

OCR G485 Definitions

Module 1 - Electric and Magnetic Fields

Coulomb's Law - The force between two electric charges is proportional to the product of the charges and inversely proportional to the square of the distance between them.

Electric Field Strength - Force per unit positive charge

Magnetic Flux Density - A measure of the strength of a magnetic field, defined by:

$B = \frac{F}{Il \sin \theta}$ where B = magnetic flux density (T), I = current in the wire (A), l = length of the wire (m), F = the force experienced (N) and θ = the angle between the wire and the field.

Tesla - The unit of magnetic flux density, when a wire of length 1m carrying a current of 1A perpendicular to the field experiences a force of 1N.

Magnetic Flux - The product of magnetic flux density, B and the projection of area, A onto a surface at right angles to the flux. Unit = Weber

Weber - One Weber is the unit of magnetic flux when a magnetic field of magnetic flux density 1 Tesla, passes at right angles through an area of 1m^2 .

Magnetic Flux Linkage - the product of the magnetic flux and the number of turns on the coil. Unit = Weber turns.

Faradays Law of E.M. Induction - The magnitude of the induced e.m.f. is equal to the rate at which magnetic flux is cut.

For a coil this becomes: The induced e.m.f. is equal to the rate of change of flux linkage.

Lenz's Law - The direction of the induced e.m.f. is such that it opposes the change causing it.

Module 2 - Capacitance

Capacitance - Charge stored per unit potential difference.

Farad - One Coulomb per volt.

Time Constant - The time taken for the voltage or charge to drop to 37% of its original value.

Module 3 - Nuclear Physics

Proton Number, Z - The number of protons in a nucleus.

Nucleon Number, A - The number of nucleons in any nucleus.

Isotopes - Two nuclides (a nucleus with a distinct number of protons and neutrons) with the same number of protons but different numbers of neutrons.

Fundamental Particles - Particles which cannot be broken down into smaller components.

Activity - The number of radioactive decays per unit time. Unit = Becquerels.

N.B. $1 \text{ Bq} = 1 \text{ s}^{-1}$ (1 decay per second.)

Decay Constant, λ - The fraction of atoms decaying in unit time.

Half-life - The average time taken for the activity of a radioactive source to decrease to one half of its original value. **OR** The time taken for the number of radioactive nuclei to decrease by $\frac{1}{2}$.

Binding Energy - The work done against the electrostatic force in assembling a nucleus from its individual protons and neutrons.

Module 4 - Medical Imaging

Intensity (of a beam of X-Rays) - Power per unit Cross-Sectional Area.

Module 5 - Modelling the Universe

Astronomical Unit (AU) - the average distance from the centre of the Earth to the centre of the Sun. $1 \text{ AU} = 1.496 \times 10^{11} \text{ m}$

Parsec (PC) - The distance when a baseline of length 1 AU when the angle is one second of an arc (that angle is $\frac{1}{3600}$ of a degree.) $1 \text{ Pc} = 3.086 \times 10^{16} \text{ m}$

Light-Year (ly) - The distance light travels through a vacuum in a year. $1 \text{ ly} = 9.461 \times 10^{15} \text{ m}$

Olber's Paradox - If the universe was infinite, there would be stars in every direction; so it wouldn't be dark at night.

Conclusions:

- either the universe is not infinite
- or the stars are not uniformly distributed
- or the universe is not static

(or two or all of these might be true.)

Hubble's Law - The speed of recession of a galaxy is directly proportional to its distance from Earth.

Conclusions: The universe is expanding - everything is moving away from everything else, not just moving away from Earth.

Cosmological Principle - On a large scale, the universe is homogenous (of uniform density) and isotropic (the same in all directions.) Providing a large enough volume is considered.

Critical Density - The average density of the universe, above which the universe will collapse (closed universe) and below which the universe will expand forever (open universe.)