

## **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 =)  $2\pi \times \text{frequency}$  or  $2\pi / \text{period}$

**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  $6.02 \times 10^{23}$ ) 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:  $\text{gain} = \text{voltage output} / \text{voltage input}$*

*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  $\alpha$ -particles,  $\beta$ -particles,  $\gamma$ -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)

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

$I$ ,  $I_0$ ,  $(\mu)$  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