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

PHYSICS

YEAR 11

FORMULAE AND DATA

2020/26485

Linear motion and force

Mean velocity	$v_{av} = \frac{s}{t} = \frac{v+u}{2}$
Equations of motion	$a = \frac{v-u}{t}$; $s = ut + ½\,at^2$; $v^2 = u^2 + 2as$; $v = u + at$
Force	$F = ma$
Weight force	$F = mg$
Momentum	$p = mv$; $\Sigma p_{before} = \Sigma p_{after}$
Change in momentum (impulse)	$\Delta p = F\Delta t = mv - mu$
Kinetic energy	$E_k = ½\,mv^2$
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 × 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	$R_T = R_1 + R_2 + ...$
Resistances in parallel	$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + ...$
Power	$P = \frac{W}{t} = VI$

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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 $I \alpha \frac{1}{r^2}$

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

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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 particle	m_α	= 6.64 × 10^{-27} kg
Mass–energy equivalent	1 u	= 931 MeV
Tonne	1 t	= 10^{3} kg = 10^{6} g
Absolute zero	0 K	= -273 °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 × 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}
Speed of sound in air at 25 °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

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Periodic table of the elements

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 6.94	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 47.87	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 72.63	33 **As** arsenic 74.92	34 **Se** selenium 78.97	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 95.95	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 lathanoids	72 **Hf** hafnium 178.5	73 **Ta** tantalum 180.9	74 **W** tungsten 183.8	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	89–103 actinoids	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	113 **Nh** nihonium	114 **Fℓ** flerovium	115 **Mc** moscovium	116 **Lv** livermorium	117 **Ts** tennessine	118 **Og** oganesson

Key:

Atomic number
Symbol
Name
Standard atomic weight

57 **La** lanthanum 138.9	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
89 **Ac** actinium	90 **Th** thorium 232.0	91 **Pa** protactinium 231.0	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 (2018). IUPAC periodic table of the elements Retrieved from https://iupac.org/what-we-do/periodic-table-of-elements/]