

Definitions A2 Physics

Circular Motion

Radian: Angle (subtended) where arc (length) is equal to radius (angle subtended) at the centre of a circle.

Angular Velocity: Rate of change of angle / angular displacement swept out by radius.

Gravitational Field

Newtons Law of Gravitation: Two-point masses attract each other with a force that is proportional to product of their masses and inversely proportional to the square of their separation.

Gravitational Field Strength: Gravitational force experienced by an object per unit mass.

Gravitational Potential: Work done per unit mass bringing (small test) mass from infinity (to the point).

Geostationary Orbit: Equatorial orbit / above equator satellite moves from west to east / same direction as Earth spins period is 24 hours / same period as spinning of Earth.

Geostationary Satellite: Satellite is in equatorial orbit travelling from west to east period of 24 hours / 1 day.

Gravitational Field: Region of space area / volume where a mass experiences a force.

Potential Energy: Ability to do work as a result of the position/shape, etc. of an object

Oscillations

Angular Frequency: (angular frequency =) $2\pi \times$ frequency or $2\pi /$ period

Oscillations: To-and-fro / backward and forward motion (between two limits).

Simple Harmonic Motion: Type of vibratory motion in which acceleration/force proportional to displacement (from fixed point) and acceleration/force and displacement in opposite directions.

Free Oscillations: (body oscillates) Without any loss of energy/no resistive forces/no external forces applied.

Forced Oscillations: Continuous energy input (required)/body is made to vibrate by an (external) periodic force/driving oscillator.

Forced Frequency: Frequency at which object is made to vibrate/oscillate.

Natural Frequency: Frequency at which object vibrates when free to do so.

Resonance: Maximum amplitude of vibration of oscillating body when forced frequency equals natural frequency (of vibration).

Damping: Reduction in amplitude / energy of oscillations due to force (always) opposing motion / resistive forces.

Communication Systems

Amplitude Modulation: Amplitude of carrier wave varies in synchrony with displacement of information signal.

Noise: random (unwanted) signal / power that masks / added to / interferes with / distorts transmitted signal.

Regeneration: Noise/distortion is removed (from the signal) the (original) signal is reformed/reproduced/recovered/restored

Or

Signal detected above/below a threshold creates new signal of 1s and 0s.

Frequency Modulation: Frequency of carrier wave varies in synchrony with the displacement of the signal/information wave.

Attenuation: (gradual) Loss of power/intensity/amplitude (not "signal").

Modulated Carrier Wave: High frequency wave the amplitude or the frequency is varied the variation represents the information signal /in synchrony with (the displacement of) the information signal.

Crosslinking: Signal in one wire (pair) is picked up by a neighboring wire (pair).

Parallel to serial Convertor: Receives bits all at one time transmits the bits one after another.

Digital Signal: (series of) 'highs' and 'lows' / 'on' and 'off' / 1's and 0's / two values with no intermediate values / the values are discrete.

Analogue Signal: Signal that is continuously variable. Signal has same variation (with time) as the data.

Analogue to Digital Convertor: Analogue signal is sampled at (regular time) intervals sampled signal is converted into a binary number.

Cross Talk: Picking up of signal in one cable from a second (nearby) cable.

Thermal Physics

Specific Latent Heat: (thermal) energy required to change the state of a substance per unit mass without any change of temperature.

Internal Energy: The sum of random distribution of kinetic and potential energies of the atoms or molecules in a system.

Thermal Equilibrium: Same temperature no (net) transfer of thermal energy (between the bodies).

Specific Heat Capacity: The (thermal) energy per unit mass to raise the temperature of a substance by one degree.

Absolute Zero Temperature: Temperature at which atoms have minimum/zero energy.

Specific Latent Heat of Fusion: (Thermal) energy / heat required to convert unit mass of solid to liquid at its normal melting point / without any change in temperature.

First Law of thermodynamics: The increase in internal energy of a body is equal to the thermal energy transferred to it by heating plus the mechanical work done on it.

$$\Delta U = q + w$$

symbols explained (q = heating, w = work) consistent set of directions of energy change.

Ideal Gases

$\langle c^2 \rangle$: mean/average square speed/velocity

Avogadro Constant: The number of atoms in 12 g of carbon-12.

Mole: amount of substance

containing N_A (or 6.02×10^{23}) particles/molecules/atoms

or

which contains the same number of particles/atoms/molecules as there are atoms in 12 g of carbon-12

Ideal Gas: Obeys the equation $pV = nRT$

p , V and T explained

at all values of p , V and T /fixed mass/ n is constant.

Coulombs Law

Coulombs Law: Force between two-point charges is proportional to product of their charges and inversely proportional to the square of the separation.

