Government of **Western Australia**
Curriculum Council

WACE
Western Australian Certificate of Education

PHYSICS

STAGE 3

FORMULAE AND CONSTANTS SHEET

2010

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Motion and Forces in gravitational fields	
Mean velocity	$v_{av} = \frac{s}{t} = \frac{v+u}{2}$
Equations of motion	$a = \frac{v-u}{t}$; $s = ut + \frac{1}{2}at^2$; $v^2 = u^2 + 2as$; $v = u + at$
Force	$F = ma$
Weight force	$F = mg$
Momentum	$p = mv$
Change in momentum (impulse)	$Ft = mv - mu$
Kinetic energy	$E_k = \frac{1}{2}mv^2$
Gravitational potential energy	$E_p = mgh$

Motion and Forces in gravitational fields	
Work done	$W = Fs = \Delta E$
Power	$P = \frac{W}{t} = \frac{\Delta E}{t} = Fv_{av}$
Centripetal acceleration	$a_c = \frac{v^2}{r}$
Centripetal force	$F_c = ma_c = \frac{mv^2}{r}$
Newton's Law of Universal Gravitation	$F = G\frac{m_1 m_2}{r^2}$
Gravitational field strength	$g = G\frac{M}{r^2}$
Moment of a force	$\tau = rF$

Note: the variable "t" refers to the "time taken" sometimes referred to as the "change in time" or Δt

Electricity and Magnetism	
Electric current	$I = \frac{q}{t}$
Electric field	$E = \frac{F}{q}$ $= \frac{V}{d}$
Work and energy	$W = Vq$ $= VIt$
Ohm's Law	$V = IR$
Resistances in series	$R_T = R_1 + R_2 + ...$
Resistances in parallel	$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + ...$
Power	$P = VI$ $= I^2R$ $= \frac{V^2}{R}$
Magnetic flux	$\Phi = BA$
Electromagnetic induction	$emf = -N\frac{\Phi_2 - \Phi_1}{t}$, $emf = \ell v B$

Electricity and Magnetism	
Magnetic force	$F = I\ell B$ $F = qvB$
Ideal transformer turns ratio	$\frac{V_s}{V_p} = \frac{N_s}{N_p}$

Particles and waves	
Energy of photon	$E = hf$
Energy transitions	$E_2 - E_1 = hf$
Wave period	$T = \frac{1}{f}$
Wave equation	$v_{wave} = f\lambda$
Internodal distance	$d = \frac{1}{2}\lambda$

Motion and Forces in electric and magnetic fields	
Electric field	$E = \frac{F}{q}$ $= \frac{V}{d}$
Magnetic force	$F = qvB$

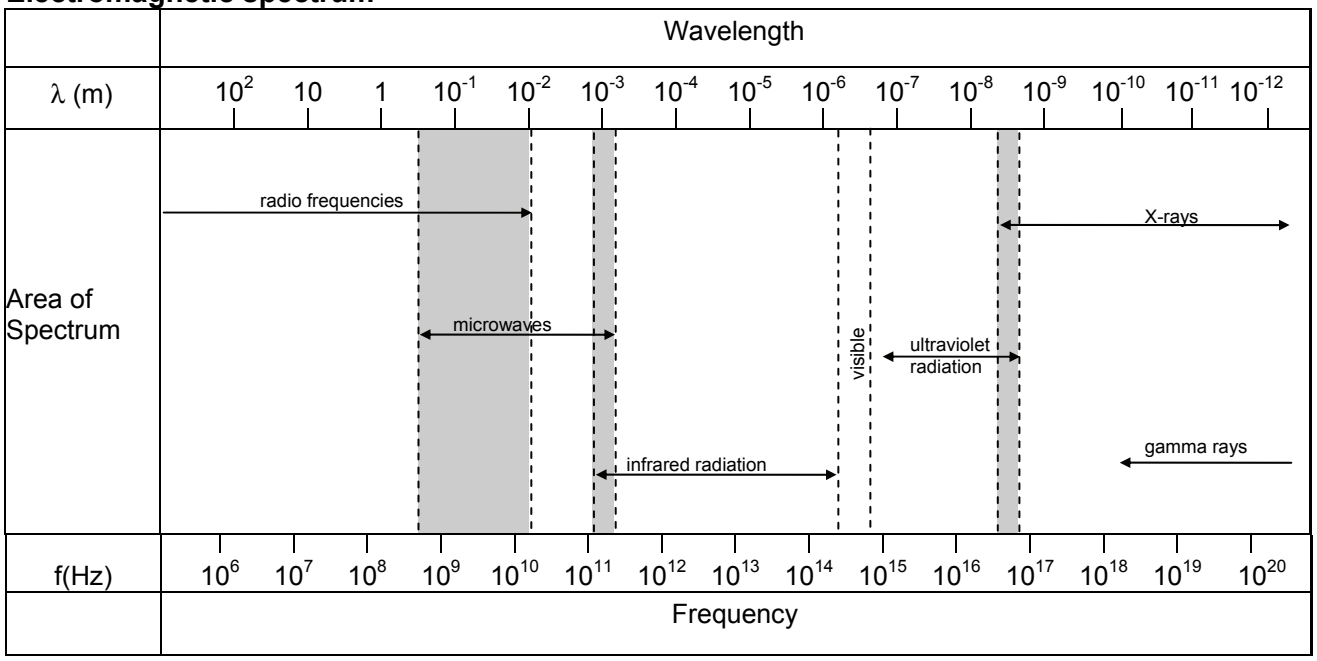
Physical Constants

Speed of light in vacuum or air ..... c = 3.00×10^8 m s^{-1}
Speed of sound in air at 25 °C ..... v = 346 m s^{-1}
Electron charge ..... e = -1.60×10^{-19} C
Mass of electron ..... m_e = 9.11×10^{-31} kg
Mass of proton ..... m_p = 1.67×10^{-27} kg
Mass of alpha ..... m_α = 6.65×10^{-27} 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

Physical Data

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

Electromagnetic spectrum



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

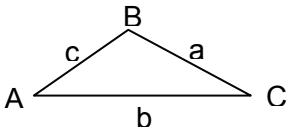
Prefixes of the Metric System

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

Mathematical expressions

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

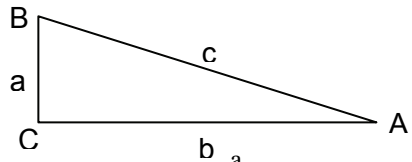
The following expressions apply to the triangle ABC as shown:



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

$$a = \sqrt{b^2 + c^2 - 2bc\cos A}$$

The following expressions apply to the right-angled triangle ABC as shown:



$$\sin A = \frac{a}{c}$$

$$\cos A = \frac{b}{c}$$

$$\tan A = \frac{a}{b}$$