



Physics Year 12: Formulae and Constants Sheet

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Area of Study:	Movement
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Average velocity	$v_{av} = \frac{s}{t} = \frac{v+u}{2}$
Acceleration	$a = \frac{v-u}{t}$
Momentum	$p = mv$
Force	$F = ma$
Weight	$\text{weight} = mg$
Work done	$W = Fs$
Kinetic energy	$E_k = \frac{1}{2}mv^2$
Gravitational potential energy	$E_p = mgh$
Equations of motion	$a = \frac{v-u}{t}; \quad s = ut + \frac{1}{2}at^2; \quad v^2 = u^2 + 2as$
Centripetal acceleration	$a = \frac{v^2}{r}$
Centripetal force	$F = ma = \frac{mv^2}{r}$
Newton's Law of Universal Gravitation	$F = G \frac{m_1 m_2}{r^2}$
Gravitational field strength	$g = G \frac{M}{r^2}$

Area of Study:	Structure and Materials
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Moment of a force	$M = rF$
Principle of moments	$\Sigma M = 0$
Stress	$\text{Stress} = \frac{F}{A}$
Strain	$\text{Strain} = \frac{\Delta \ell}{\ell}$
Young's Modulus	$Y = \frac{F/A}{\Delta \ell / \ell}$

Area of Study:	Electric Power
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Power	$P = \frac{W}{t} = VI$
Electric current	$I = \frac{q}{t}$
Work	$W = qV$
Ohm's Law	$V = IR$
Resistances in Series	$R_T = R_1 + R_2 \dots$
Resistances in Parallel	$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} \dots$
Magnetic flux	$\Phi = BA$
Electromagnetic induction	$\text{emf} = -N \frac{(\Phi_2 - \Phi_1)}{t}$ $\text{emf} = \ell \mathbf{v} \times \mathbf{B}$
Magnetic force	$F = I \ell B$
Transformer turns ratio	$\frac{V_s}{V_p} = \frac{N_s}{N_p}$

Area of Study:	Sound Waves
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Period	$T = \frac{1}{f}$
Speed, frequency, wavelength	$v = f\lambda$
Beats	$f_{\text{beat}} = f_2 - f_1 $
Intensity and levels	Decibel(dB) change = $10 \log_{10} \left(\frac{I}{I_0} \right)$ Where I_0 is taken as the hearing threshold = $10^{-12} \text{ W m}^{-2}$
Standing waves	nodal separation = $\frac{\lambda}{2}$

Area of Study:	Atomic Physics
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Energy of photons	$E = hf$
Magnetic force	$F = qvB$

Physical Constants

Speed of light in air	$c = 3.00 \times 10^8 \text{ m s}^{-1}$
Electron charge	$e = -1.60 \times 10^{-19} \text{ C}$
Mass of electron	$m_e = 9.11 \times 10^{-31} \text{ kg}$
Planck's constant	$h = 6.63 \times 10^{-34} \text{ J s}$
Universal gravitational constant	$G = 6.67 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$
Electron volt	$1 \text{ eV} = 1.60 \times 10^{-19} \text{ J}$
Mass of proton	$m_p = 1.67 \times 10^{-27} \text{ kg}$

Physical Data

Acceleration due to gravity on Earth	$g = 9.80 \text{ m s}^{-2}$
Acceleration due to gravity on the Moon	$g_M = 1.62 \text{ m s}^{-2}$
Radius of the Earth	$R_E = 6.37 \times 10^6 \text{ m}$
Mass of the Earth	$M_E = 5.98 \times 10^{24} \text{ kg}$
Radius of the Sun	$R_S = 6.96 \times 10^8 \text{ m}$
Mass of the Sun	$M_S = 1.99 \times 10^{30} \text{ kg}$
Radius of the Moon	$R_M = 1.74 \times 10^6 \text{ m}$
Mass of the Moon	$M_M = 7.35 \times 10^{22} \text{ kg}$
Earth-Moon distance	$3.84 \times 10^8 \text{ m}$
Earth-Sun distance	$1.50 \times 10^{11} \text{ m}$
Tonne	$1 \text{ tonne} = 1.00 \times 10^3 \text{ kg}$

