



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

PHYSICS

YEAR 11

FORMULAE AND DATA

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Linear motion and force

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	$p = mv$; $\Sigma p_{\text{before}} = \Sigma p_{\text{after}}$
Change in momentum (impulse)	$\Delta p = F\Delta t = mv - mu$
Kinetic energy	$E_k = \frac{1}{2}mv^2$
Gravitational potential energy	$E_p = mg\Delta h$
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 .

Ionising radiation and nuclear reactions

Activity	$A = \frac{\Delta N}{t}$
Half-life	$N = N_0 \left(\frac{1}{2}\right)^n$
Absorbed radiation dose	absorbed dose = $\frac{E}{m}$
Dose equivalent	dose equivalent = absorbed dose \times quality factor
Mass-energy relationship	$\Delta E = \Delta mc^2$

Heating processes

Change of temperature	$Q = mc\Delta T$
Change of state	$Q = mL$
Efficiency	$\eta = \frac{\text{energy output}}{\text{energy input}} \times \frac{100}{1} \%$

Electrical circuits

Electric current	$I = \frac{q}{t}$
Work and energy	$V = \frac{W}{q}$
Ohm's law	$R = \frac{V}{I}$
Resistances in series	$R_T = R_1 + R_2 + \dots$
Resistances in parallel	$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$
Power	$P = \frac{W}{t} = VI$

See next page

Waves

Wave velocity $v = f\lambda$

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

Strings and open pipes $\lambda = \frac{2\ell}{n}$

Closed pipes $\lambda = \frac{4\ell}{(2n - 1)}$

Intensity $I \propto \frac{1}{r^2}$

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

Physical constants

Speed of light in vacuum or air	c	=	$3.00 \times 10^8 \text{ m s}^{-1}$
Electron charge	e	=	$-1.60 \times 10^{-19} \text{ C}$
Electron volt.....	1 eV	=	$1.60 \times 10^{-19} \text{ J}$
Unified atomic mass unit	1 u	=	$1.66 \times 10^{-27} \text{ kg}$
Rest mass of electron.....	m_e	=	$9.11 \times 10^{-31} \text{ kg}$
Rest mass of proton	m_p	=	$1.67 \times 10^{-27} \text{ kg}$
Rest mass of neutron	m_n	=	$1.67 \times 10^{-27} \text{ kg}$
Rest mass of alpha particle	m_α	=	$6.64 \times 10^{-27} \text{ kg}$
Mass–energy equivalent.....	1 u	=	931 MeV
Tonne.....	1 t	=	$10^3 \text{ kg} = 10^6 \text{ g}$
Absolute zero.....	0 K	=	$-273 \text{ }^\circ\text{C}$

Physical data

Mean acceleration due to gravity on Earth.....	g	=	9.80 m s^{-2}
Specific heat capacity of water.....	c_w	=	$4.18 \times 10^3 \text{ J K}^{-1} \text{ kg}^{-1}$
Specific heat capacity of ice	c_i	=	$2.10 \times 10^3 \text{ J K}^{-1} \text{ kg}^{-1}$
Specific heat capacity of steam.....	c_s	=	$2.00 \times 10^3 \text{ J K}^{-1} \text{ kg}^{-1}$
Latent heat of fusion for H_2O	L_f	=	$3.34 \times 10^5 \text{ J kg}^{-1}$
Latent heat of vaporisation for H_2O	L_v	=	$2.26 \times 10^6 \text{ J kg}^{-1}$
Speed of sound in air at $25 \text{ }^\circ\text{C}$	v_s	=	346 m s^{-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

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 6.968	4 Be beryllium 9.012															9 F fluorine 19.00	10 Ne neon 20.18	
11 Na sodium 22.99	12 Mg magnesium 24.31															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		114 Fl flerovium		116 Lv livermorium			

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

[Data source: The International Union of Pure and Applied Chemistry Periodic Table of the Elements (May 2013)]