GCSE Physics Formulae Sheet

Eason's Quantitative Toolbox

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Contents

What is this and why this?

Most calculation error in GCSE Physics exams is caused by not knowing the formulae, not knowing the derived form and not knowing the meaning of the symbols. I made this document based on the CIE IGCSE Physics (9-1) Syllabus from 2023 onwards. I hope this could help with your IGCSE studies!

I am also an IGCSE student so errors are inevitable in this document. Feel free to email yicheng_shao@oxcoll.com to point out any mistakes or submit an issue on the GitHub page!

P.S. I want to try my best to include quantitative formulae for qualitative requirements at GCSE, but they usually require more Mathematical tools so it is normal to have unexpected symbols.

This is the simplified version with only the formulae you are required to use to calculate. Vector notations are still present just for the sake of science.

Section 1 Mechanics

§1.1 Kinematics

1. **Definition of speed:**

$$v = \frac{\Delta s}{\Delta t}.$$

Meaning of Symbols (and Units): v stands for speed, $\mathrm{m\,s^{-1}}$; Δs stands for distance elapsed, m; Δt stands for time elapsed, s.

Word Explanation: Speed equals distance covered per unit time.

Derived Formulae: $\Delta s = v\Delta t, t = \frac{\Delta s}{v}$.

Note: Speed and distance are both scalars.

2. **Definition of velocity:**

$$\boldsymbol{v} = \frac{\Delta \boldsymbol{s}}{\Delta t}.$$

Meaning of Symbols (and Units): $\boldsymbol{v}$ stands for velocity, $\mathrm{m\,s^{-1}}$; $\Delta \boldsymbol{s}$ stands for displacement, m; Δt stands for time elapsed, s.

Word Explanation: Velocity equals the displacement over the time elapsed.

Derived Formulae: $\Delta \boldsymbol{s} = \boldsymbol{v}\Delta t, \Delta t = \frac{\Delta \boldsymbol{s}}{\boldsymbol{v}}$.

Note: Velocity and displacement are both vectors.

3. **Definition of average speed:**

$$\bar{v} = \frac{s}{t}$$

Meaning of Symbols (and Units): $\bar{v}$ stands for average speed, $\mathrm{m\,s^{-1}}$; s stands for distance, m; t stands for time, s.

Word Explanation: Average speed equals the total distance over total time.

Derived Formulae: $s = \bar{v}t, t = \frac{s}{\bar{v}}$.

Note: Difference between average speed and speed: one is over a period, another is at a certain time.

4. **Definition of acceleration:**

$$\boldsymbol{a} = \frac{\Delta \boldsymbol{v}}{\Delta t}.$$

Meaning of Symbols (and Units): $\boldsymbol{a}$ stands for acceleration, $\mathrm{m\,s^{-2}}$; $\Delta \boldsymbol{v}$ stands for change in velocity, $\mathrm{m\,s^{-1}}$; Δt stands for time elapsed, s.

Word Explanation: Acceleration is the rate of change in velocity.

Derived Formulae: $\Delta \boldsymbol{v} = \Delta t \boldsymbol{a}, \Delta t = \frac{\Delta \boldsymbol{v}}{\boldsymbol{a}}$,

$$\boldsymbol{v} = \boldsymbol{v_0} + \boldsymbol{a}t$$

Note: Acceleration is (usually) a vector.

You are not expected to know the *suvat* equation, but please draw a $\boldsymbol{v} - t$ graph if necessary.

§1.2 Statics and Energy

1. **Weight:**

$$\boldsymbol{W} = m\boldsymbol{g}.$$

Meaning of Symbols (and Units): $\boldsymbol{W}$ stands for the weight (a force), N; m stands for mass, kg; $\boldsymbol{g}$ stands for gravitational acceleration or gravitational field strength, $\mathrm{m\,s^{-2}}$ or $\mathrm{N\,kg^{-1}}$.

Word Explanation: The gravitational acceleration is the gravitational force (weight) per unit time (and equivalent to gravitational acceleration).

Derived Formulae: $\boldsymbol{g} = \frac{\boldsymbol{W}}{m}, m = \frac{\boldsymbol{W}}{\boldsymbol{g}}$.

Note: Weight and gravitational acceleration/gravitational field strength are both vectors.

2. **Density:**

$$\rho = \frac{m}{V}$$

Meaning of Symbols (and Units): ρ stands for density, $\mathrm{kg\,m^{-3}}$; m stands for mass, kg; V stands for volume, $\mathrm{m^3}$.

