

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

### Component 1: Motion, Energy and Matter

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**Acceleration:** The rate of change of velocity.

**Air Resistance:** A resistive force that opposes an object's motion through air.

**Amorphous:** Materials where the atoms or molecules are arranged in a non-ordered structure.

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

**Antiparticles:** All particles have a corresponding antiparticle with the same mass but opposite charge and conservation numbers.

**Baryon Number:** A quantum number that is conserved in all particle interactions. Baryons have a baryon number of +1 and non-baryons have a baryon number of 0.

**Baryons:** A class of hadron, that is made up of three quarks. The proton is the only stable baryon.

**Black Bodies:** A perfect emitter and absorber of all possible wavelengths of radiation.

**Brittle:** A brittle object will show very little strain before reaching its breaking stress.

**Centre of Gravity:** The single point through which the object's weight can be said to act.

**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.

**Conservation of Momentum:** The total momentum of a system before an event, must be equal to the total momentum of the system after the event, assuming no external forces act.

**Continuous Emission Spectrum:** An emission spectrum that covers a full range of frequencies without any gaps.

**Crack Propagation:** The way a crack propagates in a solid. For example, a crack opening up and causing a brittle fracture.

**Crystalline:** materials which have atoms arranged in an ordered structure making a crystal

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lattice.

**Density:** The mass per unit volume of a material.

**Dislocations:** Small gaps in the ordered structure of crystalline materials.

**Displacement-Time Graph:** A plot of how an object's displacement changes over time. The gradient of the graph at any point, equals the object's velocity at that point.

**Displacement:** A measure of how far an object moves in a given direction. It is the straight line between the starting and finishing points and is a vector quantity.

**Dissipative Forces:** Forces which reduce the efficiency/useful types of energy in a system.

**Distance:** A measure of how far an object moves. It doesn't depend on direction and is therefore a scalar quantity.

**Drag:** A resistive force that acts to oppose the motion of an object through a fluid.

**Ductile Fracture:** Occurs when necking continues until the material separates at a point.

**Efficiency:** A ratio of the useful output of a system over the total input.

**Elastic Collisions:** 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.

**Elastic Potential Energy:** The energy stored in an object when it is stretched. It is equal to the work done to stretch the object and can be determined from the area under a force-extension graph.

**Elastic Strain:** A strain for which an object will return to its original shape when the deforming forces are removed. The object will not be permanently deformed.

**Electromagnetic Interaction:** An interaction between charged particles with infinite range. It follows the inverse square law.

**Equilibrium:** An object in equilibrium has a zero resultant force and a zero net moment.

**Fluid:** A liquid or gas.

**Force-Extension Graph:** The gradient of a force-extension graph for a spring obeying Hooke's law is equal to the spring constant. The area under the graph is the work done in stretching the spring.

**Free Body Diagrams:** A visual representation of the forces that act on an object.

**Free-Fall:** Motion under the force of gravity alone.



**Friction:** A resistive contact force that acts to oppose the relative motion between two surfaces.

**Grain Boundaries:** The boundary between two grains in a solid.

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

**Gravitational Interaction:** The interaction between two bodies with mass at a given distance. It follows the inverse square law.

**Gravitational Potential Energy:** The component of an object's energy due to its position in a gravitational field.

**Hadrons:** A class of subatomic particles that experience the strong nuclear interaction.

**Homogeneity of Units:** The units on each side of an equation must always be equivalent to each other.

**Hooke's Law:** The extension of an elastic object will be directly proportional to the force applied to it up to the object's limit of proportionality.

**Hysteresis:** When the stress-strain graph is different depending on whether you are loading or unloading the material.

**Inelastic Collisions:** 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.

**Inverse Square Law:** The decrease of intensity is inversely proportional to the square of the distance you are from the source. This means that if the distance doubles, the intensity quarters.

**Kinetic Energy:** A form of energy that all moving objects possess. It is directly proportional to the mass of the object, and to the square of its velocity.

**Lepton Number:** A quantum number that is conserved in all particle interactions. Both electron lepton numbers and muon lepton numbers must be conserved.

**Leptons:** A group of elementary subatomic particles, consisting of electrons, muons and neutrinos.

**Limit of Proportionality:** The point beyond which the extension of an elastic object is no longer directly proportional to the force applied to it.

**Line Absorption Spectrum:** When emitted radiation passes through a star's atmosphere a line absorption spectrum is produced where atoms absorb certain wavelengths of the electromagnetic spectrum.



