Physics Year 12: Formulae and Constants Sheet

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Area of Study:	***Movement***
Average velocity	$v_{av} = \frac{s}{t} = \frac{v+u}{2}$
Acceleration	$a = \frac{v-u}{t}$
Momentum	$p = mv$
Force	$F = ma$
Weight	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***
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

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

Area of Study: Sound Waves

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

Area of Study: Atomic Physics

Energy of photons	$E = hf$
Magnetic force	$F = qvB$

Physical Constants

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

Physical Data

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

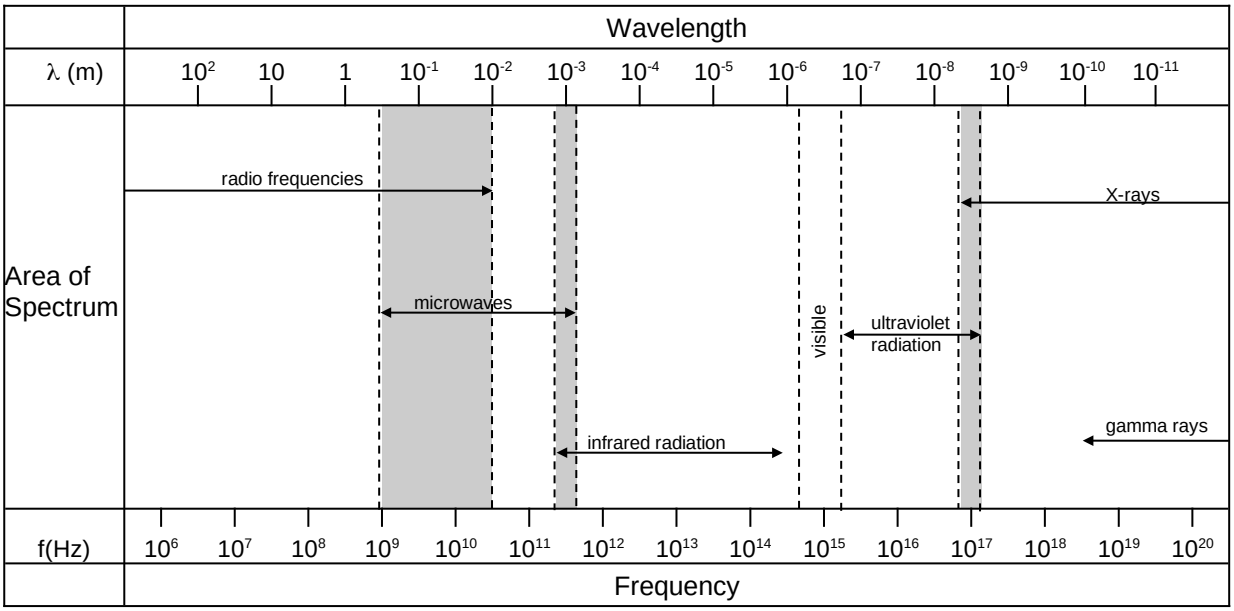
Speed of sound in selected substances

Substance	***Velocity m s^{-1}***	***Substance***	***Velocity m s^{-1}***	***Substance***	***Velocity m s^{-1}***
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.

Material	***Young modulus x 10^{11} Pa***	***Breaking stress x 10^{8} Pa***
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

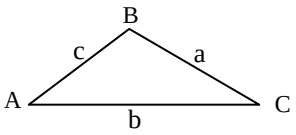


Note: 1. Shaded areas represent regions of overlap.

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