Word Explanation: The density is mass per unit volume.

Derived Formulae: $m = \rho V, V = \frac{\rho}{m}$.

Note: Density is a scalar, and it is a property of a material (usually), which could also determine floating and sinking.

3. **Definition of pressure (General):**

$$p = \frac{F}{A}.$$

Meaning of Symbols (and Units): p stands for pressure, Pa or $\mathrm{N\,m^{-2}}$; F stands for the magnitude of the normal force, N; A stands for area, $\mathrm{m^2}$.

Word Explanation: Pressure is the magnitude of the force exerted per unit area.

Derived Formulae: $F = pA, A = \frac{F}{p}$.

Note: Though force is a vector, pressure is a scalar. This will be more significant in the next formula.

4. **Pressure (Liquid and Prism):**

$$\Delta p = \rho g \Delta h.$$

Meaning of Symbols (and Units): Δp stands for change in pressure, Pa; ρ stands for the density, $\mathrm{kg\,m^{-3}}$; g stands for gravitational acceleration, $\mathrm{N\,kg^{-1}}$; Δh stands for difference in depth/height, m.

Word Explanation: The change in the pressure (over a depth) is the gravitational acceleration times the density times the change in depth.

Derived Formulae: $\rho = \frac{\Delta p}{g\Delta h}, \Delta h = \frac{\Delta p}{\rho g}$.

Note: Pressure is exerted in all directions in the liquid.

5. **Definition of work:**

$$W = \Delta E = \boldsymbol{F} \cdot \boldsymbol{d} = Fd\cos\theta.$$

Meaning of Symbols (and Units): W stands for work, J or N m; ΔE stands for change in energy, J; $\boldsymbol{F}$ stands for force, N; $\boldsymbol{d}$ stands for displacement, m; θ stands for the angle between the force and the direction of travel, ° or rad (note that radians just a dimension of 1).

Word Explanation: Work is energy transferred. Work is the force times distance travelled in the direction of the force.

Derived Formulae: $F = \frac{W}{d\cos\theta}, d = \frac{W}{F\cos\theta}$.

Note: Usually the $\cos\theta$ can be ignored, but please remember the distance travelled in the direction of the force.

6. **Kinetic energy:**

$$E_k = \frac{1}{2}mv^2.$$

Meaning of Symbols (and Units): E_k stands for kinetic energy, J; m stands for mass, kg; v stands for speed or magnitude of velocity, $\mathrm{m\,s^{-1}}$.

Word Explanation: The kinetic energy is half the mass times energy squared.

Derived Formulae: $v = \sqrt{\frac{2E_k}{m}}$.

Note: Energy is always a scalar. It makes no difference using speed or dot product of velocity here. Note that $\Delta E_k \neq \frac{1}{2}m\Delta v^2$.

7. **Gravitational potential energy (in a uniform gravitational field):**

$$\Delta E_p = mg\Delta h.$$

Meaning of Symbols (and Units): E_p stands for gravitational potential energy, J; m stands for mass, kg; g stands for gravitational acceleration (magnitude), $\mathrm{m\,s^{-2}}$; Δh stands for change in height, m.

Word Explanation: The change in gravitational potential energy is the mass times the gravitational field strength times the change in the height.

Derived Formulae: $m = \frac{\Delta E_p}{g\Delta h}, g = \frac{\Delta E_p}{m\Delta h}, \Delta h = \frac{\Delta E_p}{mg} = \frac{\Delta E_p}{W}, E_p = W\Delta h$.

Note: This formula only holds in a uniform gravitational field, there is another one in more complex gravitational fields (e.g. Newtonian Gravity and Einstein's General Relativity).

8. **Definition of power:**

$$P = \frac{\Delta E}{\Delta t}.$$

Meaning of Symbols (and Units): P stands for power, W or $\mathrm{J\,s^{-1}}$; ΔE stands for energy transferred $= W$, J; Δt stands for time elapsed, s.

Word Explanation: Power is the rate of energy transferred.

Derived Formulae: $P = \frac{W}{\Delta t}, \Delta E = W = P\Delta t, t = \frac{W}{P} = \frac{\Delta E}{P}$,

$$P = \boldsymbol{F} \cdot \boldsymbol{v}.$$

Note: This formula also works for electrical power.

9. **Efficiency:**

$$\eta = \frac{P_{\text{useful}}}{P_{\text{total}}}.$$

Meaning of Symbols (and Units): η stands for efficiency, dimension of 1 without unit; P_{useful} stands for useful power (output), W; P_{total} stands for total power (input), W.

