Government of **Western Australia**
School Curriculum and Standards Authority

WACE
Western Australian Certificate of Education

PHYSICS

STAGE 2

FORMULAE AND DATA

2013

This document is valid for teaching and examining until 31 December 2013.

Forces and motion

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	$p = mv$; $\Sigma p_{before} = \Sigma p_{after}$
Change in momentum (impulse)	$Ft = mv - mu$
Kinetic energy	$E_k = \frac{1}{2} mv^2$
Gravitational potential energy	$E_p = mgh$
Work done	$W = Fs = \Delta E$
Power	$P = \frac{W}{t} = \frac{\Delta E}{t} = Fv_{av}$

Note: the variable t refers to the 'time taken' sometimes referred to as the 'change in time' or Δt.

Nuclear physics

Activity	$A = \frac{\Delta N}{t}$
Half-life	$A = A_0 \left(\frac{1}{2} \right)^n$
Absorbed radiation dose	absorbed dose = $\frac{E}{m}$
Dose equivalent	dose equivalent = absorbed dose × quality factor
Mass-energy relationship	$E = mc^2$

Heating and cooling

Change of temperature	$Q = mc\Delta T$
Change of state	$Q = mL$
Absolute zero	$0\ \text{K} = -273°\text{C}$

Electricity and magnetism

Electric current	$I = \frac{q}{t}$
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	$P = VI = I^2R = \frac{V^2}{R}$

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Physical constants

Speed of light in vacuum or air ..... c = 3.00×10^{8} m s^{-1}

Electron charge ..... e = -1.60×10^{-19} C

Electron volt ..... 1 eV = 1.60×10^{-19} J

Unified atomic mass unit ..... 1 u = 1.66×10^{-27} kg

Rest mass of electron ..... m_e = 9.11×10^{-31} kg

Rest mass of proton ..... m_p = 1.67×10^{-27} kg

Rest mass of neutron ..... m_n = 1.67×10^{-27} kg

Rest mass of alpha ..... m_α = 6.64×10^{-27} kg

Mass–energy equivalent ..... 1 u = 931 MeV

Tonne ..... 1 t = 10^{3} kg = 10^{6} g

Physical data

Mean acceleration due to gravity on Earth ..... g = 9.80 m s^{-2}

Specific heat capacity of water ..... c_w = 4.18×10^{3} J K^{-1} kg^{-1}

Specific heat capacity of ice ..... c_i = 2.10×10^{3} J K^{-1} kg^{-1}

Specific heat capacity of steam ..... c_s = 2.00×10^{3} J K^{-1} kg^{-1}

Latent heat of fusion for H_2O ..... L_f = 3.34×10^{5} J kg^{-1}

Latent heat of vaporisation for H_2O ..... L_v = 2.26×10^{6} J kg^{-1}

Quality factors

Approximate quality factor for alpha radiation ..... QF_α = 20

Approximate quality factor for beta radiation ..... QF_β = 1

Approximate quality factor for gamma radiation ... QF_γ = 1

Approximate quality factor for slow neutrons ..... QF_{sn} = 3

Approximate quality factor for fast neutrons ..... QF_{fn} = 10

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

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Periodic table

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 **H** hydrogen 1.008																	2 **He** helium 4.003
3 **Li** lithium 6.941	4 **Be** beryllium 9.012											5 **B** boron 10.81	6 **C** carbon 12.01	7 **N** nitrogen 14.01	8 **O** oxygen 16.00	9 **F** fluorine 19.00	10 **Ne** neon 20.18
11 **Na** sodium 22.99	12 **Mg** magnesium 24.31											13 **Aℓ** aluminium 26.98	14 **Si** silicon 28.09	15 **P** phosphorus 30.97	16 **S** sulfur 32.06	17 **Cℓ** chlorine 35.45	18 **Ar** argon 39.95
19 **K** potassium 39.10	20 **Ca** calcium 40.08	21 **Sc** scandium 44.96	22 **Ti** titanium 47.88	23 **V** vanadium 50.94	24 **Cr** chromium 52.00	25 **Mn** manganese 54.94	26 **Fe** iron 55.85	27 **Co** cobalt 58.93	28 **Ni** nickel 58.69	29 **Cu** copper 63.55	30 **Zn** zinc 65.38	31 **Ga** gallium 69.72	32 **Ge** germanium 72.59	33 **As** arsenic 74.92	34 **Se** selenium 78.96	35 **Br** bromine 79.90	36 **Kr** krypton 83.80
37 **Rb** rubidium 85.47	38 **Sr** strontium 87.62	39 **Y** yttrium 88.91	40 **Zr** zirconium 91.22	41 **Nb** niobium 92.91	42 **Mo** molybdenum 95.94	43 **Tc** technetium	44 **Ru** ruthenium 101.1	45 **Rh** rhodium 102.9	46 **Pd** palladium 106.4	47 **Ag** silver 107.9	48 **Cd** cadmium 112.4	49 **In** indium 114.8	50 **Sn** tin 118.7	51 **Sb** antimony 121.8	52 **Te** tellurium 127.6	53 **I** iodine 126.9	54 **Xe** xenon 131.3
55 **Cs** caesium 132.9	56 **Ba** barium 137.3	57–71 ***La** lanthanum 138.9	72 **Hf** hafnium 178.5	73 **Ta** tantalum 180.9	74 **W** tungsten 183.9	75 **Re** rhenium 186.2	76 **Os** osmium 190.2	77 **Ir** iridium 192.2	78 **Pt** platinum 195.1	79 **Au** gold 197.0	80 **Hg** mercury 200.6	81 **Tℓ** thallium 204.4	82 **Pb** lead 207.2	83 **Bi** bismuth 209.0	84 **Po** polonium	85 **At** astatine	86 **Rn** radon
87 **Fr** francium	88 **Ra** radium 226.0	89–103 ****Ac** actinium	104 **Rf** rutherfordium	105 **Db** dubnium	106 **Sg** seaborgium	107 **Bh** bohrium	108 **Hs** hassium	109 **Mt** meitnerium	110 **Ds** darmstadtium	111 **Rg** roentgenium	112 **Cn** copernicium						

Key:

Atomic number
Symbol
Name
Standard atomic weight

* Lanthanide series	58 **Ce** cerium 140.1	59 **Pr** praseodymium 140.9	60 **Nd** neodymium 144.2	61 **Pm** promethium	62 **Sm** samarium 150.4	63 **Eu** europium 152.0	64 **Gd** gadolinium 157.3	65 **Tb** terbium 158.9	66 **Dy** dysprosium 162.5	67 **Ho** holmium 164.9	68 **Er** erbium 167.3	69 **Tm** thulium 168.9	70 **Yb** ytterbium 173.0	71 **Lu** lutetium 175.0
** Actinide series	90 **Th** thorium 232.0	91 **Pa** protactinium	92 **U** uranium 238.0	93 **Np** neptunium	94 **Pu** plutonium	95 **Am** americium	96 **Cm** curium	97 **Bk** berkelium	98 **Cf** californium	99 **Es** einsteinium	100 **Fm** fermium	101 **Md** mendelevium	102 **No** nobelium	103 **Lr** lawrencium