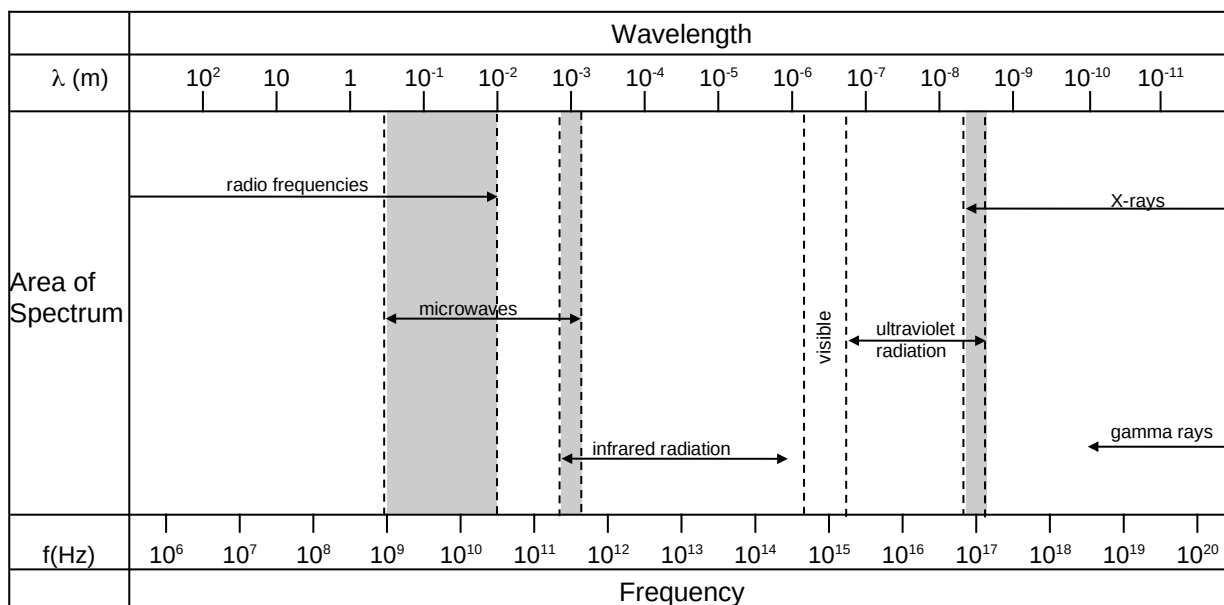
Speed of sound in selected substances

<i>Substance</i>	<i>Velocity m s^{-1}</i>	<i>Substance</i>	<i>Velocity m s^{-1}</i>	<i>Substance</i>	<i>Velocity m s^{-1}</i>
Gases (25°C, 101.3 kPa)		Liquids (25°C)		Solids (thin rods)	
air, dry	3.46×10^2	glycerol	1.90×10^3	aluminium	5.00×10^3
carbon dioxide	2.69×10^2	kerosene	1.32×10^3	brass	3.48×10^3
helium	9.85×10^2	water, distilled	1.50×10^3	brick	3.65×10^3
nitrogen	3.49×10^2	water, sea	1.53×10^3	copper	3.81×10^3
oxygen	3.30×10^2			iron	5.20×10^3

Young's modulus and the breaking stress for selected materials.

<i>Material</i>	<i>Young modulus $\times 10^{11} \text{ Pa}$</i>	<i>Breaking stress $\times 10^8 \text{ Pa}$</i>
aluminium	0.70	2.4
copper	1.16	4.9
brass	0.90	4.7
iron (wrought)	1.93	3.0
mild steel	2.10	11.0
glass	0.55	10
tungsten	4.10	20
bone	0.17	1.8

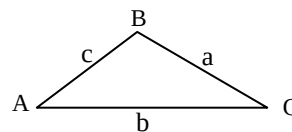
Electromagnetic spectrum



- Note:
1. Shaded areas represent regions of overlap.
 2. Gamma rays and X-rays occupy a common region.

Mathematical expressions

Given $ax^2 + bx + c = 0$, $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$



$$b = \sqrt{a^2 + c^2 - 2ac \cos B}$$

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Prefixes of the Metric System

Factor	Prefix	Symbol	Factor	Prefix	Symbol
10^{12}	tera	T	10^{-3}	milli	m
10^9	giga	G	10^{-6}	micro	μ
10^6	mega	M	10^{-9}	nano	n
10^3	kilo	k	10^{-12}	pico	p