Word Explanation: The efficiency is the percentage/proportion of useful energy/power output to the total energy/power input.

Derived Formulae:

$$\eta = \frac{W_{\text{useful}}}{W_{\text{total}}}.$$

Note: You can times 100% which is basically 1 to get a percentage.

§1.3 Effect of Forces

1. **Definition of momentum:**

$$\boldsymbol{p} = m\boldsymbol{v}.$$

Meaning of Symbols (and Units): $\boldsymbol{p}$ stands for momentum, $\mathrm{kg\,m\,s^{-1}}$; m stands for mass, kg; $\boldsymbol{v}$ stands for velocity, $\mathrm{m\,s^{-1}}$.

Word Explanation: Momentum is the product of mass and its velocity.

Derived Formulae: $m = \frac{\boldsymbol{p}}{\boldsymbol{v}}, \boldsymbol{v} = \frac{\boldsymbol{p}}{m}$.

Note: Momentum itself is a vector and has a direction.

2. **Newton's 2nd Law:**

$$\boldsymbol{F} = \frac{\Delta \boldsymbol{p}}{\Delta t}.$$

Meaning of Symbols (and Units): $\boldsymbol{F}$ stands for force, N; $\Delta\boldsymbol{p}$ stands for change in momentum, $\mathrm{kg\,m\,s^{-1}}$; Δt stands for time elapsed, s.

Word Explanation: Force is equal to the rate of change in momentum.

Derived Formulae: $\Delta\boldsymbol{p} = \boldsymbol{F}\Delta t, \Delta t = \frac{\Delta\boldsymbol{p}}{\boldsymbol{F}}$,

$$\boldsymbol{F} = m\boldsymbol{a}.$$

Note: This is a very important equation in physics, and it could lead to discussions about inertial mass/gravitational mass, Lagrange – d'Almbert's Principle (turning non-inertial frames into inertial ones), special relativity, etc.

3. **Impulse:**

$$\boldsymbol{I} = \Delta \boldsymbol{p}.$$

Meaning of Symbols (and Units): $\boldsymbol{I}$ stands for impulse, $\mathrm{kg\,m\,s^{-1}}$; $\Delta \boldsymbol{p}$ stands for change in momentum, $\mathrm{kg\,m\,s^{-1}}$.

Word Explanation: Impulse is equal to the change in momentum.

Derived Formulae: The following is derived from Newton's 2nd Law:

$$\boldsymbol{I} = \boldsymbol{F}\Delta t.$$

Note: This is only meaningful if momentum is conserved - just like work and energy.

4. **Moment:**

$$\boldsymbol{M} = \boldsymbol{r} \times \boldsymbol{F}.$$

Meaning of Symbols (and Units): $\boldsymbol{M}$ stands for the moment (of a force), $\mathrm{N\,m}$ (according to SI standards, we don't write it as a J); $\boldsymbol{r}$ stands for the position vector of the force, m; $\boldsymbol{F}$ stands for the force, N.

Word Explanation: The magnitude of the moment of a force is equal to the magnitude of the force times the perpendicular distance between the pivot and the line of action of the force.

Derived Formulae: To be simple, denote d as the perpendicular distance between the pivot and the line of action of the force, m, then we have $M = Fd, F = \frac{M}{d}, d = \frac{M}{F}$.

Note: I wrote this in terms of vector and their cross-product just for the sake of science but this is not required at all.

5. **Hooke's Law:**

$$\boldsymbol{F} = k\boldsymbol{x}.$$

Meaning of Symbols (and Units): $\boldsymbol{F}$ stands for force, N; k stands for the spring constant, $\mathrm{N\,m^{-1}}$; $\boldsymbol{x}$ stands for the extension (vector).

Word Explanation: The force to extend or compress a spring (within the limit of linearity) is perpendicular to the extension.

Derived Formulae: $k = \frac{\boldsymbol{F}}{\boldsymbol{x}}, \boldsymbol{x} = \frac{\boldsymbol{F}}{k}$.

Note: Remember to use extension for the $\boldsymbol{x}$ not the total length.

Section 2 Thermal Physics

§2.1 Ideal Gas

Boyle's Law:

$$pV = \text{const.}$$

Meaning of Symbols (and Units): p stands for pressure, Pa; V stands for volume, $\mathrm{m^3}$.

Word Explanation: The pressure of a gas is inversely proportional to its volume given that its temperature remains the same.

Derived Formulae: $p_1V_1 = p_2V_2$.

