

## Definitions and Concepts for Edexcel Physics A Level

### Topic 8: Nuclear and Particle Physics

**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.

**Baryon:** 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.

**Cyclotron:** A particle accelerator that has two semicircular electrodes with a gap between. When a charged particle is in the electrodes it is curved due to the magnetic field perpendicular to the plane of the electrodes and when it is in the gap it accelerates in an alternating voltage electric field resulting in a spiral path and accelerated charged particle.

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

**Gauge Boson:** Fundamental particles that are the carriers of the fundamental forces.

**Gluon:** Gauge boson of the strong interaction.

**Hadron:** Particles that undergo strong interactions, they are made up of quarks so include mesons and baryons.

**Lepton:** 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.

**Linac:** Linear accelerator. These accelerate charged particles through sets of oscillating electric fields that create large electric potentials that accelerate the particles.

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

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

**Photon:** Gauge boson of the electromagnetic force.



**Plum Pudding Model:** A model of the atom that describes it as a ball of positive charge with evenly distributed negative electrons throughout it.

**Proton Number:** The number of protons in the nucleus.

**Quark:** Fundamental particle that interacts with other quarks via the strong interaction, it will change flavour via the weak interaction and annihilate with antiquarks to form photons via the electromagnetic interaction. They come in 6 flavours: up, down, charm, strange, top, bottom.

**Quark Confinement:** The principle that states that quarks cannot exist alone and must be either in quark, antiquark pairs or in threes.

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

**Strangeness:** A measure of how many anti-strange quarks a particle has, a  $K^+$  is formed of an up and anti-strange so has Strangeness +1, a  $K^-$  is formed of a strange and an anti-up so has strangeness -1.

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

**Weak Interaction:** The force that causes flavour change in quarks and leptons, it is responsible for beta decay.

**$W^+/W^-/Z^0$ :** Gauge bosons of the weak interaction.