Relation between E and V : Field strength equals the potential gradient. Field strength and potential gradient are in opposite directions.

Electric Potential: Work done bringing/moving per unit positive charge from infinity (to the point).

Electric field Strength: Force per unit charge on either a stationary charge or a positive charge.

Capacitance

Capacitance of a capacitor: Ratio of charge on one plate to the potential difference between the plates.

Capacitance: Charge / potential (difference) or charge per (unit) potential (difference)

Electronics

Feedback: (part of) the output signal is combined with the input signal.

Virtual Earth: Gain of amplifier is very large

$V+$ is at earth (potential)

for amplifier not to saturate

difference between V^- and V^+ must be very small or V^- must be equal to V^+

Infinite Slew Rate: The output voltage is changed instantaneously as the input voltage is changed. There is no time delay between change in input and change in output.

Voltage gain: $gain = \text{voltage output} / \text{voltage input}$

Relay: Relay is used to switch on/off mains supply using a low voltage/current output

*Negative Feedback: Fraction of the output (signal) is added to the input (signal).
Out of phase by $180^\circ / \pi \text{ rad}$ / to inverting input.*

Comparator: Used to compare two potentials / voltages, output depends upon which is greater.

Processing Unit: Operates on / takes signal from sensing device (so that) it gives a voltage output.

Magnetic Fields and Electromagnetism

Field of force: Region (of space) where an object/particle experiences a force.

Magnetic Field: Region (of space) / area where a force is experienced by current-carrying conductor / moving charge / permanent magnet

Tesla: One tesla is when (long) straight conductor carrying current of 1 A is normal to magnetic field (for flux density 1 T,) and experiences a force of one newton per meter.

Charged Particles

Quantization of charge: either charge exists in discrete and equal quantities or multiples of elementary charge / $e / 1.6 \times 10^{-19} \text{ C}$

Electromagnetic Induction

Faraday's Law: (induced) e.m.f. proportional to rate of change of magnetic flux (linkage).

Lenz's Law: Induced e.m.f./current produces effects / acts in such a direction / tends to oppose the change causing it.

Magnetic Flux Density: (numerically equal to) force per unit length on straight conductor carrying unit current normal to the field.

Alternating Currents

*Smoothing: (output) p.d. / voltage / current does not fall to zero
range of (output) p.d. / voltage / current is reduced*

Ideal Transformer: no power loss in transformer or input power = output power.

Root Mean square value of an alternating current: That value of the direct current / steady current producing same (mean) power / heating in a resistor as the alternating current.

Quantum Physics

Photon: Packet/quantum/discrete amount of energy of electromagnetic radiation having energy equal to Planck constant \times frequency.

De Broglie's Wave Length: Particle/electron has a wavelength (associated with it) dependent on its momentum or when/because particle is moving.

Photo Electric Effect: Electromagnetic radiation/photons incident on a surface causes emission of electrons (from the surface).

Threshold Frequency: Minimum frequency of photon required for electron(s) to be emitted (from surface) or frequency of photon causing emission of electron(s) from surface with zero kinetic energy.

Work function Energy: Minimum photon energy required to remove an electron (from the surface).

Nuclear Physics

Radioactive: Unstable Nucleus emits particles/EM radiation/ionizing radiation. Emission from nucleus is random and spontaneous.

Decay Constant: Probability of decay (of a nucleus) per unit time.

Binding Energy: (minimum) energy required / work done to separate the nucleons (in a nucleus) to infinity.

Half Life: Time for number of atoms/nuclei or activity to be reduced to half of original value/initial activity.

Gamma Radiations: (photons of) Electromagnetic radiation emitted from nuclei.

Nucleus: Small central part/core of an atom.

Nucleon: Proton or a neutron (particle) contained within a nucleus.

Isotopes: Different forms of same element or nuclei having same number of protons with different numbers of neutrons.

Radioactive Decay: Nucleus/nuclei emits spontaneously/randomly α -particles, β -particles, γ -ray photons.

Nuclear Fusion: Two (light) nuclei combine to form a more massive nucleus.

Nuclear Fission: Heavy / large nucleus breaks up / splits into two nuclei / fragments of approximately equal mass.

Medical Imaging

Hardness: Penetration of beam. Greater hardness means greater penetration/shorter wavelength/higher frequency/higher photon energy.

Sharpness: Clear distinction of boundaries between regions.

Contrast: Significant difference in degree of blackening between regions.

Acoustic Impedance: Product of speed of sound in medium and density (of medium).

Linear Absorption coefficient: parallel beam (in matter)

$$I = I_0 \exp(-\mu x)$$

I , I_0 , (μ) and x explained

Newtons Third Law: When two bodies interact, force on one body is equal but opposite in direction to force on the other body.

Mega Lecture