Note: This only remains true if the temperature is constant.

§2.2 Temperature

1. **Conversion between kelvin and degree celsius:**

$$T\text{K}^{-1} = \theta^\circ\text{C}^{-1} + 273(.15).$$

Meaning of Symbols (and Units): T stands for (thermodynamic) temperature in kelvin, K; θ stands for temperature in degrees Celsius, °C.

Word Explanation: The temperature in kelvin is equal to the temperature in degrees Celsius plus 273.15.

Derived Formulae: $\theta^\circ\text{C}^{-1} = T\text{K}^{-1} - 273(.15)$.

Note: Please note that in all the ideal gas equations you need to use the thermodynamic temperature, but in the following equation you do not need to convert, as the change in one degree Celsius equals the change in one kelvin.

2. **Thermal capacity:**

$$Q = mc\Delta T.$$

Meaning of Symbols (and Units): Q stands for thermal energy transferred, J; m stands for mass, kg; c stands for thermal capacity, $\text{J}\,\text{kg}^{-1}\,\text{K}^{-1}$ or $\text{J}\,\text{kg}^{-1}\,{}^\circ\text{C}^{-1}$; ΔT stands for change in temperature, K or °C.

Word Explanation: The thermal capacity is defined as the heat energy transferred per unit mass per unit change in temperature.

Derived Formulae: $m = \frac{Q}{c\Delta T}, c = \frac{Q}{m\Delta T}, \Delta T = \frac{Q}{mc}$.

Note: Thermal capacity is a property of a material. It doesn't matter whether you calculate with degrees Celsius or kelvin, but make sure you use the same unit to calculate the temperature change.

Section 3 Waves

§3.1 Waves

1. **Frequency and Period:**

$$f = \frac{1}{T}.$$

Meaning of Symbols (and Units): f stands for the frequency, Hz or s^{-1}; T stands for the period, s.

Word Explanation: Frequency is the reciprocal of the period.

Derived Formulae: $fT = 1, T = \frac{1}{f}$.

Note: This is true for all waves.

2. **The wave equation:**

$$v = f\lambda.$$

Meaning of Symbols (and Units): v stands for the wave speed, $\mathrm{m\,s^{-1}}$; f stands for the frequency, Hz; λ stands for the wavelength, m.

Word Explanation: The wave speed of a wave is equal to its frequency times its wavelength.

Derived Formulae: $f = \frac{v}{\lambda}, \lambda = \frac{v}{f}$.

Note: The frequency of a wave will not change (Doppler Effect! but that's an observation), so usually we can just say $\lambda \propto v$.

§3.2 Optics

1. **Refractive index:**

$$n = \frac{c}{v}$$

Meaning of Symbols (and Units): n stands for the refractive index, dimension of 1; c stands for the speed of light in vacuum, $c = 3.00 \times 10^8\,\mathrm{m\,s^{-1}}$; v stands for the speed of light in that certain medium.

Word Explanation: The refractive index of a medium is the ratio of the speed of light in a vacuum and the speed of light in that certain medium.

Derived Formulae: $c = nv, v = \frac{c}{n}$.

Note: As the speed of light in a vacuum is the fastest thing in the world (special relativity!), n is always no smaller than one i.e. $n \geq 1$ and $n = 1$ iff. the medium is a vacuum. For simplicity we take $n_{\text{air}} = 1$.

2. **Snell's law:**

$$n_1 \sin\theta_1 = n_2 \sin\theta_2.$$

Meaning of Symbols (and Units): n_1 stands for the refractive index in the first medium, dimension of 1; θ_1 stands for the angle between the incident ray and the normal (i.e. incidence angle), °; n_2 stands for the refractive index in the second medium, dimension of 1; θ_2 stands for the angle between the refracted ray and the normal (i.e. refraction angle), °.

Word Explanation: The product of the refractive index and the angle between the ray and the normal is the same while the light is refracting.

Derived Formulae: $\theta_2 = \arcsin\frac{n_1 \sin\theta 1}{n_2}, n_2 = \frac{n_1 \sin\theta_1}{\sin\theta_2}$.

Note: This can be derived from Fermat's Principle, or maybe, least action principle!

3. **Critical angle:**

$$\sin c = \frac{n_{\text{quick}}}{n_{\text{slow}}}.$$

Meaning of Symbols (and Units): c stands for the critical angle, °; n_{quick} stands for the refractive index in the quick medium, dimension of 1; n_{slow} stands for the refractive index in the slow medium, dimension of 1.

