Important Equations in Physics for IGCSE course

General Physics:

1	*For constant motion:*	$v = \frac{s}{t}$	*'v' is the velocity in m/s, 's' is the distance or displacement in meters and 't' is the time in seconds*
2	*For acceleration 'a'*	$a = \frac{v - u}{t}$	*u is the initial velocity, v is the final velocity and t is the time.*
3	*Graph*	*Area of a rectangular shaped graph = base × height.* *Area of triangular shaped graph = ½ × base × height*	*In velocity-time graph the area under the graph is the total distance covered by an object.*
4	*Weight and mass*	$w = m \times g$	*w is the weight in newton (N), m is the mass in kg and g is acceleration due to gravity = 10 m/s*^{2}
5	*Density 'ρ' in kg/m*^{3}	$\rho = \frac{m}{V}$	*m is the mass and V is the volume*
6	*Force F in newton (N)*	$F = m \times a$	*m is the mass and a is the acceleration*
7	*Terminal Velocity*	$Weight\ of\ an\ object(downward) = air\ resistance\ (upwards)$	
8	*Hooke's Law*	$F = k \times x$	*F is the force, x is the extension in meters and k is the spring constant.*
9	*Moment of a force in N.m*	$moment\ of\ force = F \times d$	*F is the force and d is the distance from the pivot*
10	*Law of moment or equilibrium:*	$Total\ clockwise\ moment = total\ anticlockwise\ moment$ $=> F_1 \times d_1 = F_2 \times d_2$	
11	*Work done W joules (J)*	$W = F \times d$	*F is the force and d is the distance covered by an object*
12	*Kinetic Energy* E_k *in joules (J)*	$E_k = \frac{1}{2} \times m \times v^2$	*m is the mass(kg) and v is the velocity (m/s)*
13	*Potential Energy* E_p *in joules (J)*	$E_p = m \times g \times h$	*m is the mass (kg) and g is the acceleration due to gravity and h is the height from the ground.*
14	*Law of conservation of energy:*	$Loss\ of\ E_p = gain\ of\ E_k$ $m \times g \times h = \frac{1}{2} \times m \times v^2$	
15	*Power in watts (W)*	$P = \frac{work\ done}{time\ taken}$ $P = \frac{Energy\ transfer}{time\ taken}$	*Power is the rate of doing work*
16	*Pressure p in pascal (Pa)*	$p = \frac{F}{A}$	*F is the force in newton(N) and A is the area in m*^{2}
17	*Pressure p due to liquid*	$p = \rho \times g \times h$	*ρ is the density in kg/m*^{3}*, g is the acceleration due to garvity and h is the height or depth of liquid in meters.*
18	*Atmospheric pressure*	*P=760mmHg = 76cm Hg =1.01x10*^{5}*Pa*	

Thermal Physics:

