Theme D

Fields

HL Only

#	Physical Quantity	Definition
	D.1 Gravitational Fields - Includes HL Section	
1	**Point Mass**	" Is an object with mass which does not occupy any space. It cannot exist in reality but it can simplify theories."
2	**Gravitational Field**	" Is a region in which a mass would experience a non-contact force."
3	**Newton's Universal Law of Gravitation**	" Every single point mass attracts every other point mass with a gravitational force that is directly proportional to the product of their masses and inversely proportional to the square of their separation."
4	**The Inverse-Square Law**	" Describes how the intensity or strength of a certain physical quantity decreases with the square of the distance from its source. Intensity α 1/Distance^2."
5	**Gravitational Field Strength, g**	" Is defined as the gravitational force per unit test mass placed at a certain point in a g-field."
6	**Gravitational Potential, V_g**	" Is the work done per unit mass required to take a small point test mass m from infinity to a certain point in the gravitation field."
7	**Equipotential Line or Surface**	" Is a line or surface joining points of equal potential. Equipotential lines are always perpendicular to the Field lines."
8	**Gravitational Potential Energy, GPE**	" Is the work done required to take a small point test mass m from infinity to a certain point in the gravitation field."
9	**Gravitational Potential Gradient**	" Is the rate of change of gravitational potential w.r.t. distance and it is equal in magnitude to the Field strength."
10	**Kepler's First Law**	" States that the planets orbit in elliptical paths, with the Sun at one of the two foci."
11	**Kepler's Second Law**	" A line joining a planet and the Sun sweeps out equal areas in equal times."
12	**Kepler's Third Law**	" The square of a planet's orbital time period, T, is proportional to the cube of its average orbital radius, R."
13	**Geosynchronous Orbit**	" Is one with an orbital period that matches the Earth's spinning on its axis (~24 hours)."
14	**Geostationary Orbit (Satellite)**	" Is a special type of geosynchronous orbits where a satellite remains apparently fixed in position when viewed from Earth."
15	**Polar Orbit (Satellite)**	" Is a low-orbit satellite that passes over the poles of the Earth and completes many orbits every day."
16	**Escape Speed**	" Is the minimum theoretical speed needed for an object to move to an infinite distance away from a gravitational field."
17	**Orbital Speed**	" Is the speed required to maintain a circular orbit."
	D.2 Electric and Magnetic Fields - Includes HL Section	
18	**Electric Field**	" Is a 3D region in which a charged particle would experience a non-contact force."
19	**Point Charge**	" Is a point-like object with a nonzero electric charge."
20	**The Charge**	" Is a scalar property of matter that can cause it to experience a force in an electromagnetic field."
21	**The Fundamental (Elementary) Charge**	" Is the smallest amount of charge that exists in ordinary matter; e = $1.60*10^{-19}$ C."
22	**Electrostatic Induction**	" Is the movement of charged particles (electrons) caused by the influence of a nearby charged object, but without physical contact."

23	**Coulomb's Law**	" States that the magnitude of the electrostatic force F between two point electric charges is directly proportional to the product of the magnitudes of charges and inversely proportional to the square of the distance between them."
24	**Permittivity of Free Space, ε_0**	" Is a fundamental constant which represents the ability of a vacuum to transfer an electric force and field."
25	**Permittivity of Medium - Def.1**	" Is a constant which represents the ability of a particular medium to transfer an electric force and field."
26	**Permittivity of Medium - Def.2**	" Is a measure of the resistance offered by the substance in creating an electric field within it and affects the transmission of the electric force. The SI unit for permittivity is farad.m^{-1}."
27	**Relative Permittivity (Dielectric Constant)**	" Is the ration of the permittivity of particular medium to the permittivity of free space."
28	**Electric Field Strength, E**	" Is defined as the electric force per unit charge experienced by a small positive test charge placed at a certain point in the field."
29	**Electric Potential Energy, EPE - Def.1**	" The electric potential energy for a system is the work needed to assemble that system from infinite separation."
30	**Electric Potential Energy, EPE - Def.2**	" Is the work done required in bringing a small positive test charge from infinity to a certain point in the electric field."
31	**Electric Potential, V_e**	" Is the work done per unit charge required in bringing a small positive test charge q from infinity to a certain point in the electric field."
32	**Magnets**	" Are objects that have two pole types, which by arbitrary convention are called north (N or north-seeking), and south (S or south-seeking).
33	**Magnetic Forces**	" Are fundamental forces that act across space among all moving charges, currents and/or permanent magnets."
34	**Ferromagnetic Materials**	" Are materials that are readily magnetized to form permanent magnets, e.g. Iron (soft Iron), Nickel, Cobalt and some rare Earth metals."
35	**Soft Iron**	" Is a form of pure Iron that is easily magnetized and demagnetized."
36	**Magnetic Field Strength [Magnetic Flux Density], B**	" Is defined in terms of the force on a current: The field which produces a force of 1 N on each 1 m length of a conductor carrying a current of 1 A perpendicularly across the Field."
37	**Tesla**	" Is the magnetic flux density that would cause a 1 m long wire, carrying a current of 1 A, perpendicular to the magnetic Field to experience a force of 1 N."
38	**Magnetic Permeability**	" Is a constant which represents the ability of a particular medium to transfer an magnetic force and field."
39	**Permeability of Free Space, μ_0**	" Is a fundamental constant which represents the ability of a vacuum to transfer a magnetic force and field."
40	**Magnetic Field**	" Is the area of space where a magnetic pole experiences a non-contact force."
	D.3 Motion in Electromagnetic Fields	
41	**Particle Beams**	" Are streams of very fast-moving charged particles (electrons, protons, or ions), moving across a vacuum with the same velocity."
42	**Thermionic Emission**	" Is the release of electrons from a very hot metal surface."
	D.4 Induction - HL Only	
43	**Electromagnetic Induction**	" Is a process in which an emf is produced across a conductor that is experiencing a changing magnetic field."
44	**The Induced emf across a conductor**	" Is the work done per unit charge, taking a small positive test charge from one side to the other."
45	**Galvanometer**	" Is an ammeter that measures very small currents."
46	**Magnetic Flux, Φ**	" Is defined as the product of an area A, and the component of the magnetic field strength perpendicular to that area. Unit: Weber, Wb."
47	**Magnetic Flux Linkage, NΦ**	" Is the product of magnetic flux and the number of turns in a circuit. Unit: Wb-turns."
48	**Faraday's Law**	" The magnitude of an induced emf is equal to the rate of change of magnetic flux linkage through a conductive loop."

49	**Lenz's Law**	" The direction of the induced current is such as to oppose the change in flux producing it. This is a result of the principle of conservation of energy."
50	**Eddy Currents**	" Are circulating currents induced in solid pieces of metal when changing magnetic fields pass through them."
51	**Self-Induction**	" Is the phenomenon in which a change in the current in a circuit tends to produce an induced emf which opposes the change of current in the same circuit."
52	**Back-emf**	" Is an induced potential difference that opposes a change of current in the same circuit."