Word Explanation: The sine of the critical angle is equal to the ratio between the refractive index of the fast medium and the slow medium.

Derived Formulae: $n_{\text{slow}} = \frac{n_{\text{quick}}}{\sin c}$.

Note: This is a special case of the general Snell's law where a θ equals 90°. We see $\sin c = \frac{1}{n}$ as we take the quick n_{quick} as 1 (in the case of air).

Section 4 Electricity

§4.1 Electrical Quantities

1. **Definition of electromotive force (e.m.f.):**

$$E = \frac{W}{Q}.$$

Meaning of Symbols (and Units): E stands for the e.m.f., V or $\mathrm{J\,C^{-1}}$; W stands for work, J; Q stands for charge, C.

Word Explanation: The e.m.f. is equal to the electrical work done per unit charge to move it around a circuit.

Derived Formulae: $W = EQ, Q = \frac{W}{E}$.

Note: The e.m.f. is not electromagnetic force, it is electromotive force! But not a force.

2. **Definition of potential difference (p.d.):**

$$V = \frac{W}{Q}.$$

Meaning of Symbols (and Units): V stands for the p.d., V or $\mathrm{J\,C^{-1}}$; W stands for work, J

Word Explanation: The p.d. is the work done per unit charge passing through an electric component.

Derived Formulae: $W = VQ, Q = \frac{W}{V}$.

Note: The p.d. is effectively the same with e.m.f. – but e.m.f. is converting other forms of energy into electrical energy while p.d. is the other way round.

3. **Definition of current:**

$$I = \frac{Q}{t}.$$

Meaning of Symbols (and Units): I stands for the current, A or $\mathrm{C\,s^{-1}}$; Q stands for the charge, C; t stands for time, s.

Word Explanation: The current is the charge flowing through a point per unit time. (Technically it should be ΔQ and Δt but we don't mind here.)

Derived Formulae: $Q = It, t = \frac{Q}{I}$.

Note: We don't care about $I = \frac{\Delta Q}{\Delta t}$ because we only study constant current at this stage. Current is **not** a vector, but current density is (we don't need to know that yet but just FYI.)

4. **Formula for electrical work and electrical power:**

$$P = VI, W = Pt = VIt = VQ.$$

Meaning of Symbols (and Units): P stands for power, W; V stands for voltage, V; I stands for current, A; W stands for work, J; t stands for time, s.

Word Explanation: The electrical power is equal to the voltage times the current; the electrical work done is equal to the voltage times the current times the time elapsed, which is also equal to the voltage times the charge.

Derived Formulae: $V = \frac{P}{I}, I = \frac{P}{V}$.

Note: These are derived formulae from the definition of work and the definition of the current so it shouldn't be surprising if these are true. We will see an updated version of these in the next section.

§4.2 Circuits

1. **Ohm's Law and Definition of Resistance:** (simplified version)

$$R = \frac{V}{I}.$$

Meaning of Symbols (and Units): R stands for resistance, Ω or $\mathrm{V\,A^{-1}}$; V stands for voltage (usually p.d.), V; I stands for current, A.

Word Explanation: The resistance of an electrical component is the potential difference across it over the current passing through it.

Derived Formulae: $V = RI, I = \frac{V}{R}$.

Note: This is a very important thing in electrical circuit calculation – please remember this as it links some of the most important quantities together. Note that $R \neq \frac{\Delta V}{\Delta I}$ which means resistance is not a gradient at a point!

2. **More Power:**

$$P = VI = I^2R = \frac{V^2}{R}.$$

Meaning of Symbols (and Units): P stands for electrical power, W; V stands for voltage, V; I stands for current, A; R stands for resistance, Ω.

Word Explanation: The power is the product of the square of current and the resistance, which is equal to the square of voltage over the resistance.

Derived Formulae: Too many.

Note: This is a direct corollary of Ohm's Law.

3. **Kirchoff's First Law:**

$$\sum I_{\text{in}} = \sum I_{\text{out}}.$$

Meaning of Symbols (and Units): $\sum$ stands for the sum; I_{in} stands for the current flowing into a junction, A; I_{out} stands for the current flowing out a junction, A.

Word Explanation: The current flowing into a junction is equal to the current flowing out of a junction.

Derived Formulae: The parallel circuit law (which will appear later).

Note: This is a direct corollary from the conservation of charge.