1	*Pressure and volume relationship (Boyle's law)*	*pV=constant* $p_1 \times V_1 = p_2 \times V_2$	*p_1 and p_2 are the two pressures in Pa and V_1 and V_2 are the two volumes in m^3*
2	*Thermal Expansion (Linear)*	$\Delta L = \alpha \times L_o \times \Delta\theta$ *L_o is the original length in meters,* *$\Delta\theta$ is the change in temperature in ^oC,* *ΔL is the change in length in meters (L_1- L_o) and* *α is the linear expansivity of the material*	
3	*Thermal Expansion (Cubical)*	$\Delta V = \gamma$ Vo $\Delta\theta$ *V_o is the original volume in m^3,* *$\Delta\theta$ is the change in temperature in ^oC,* *ΔV is the change in volume in m^3 (V_1- V_o) and* *γ is the cubical expansivity of the material.*	
4	*Relationship between linear and cubical expansivities*	$\gamma = 3\alpha$	
5	*Charle's Law:* *Volume* is directly proportional to absolute temperature $V \propto T$	$\frac{V}{T} = constant$ $\frac{V_1}{T_1} = \frac{V_2}{T_2}$	*V is the volume in m^3 and T is the temperature in Kelvin (K).*
6	*Pressure Law:* *Pressure of a gas is directly proportional to the absolute temperature* $p \propto T$	$\frac{p}{T} = constant$ $\frac{p_1}{T_1} = \frac{p_2}{T_2}$	*p is the pressure in Pa and T is the temperature in Kelvin (K).*
7	*Gas Law:* $\frac{pV}{T} = constant$	$\frac{p_1V_1}{T_1} = \frac{p_2V_2}{T_2}$	*In thermal physics the symbol θ is used of celsius scale and T is used for Kelvin scale.*
8	*Specific Heat Capacity:* *The amount of heat required to raise the temperature of 1 kg mass by 1^oC.*	$c = \frac{Q}{m \times \Delta\theta}$	*c is the specific heat capacity in J/kg^oC,* *Q is the total heat in joules (J),* *m is the mass in kg and* *$\Delta\theta$ is the change in temperature*
9	*Thermal Capacity: amount of heat require to raise the temperature of a substance of any mass by 1^oC*	*Thermal capacity=m×c* $Thermal\ capacity = \frac{Q}{\Delta\theta}$	*The unit of thermal capacity is $J/^oC$.*
10	*Specific latent heat of fusion (from Ice to liquid)*	$L_f = \frac{Q}{m}$	*L_f is the specific latent heat of fusion in J/kg or J/g,* *Q is the total heat in joules (J),* *m is the mass of liquid change from ice in kg or g.*
11	*Specific latent heat of vaporization (from liquid to vapour)*	$L_v = \frac{Q}{m}$	*L_v is the specific latent heat of vaporization in J/kg or J/g,* *Q is the total heat in joules (J),* *m is the mass of vapour change from liquid in kg or g.*
12	*Thermal or heat transfer*	*In solid = conduction* *In liquid and gas = convection and also convection current* *In vacuum = radiation*	
13	*Emitters and Radiators*	*Dull black surface = good emitter, good radiator, bad reflector* *Bright shiny surface = poor emitter, poor radiator, good reflector*	

Waves, light and sound:

1	*Wave equation 1*	$v = f \times \lambda$	*v is the speed of wave in m/s* *f is the frequency in Hz* λ *is the wavelength in meters*
2	*Wave equation 2*	$f = \frac{1}{T}$	*T is the time period of wave in seconds*
3	*Movement of the particles of the medium*	*Longitudinal waves=> back and forth in the direction of the waves* *Transverse waves=> perpendicular to the direction of the waves*	
4	*Law of reflection*	*Angle of incidence i = angel of reflection* $angle\ i^o = angle\ r^o$	
5	*Refraction*	*From lighter to denser medium → light bend towards the normal* *From denser to lighter medium →light bend away from the normal*	
6	*Refractive index n*	$n = \frac{\sin \angle i}{\sin \angle r}$	*Refractive index has no unit*
7	*Refractive index n*	$n = \frac{speed\ of\ light\ in\ air\ or\ vacuum}{speed\ of\ light\ in\ any\ other\ medium}$	
8	*Image from a plane mirror*	*Virtual, upright, same size and laterally inverted,* *same distance from the mirror inside*	
9	*Image from a convex lens*	*When close: virtual, enlarge, upright* *When far: real, small, upside down*	
10	*Image from a concave lens*	*Virtual, upright, small*	
11	*Critical angle*	*When light goes from denser to lighter medium, the incident angle at which the reflected angle is* 90^o*,is called critical angle.*	
12	*Total internal reflection(TIR)*	*When light goes from denser to lighter medium, the refracted ray bend inside the same medium then this is called (TIR)*	
13	*Electromagnetic Spectrum:→ this way the frequency decreases and wavelength increases* *Gamma rays ↔ X-rays ↔ UV ↔ Visible light ↔ IR ↔ Micro waves ↔ Radio waves*		
14	*Colours of visible spectrum (light)*	*VIBGYOR (from bottom-up)*	
15	*Speed of light*	*In air:* 3×10^8*m/s*	*In glass:* 2×10^8*m/s*
16	*Light wave*	*Electromagnetic waves*	
17	*Sound wave*	*longitudinal waves* *particle of the medium come close → compression* *particles of the medium far apart → rarefaction*	
18	*Echo*	$v = \frac{2 \times d}{t}$	*v is the speed of sound waves, d is the distance in meters between source and the reflection surface and* *t is the time for echo*
19	*Properties of sound waves*	*Pitch means the frequency of the wave* *Loudness means the amplitude of the wave*	
20	*Speed of sound waves*	*Air : 330-340 m/s* *Water: 1400 m/s* *Concrete : 5000 m/s* *Steel: 6000 – 7000 m/s*	

