on a positive charge.

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

Equipotentials: Planes of points where the electric potential is the same, no work is done moving charge along these lines

Exponential Discharge: When a capacitor discharges, its charge and capacitance drop exponentially. This means that their rate of decrease is directly proportional to how much is left.

Faraday's Law: The magnitude of the induced EMF is directly proportional to the rate of change of magnetic flux linkage.

Fleming's Left-hand Rule: The relative direction of motion, field direction and current direction in the motor effect can be represented by the thumb, first finger and second finger of the left hand respectively. For the motion of a charged particle in a magnetic field, its direction replaces the current direction.

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.

Flux Linkage: The magnetic flux multiplied by the number of turns, N , of the coil.

Force Between Two Charges: 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.

Lenz's Law: The direction of an induced current is such that it opposes the current that created 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.

Parallel Plate Electric Field: Two parallel conductors separated by a fixed gap produce a uniform electric field between them.

Point Charge: An infinitesimally small point with charge Q . Any sphere of charge Q can be



approximated as a point charge at its centre; they produce the same electric field.

Radial Field: A field in which the field lines are all directed towards a single point (e.g. the centre of a planet or a point charge)

Time Constant: Describes the rate of charge or discharge of a capacitor. It is the time taken for the capacitor to charge from zero to 63% of its full value or to discharge from full to 37% of its full value.

Uniform Electric Fields: An electric field in which the electric field strength does not change. Therefore, the force that a charge experiences in it is constant, and the *suvat* equations can be used to describe motion.

4.3 Nuclear and Particle Physics

Alpha Particle Scattering: An experiment that involved firing alpha particles at a thin gold foil and detecting their subsequent motion. It provided evidence for the currently accepted model of the atom.

Annihilation of Matter: The process of a particle and its antiparticle colliding and being converted into energy. The energy is released in two photons to conserve momentum.

Antimatter: A particle with the same mass / rest energy as its matter particle but with opposite charge and opposite quantum numbers. A particle and an antiparticle will annihilate to create a photon.

Baryons: A particle consisting of three quarks, protons and neutrons are both baryons. The most stable baryon is the proton and so all baryons eventually decay to the proton

Baryon number: A measure of if a particle is a baryon, it is +1 for a baryon, -1 for an antibaryon and 0 for any other particle.

Creation of Matter: When a single photon turns into a particle and antiparticle according to Einstein's mass-energy equivalence.

Fundamental Particles: Particles that cannot be broken down into smaller constituents.

Leptons: Fundamental particles that do not interact via the strong force. They can transform between flavours via the weak interaction and some have charge so undergo electromagnetic interactions. They include the electron, electron neutrino, muon, muon neutrino, tau and tau neutrino.

Lepton Number: A measure of if a particle is a lepton, it is +1 for a lepton, -1 for an antilepton and 0 for any other particle.

Mesons: A particle consisting of one quark and one antiquark. Pions and Kaons are examples of mesons.



Nuclear Model of the Atom: A atom is mainly empty space, with a tiny nucleus surrounded by a number of electrons. The nucleus is made up of protons and neutrons.

Nucleon Number: The number of neutrons and protons in the nucleus.

Proton Number: The number of protons in the nucleus.

Quark-Lepton Model: Particles can be classified as bayrons (made up of three quarks), mesons (made up of one quark and one antiquark), leptons (which are already fundamental particles) and photons (also fundamental particles).

Relativistic: Particles that are travelling at close to the speed of light. They will experience time at a slower rate than a non-relativistic particle.

Thermionic Emission: When a metal is heated free electrons gain sufficient kinetic energy and are released from the metal's surface.