4. **Parallel Circuit Laws:**

$$I = I_1 + I_2 + \cdots + I_n,$$
$$V = V_1 = V_2 = \cdots + V_n,$$
$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_n}.$$

Meaning of Symbols (and Units): I stands for the total current, A; I_i stands for the current passing through the ith component, A; V stands for the e.m.f., V; V_i stands for the p.d. over the ith component, V; R stands for the total resultant resistance, Ω; R_i stands for the resistance of the ith component, Ω.

Word Explanation: The total current in a parallel circuit is the sum of all the current in each branch; the e.m.f. of the parallel circuit is equal to the p.d. over each component; the resistance of the circuit is equal to the reciprocal of the sum of reciprocal of the resistances.

Derived Formulae: Too many.

Note: The p.d. and the e.m.f. are the same, as you are effectively measuring the same thing. The result of the current follows from the Kirchoff's Current Law and the resistance formula follows.

5. **Series Circuit Laws:**

$$I = I_1 = I_2 = \cdots = I_n,$$
$$V = V_1 + V_2 + \cdots + V_n,$$
$$R = R_1 + R_2 + \cdots + R_n.$$

Meaning of Symbols (and Units): I stands for the total current, A; I_i stands for the current passing through the ith component, A; V stands for the e.m.f., V; V_i stands for the p.d. over the ith component, V; R stands for the total resultant resistance, Ω; R_i stands for the resistance of the ith component, Ω.

Word Explanation: The current in a series circuit is all the same; the e.m.f. in a series circuit is the sum of the p.d.s of the components; the resistance of a series circuit is the sum of each component's resistance.

Derived Formulae: Potential divider:

$$V_{\text{out}} = V_{\text{in}} \cdot \frac{R_{\text{output}}}{R_{\text{total}}}.$$

Note: The current law follows from Kirchoff's Current Law and the voltage follows from the Voltage Law, the resistance result is a corollary of them.

§4.3 Electromagnetism

Transformer:

$$\frac{V_1}{V_2} = \frac{N_1}{N_2}.$$

Meaning of Symbols (and Units): V_1 stands for the primary coil voltage, V; V_2 stands for the secondary coil voltage, V; N_1 stands for the number of coils on the primary coil, dimensionless; N_2 stands for the number of coils on the secondary coil, dimensionless.

Word Explanation: The coil voltage is proportional to the number of coils on that respective coil.

Derived Formulae: By conservation of energy,

$$I_1 N_1 = I_2 N_2.$$

Note: This is a very simple equation, so don't get it wrong! Be careful with the corresponding primary and secondary.

Section 5 Space Physics

§5.1 Orbits

The orbit period:

$$T = \frac{2\pi r}{v}.$$

Meaning of Symbols (and Units): T stands for the orbit period, s; r stands for the orbit radius, m; v stands for the orbit speed, $\mathrm{m\,s^{-1}}$.

Word Explanation: The orbit period is the circumference of the orbit over the orbit speed (trivial).

Derived Formulae: $v = \frac{2\pi r}{T}, r = \frac{Tv}{2\pi}$.

Note: This can be used to derive the escape velocity (together with Newton's Law of Gravity).

§5.2 Hubble's Constant

1. **The Hubble's Constant:**

$$H_0 = \frac{v}{d}.$$

Meaning of Symbols (and Units): H_0 stands for the Hubble Constant, $H_0 \approx 2.2 \times 10^{-18}\,\mathrm{s^{-1}}$; v stands for the receding velocity, $\mathrm{m\,s^{-1}}$; d stands for the distance, m.

Word Explanation: The Hubble Constant is defined as the ratio of the speed at which the galaxy is moving away from the Earth to its distance from the Earth.

Derived Formulae: $v = H_0 d, d = \frac{v}{H_0}$.

Note: According to the syllabus, you need to know the approximate value of the Hubble Constant.

2. **Edge of Time:**

$$t = \frac{1}{H_0}.$$

Meaning of Symbols (and Units): t stands for the age of the universe, s, H_0 stands for the Hubble Constant, $\mathrm{s^{-1}}$.

Word Explanation: The Hubble Constant is equal to the reciprocal of the age of the universe.

Derived Formulae: Not really, but $tH_0 = 1$.

Note: $t \approx 1.38 \times 10^{10}\,\mathrm{yr}$.

Afterwords

This sheet took me some time to populate, but I would genuinely like to share my understanding of GCSE Physics (and beyond) with all of you.

My deepest thanks to all the Physics teachers I have met and my friends who helped and supported me with producing this.

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Finally, I hope this helped you to gain a better understanding of Physics. Feel free to email yicheng_shao@oxcoll.com to send me feedback.