Electricity and magnetism:

1	Ferrous Materials	Attracted by magnet and can be magnetized	Eg. iron, steel, nickel and cobalt
2	Non-ferrous materials	Not attracted by magnet and cannot be magnetized	copper, silver, aluminum, wood, glass
3	Electric field intensity	force exerted by the field on a unit charge placed at a point around another charge	E is the electric field intensity in N/C $E = \frac{F}{q}$
4	Current: Rate of flow of charges in a conductor	$I = \frac{Q}{t}$	I is the current in amperes (A), Q is the charge in coulombs (C) t is the time in seconds (s)
5	Current	In circuits the current always choose the easiest path	
6	Ohms law	Voltage across the resistor is directly proportional to current, $V \propto I$ or $\frac{V}{I} = R$	V is the voltage in volts (V), I is the current in amperes (A) and R is resistance in ohms (Ω)
7	Voltage	Energy per unit charge $V = \frac{Energy}{Q}$	Q is the charge in coulombs (C), V is the voltage in volts (V) Energy is in joules (J)
8	E.M.F. Electromotive force	e.m.f. = lost volts + terminal potential difference EMF=Ir+IR	
9	Resistance and resistivity	$R = \rho\frac{L}{A}$ ρ is the resistivity of resistor in Ω.m	R is the resistance a resistor, L is the length of a resistor in meters A is the area of cross-section of a resistor in m^2
10	Circuit	In series circuit→ the current stays the same and voltage divides In parallel circuit → the voltage stays the same and current divides	
11	Resistance in series	$R = R_1 + R_2 + R_3$	R, R_1, R_2 and R_3 are resistances of resistor in ohms
12	Resistance in parallel	$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$	
13	Potential divider	$\frac{V_1}{V_2} = \frac{R_1}{R_2}$	
14	Potential divider	$V_2 = (\frac{R_2}{R_1 + R_2}) \times V$	$V_1 = (\frac{R_1}{R_1 + R_2}) \times V$
15	Power	$P = I \times V$ | $P = I^2 \times R$ | $P = \frac{V^2}{R}$	P is the power in watts (W)
16	Power	$P = \frac{Energy}{time}$	The unit of energy is joules (J)
17	Transformer	$\frac{V_p}{V_s} = \frac{n_p}{n_s}$	V_p is the voltage in primary coil, V_s is the voltage in secondary coil n_p is the no of turns in primary and n_s is the no of turns in secondary
18	Transformer	Power of primary coil = power of secondary coil $P_p = P_s$ $I_p \times V_p = I_s \times V_s$ $\frac{V_p}{V_s} = \frac{I_s}{I_p}$ I_p is the current in primary coil and I_s the current in secondary coil	
19	Cathode rays	Stream of electrons emitted from heated metal (cathode). This process is called thermionic emission.	
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Atomic Physics:

1	*Alpha particles* *α-particles*	*Helium nucleus* *Stopped by paper* *Highest ionization potential*	
2	*Beta-particles* *β-particles*	*Fast moving electrons* *Stopped by aluminum* *Less ionization potential*	
3	*Gamma-particles* *γ-rays*	*Electromagnetic radiation* *Only stopped by thick a sheet of lead* *Least ionization potential*	
4	*Half-life*	*Time in which the activity or mass becomes half*	
5	*Atomic symbol*	$^{A}_{Z}X$	*A is the total no of protons and neutrons* *Z is the total no of protons*
6	*Isotopes*	*Same number of protons but different number of neutrons*	