**Linear Momentum:** The product of an object's mass and velocity.

**Luminosity:** The total power radiated by a light emitting source.

**Moment:** The product of a force and the perpendicular distance from the line of action of the force to the pivot.

**Multiwavelength Astronomy:** Astronomy involving detecting electromagnetic radiation of a variety of wavelengths.

**Necking:** where the cross-sectional area of the metal reduces as it deforms plastically

**Net Moment:** The single moment that has the same effect as the sum of all the other clockwise and anticlockwise moments acting on an object.

**Neutron:** A neutrally charged nucleon, found in the nucleus of an atom. Neutrons are a form of hadron. Composed of udd quarks.

**Newton's First Law:** An object will remain in its current state of motion, unless acted on by a resultant force. An object requires a resultant force to be able to accelerate.

**Newton's Second Law:** An object's acceleration is directly proportional to the resultant force acting on it, and inversely proportional to the object's mass.

**Newton's Third Law:** Every action has an equal and opposite reaction. If an object exerts a force on another object, then the other object must exert a force back, that is opposite in direction and equal in magnitude.

**Perpendicular:** At right-angles ( $90^\circ$ ) to each other.

**Pions:** A type of meson and the exchange particle for the strong nuclear force.

**Plastic Strain:** If a material undergoes plastic strain, it will not return to its original shape when the deforming forces are removed. The object will be permanently deformed.

**Polymeric:** Materials that contain long chain polymer molecules. The bonds in most polymers are strong and can rotate.

**Positron:** A positively charged particle that is the antiparticle of an electron.

**Power:** The rate of transfer of energy. Its unit is the Watt.

**Pressure:** The force that a surface experiences per unit area. It is measured in Pascals (Pa).

**Principle of Moments:** For an object to be in equilibrium, the sum of the clockwise moments acting about a point must be equal to the sum of the anticlockwise moments acting about the point.



**Proton:** A positively charged nucleon, found in the nucleus of an atom. Protons are a form of hadron. Composed of uud quarks.

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

**Quarks:** 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.

**Rate of Change of Momentum:** When a force acts on a moving object, or on an object that has the ability to move, a change of momentum will occur. The force is equal to the rate of change of this momentum.

**Resolution of Forces:** Resolving a force into its components along each axis.

**Resultant Force:** The single force that can replace all the individual forces acting on an object, and have the same effect.

**Scalar Quantities:** A quantity that only has a magnitude. Examples include length, mass and temperature.

**SI Units:** The standard units used for measurement.

**Speed:** A scalar quantity that is a measure of the rate of change of distance. The average speed is calculated by dividing the distance travelled by the speed taken.

**Spring Constant:** The constant of proportionality for the extension of a spring under a force. The higher the spring constant, the greater the force needed to achieve a given extension.

**Stability:** A measure of the likelihood of an object toppling. Object's are stable if the line of action of their weight lies within the object's base.

**Stefan's Law:** A law stating that the power output (luminosity) of a star is directly proportional to its surface area and its absolute temperature to the 4<sup>th</sup> power.

**Stellar Spectrum:** The spectrum created when light from a star is dispersed. There is continuous, line and emission spectrum.

**Strengthening Metals:** Introducing 'foreign atoms' to reduce the effect of dislocations in a metal or by increasing the number of grain boundaries.

**Stress-Strain Graph:** A graph showing the stress on a material for a given strain. The gradient is the Young's Modulus.

**Strong Interaction:** An interaction between all quarks, it has short range and binds quarks and nucleons together.



**Surface Imperfections:** Imperfections on the surface of a material which allows the stress to concentrate there and cause a brittle fracture.

**Tensile Strain:** The ratio of an object's extension to its original length. It is a ratio of two lengths and so has no unit.

**Tensile Stress:** The amount of force acting per unit area. Its unit is the Pascal (Pa).

**Terminal Velocity:** The maximum velocity of an object that occurs when the resistive and driving forces acting on the object are equal to each other.

**Vector Quantities:** A quantity that has both a magnitude and a direction. Examples include velocity, displacement and acceleration.

**Velocity-Time Graph:** A plot of how an object's velocity changes over time. The gradient at any point, equals the object's acceleration at that point. The area under the graph equals the object's displacement.

**Velocity:** The rate of change of an object's displacement.

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

**Weight:** The force acting on an object due to gravity. It is equal to the product of the object's mass and the gravitational field strength at its location.

**Wien's Displacement Law:** A law stating that the peak wavelength of emitted radiation is inversely proportional to its absolute temperature.

**Work-Energy Relationship:** The work done on a body is equal to the change in kinetic energy of that body.

**Work:** Work is done on an object when a force causes it to move through a distance. It is equal to the product of the distance travelled and the magnitude of the force in the direction of motion.

**Young Modulus:** The ratio of stress to strain for a given material. Its unit is the Pascal (Pa).

