PSC315118 - PHYSICAL SCIENCES
EXTERNAL EXAM INFORMATION SHEET

CONSTANTS

Acceleration due to gravity: $g = 9.81\ m\ s^{-2}$ down

Charge on an electron: $e = -1.60 \times 10^{-19}\ C$

EQUATIONS OF MOTION (for constant acceleration)

$$v_{av} = \frac{s}{t} \qquad v = u + at \qquad v^2 = u^2 + 2as \qquad s = ut + \frac{1}{2}at^2$$

MOMENTUM, ENERGY & POWER

$p = mv$

$F_{net} = \frac{\Delta p}{\Delta t} = \frac{m(v-u)}{\Delta t}$

$F_{net} = ma$

$F_g = mg$

$E_k = \frac{1}{2}mv^2$

$E_p = mgh$

$P_{av} = \frac{W}{t} = \frac{\Delta E}{t}$

$W = Fs$

$W = \Delta E$

ELECTRICITY

$I = \frac{q}{t}$

$V = \frac{W}{q} = \frac{\Delta E}{q}$

$V = IR$

$P = VI = I^2R = \frac{V^2}{R}$

$R_T = R_1 + R_2 + R_3$ resistors in series

$R_T = \frac{R_1 R_2}{R_1 + R_2}$ resistors in parallel

OR

$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$

PHYSICAL QUANTITY SYMBOLS (SI UNITS)

s	=	displacement	(m)
u	=	initial velocity	($m\ s^{-1}$)
v	=	final velocity	($m\ s^{-1}$)
a	=	acceleration	($m\ s^{-2}$)
t	=	time	(s)
p	=	momentum	($kg\ m\ s^{-1}$)
Δp	=	change in momentum	($kg\ m\ s^{-1}$)
m	=	mass	(kg)
F	=	force	(N)
E_k	=	kinetic energy	(J)
E_p	=	potential energy	(J)
ΔE	=	change in energy	(J)
g	=	acceleration due to gravity	($m\ s^{-2}$)
h	=	vertical height	(m)
P_{av}	=	average power	(W)
W	=	work done	(J)
q	=	charge	(C)
I	=	current	(A)
V	=	potential difference	(V)
R	=	resistance	(Ω)

OFFICE OF TASMANIAN ASSESSMENT, STANDARDS & CERTIFICATION

PREFIXES

T	-	tera	10^{12}
G	-	giga	10^{9}
M	-	mega	10^{6}
k	-	kilo	10^{3}
c	-	centi	10^{-2}
m	-	milli	10^{-3}
μ	-	micro	10^{-6}
n	-	nano	10^{-9}

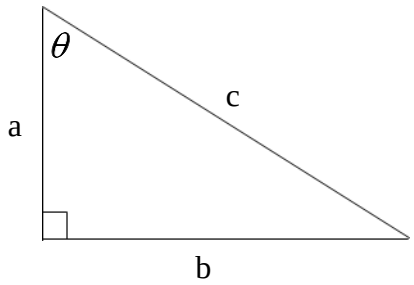
RIGHT ANGLE TRIANGLE EQUATIONS FOR USE WITH VECTORS

$$\tan\theta = \frac{\text{opposite}}{\text{adjacent}} = \frac{b}{a}$$

$$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}} = \frac{b}{c}$$

$$\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{a}{c}$$

$$c^2 = a^2 + b^2$$



IONISING RADIATION

PHYSICAL QUANTITY SYMBOL (SI unit)

A = Activity (Bq)

	α **(alpha)**	β **(beta negative)**	γ **(gamma)**	**Neutron**	**Proton**
Particle	helium nucleus	Electron	electromagnetic waves	neutron	proton
	$^{4}_{2}\text{He}$	$^{0}_{-1}\text{e}$	$^{0}_{0}\gamma$	$^{1}_{0}\text{n}$	$^{1}_{1}\text{H}$

ORGANIC CHEMISTRY

Alkanes: C_nH_{2n+2} Alkenes: C_nH_{2n} Alkynes: C_nH_{2n-2}

Cyclic Alkanes: C_nH_{2n} Cyclic Alkenes: C_nH_{2n-2}

ORGANIC STEM NAMES

Carbon Atoms in Chain	1	2	3	4	5	6	7	8	9	10
Stem Name	meth-	eth-	prop-	but-	pent-	hex-	hept-	oct-	non-	dec-

SIDE CHAINS AND FUNCTIONAL GROUPS

methyl	$-CH_3$	bromo	$-Br$
ethyl	$-C_2H_5$	chloro	$-Cl$
propyl	$-C_3H_7$	fluoro	$-F$
		iodo	$-I$

PREFIXES

Atoms in molecule	1	2	3	4	5	6	7	8	9	10
Prefix	mono-	di-	tri-	tetra-	penta-	hexa-	hepta-	octa-	nona-	deca-

GENERAL CHARACTERISTICS OF DIFFERENT STRUCTURES

Structure	**Melting /boiling point**	**Electrical conductivity**			**Further physical properties**	**Particles present**	**Charges carriers**
		Solid	**Molten**	**Aqueous**			
Metallic	high	conducts	conducts	not applicable	dense, malleable, ductile, lustrous	+ ions & electrons	electrons
Ionic	high	non-conducting	conducts	conducts if soluble	hard, brittle	+ & − ions	ions
Covalent molecular	low	non-conducting	non-conducting	non-conducting if soluble	soft solids, liquids or gases	molecules	none
Covalent network	very high	non-conducting	non-conducting	not applicable	hard, brittle	macro-molecule	none

COMMON POSITIVE IONS (CATIONS)

1+	2+	3+	4+
ammonium NH_4^+	barium Ba^{2+}	aluminium Al^{3+}	lead(IV) Pb^{4+}
hydrogen H^+	calcium Ca^{2+}	chromium(III) Cr^{3+}	tin(IV) Sn^{4+}
lithium Li^+	copper(II) Cu^{2+}	iron(III) Fe^{3+}	
potassium K^+	iron(II) Fe^{2+}		
silver Ag^+	lead(II) Pb^{2+}		
sodium Na^+	magnesium Mg^{2+}		
	mercury(II) Hg^{2+}		
	nickel(II) Ni^{2+}		
	strontium Sr^{2+}		
	tin(II) Sn^{2+}		
	zinc Zn^{2+}		

COMMON NEGATIVE IONS (ANIONS)

1–	2–	3–
bromide: Br^-	carbonate: CO_3^{2-}	nitride N^{3-}
chloride: Cl^-	chromate: CrO_4^{2-}	phosphate PO_4^{3-}
ethanoate (acetate): CH_3COO^-	dichromate: $Cr_2O_7^{2-}$	phosphide P^{3-}
fluoride: F^-	oxalate: $C_2O_4^{2-}$	
hydrogen carbonate: HCO_3^-	oxide: O^{2-}	
hydrogen sulfate: HSO_4^-	sulfate: SO_4^{2-}	
hydrogen sulfite: HSO_3^-	sulfide: S^{2-}	
hydroxide: OH^-	sulfite: SO_3^{2-}	
iodide: I^-	thiosulfate $S_2O_3^{2-}$	
nitrate: NO_3^-		
nitrite: NO_2^-		
permanganate MnO_4^-		

IMPORTANT REACTIONS OF ACIDS

acid + base [hydroxide/ metal oxide) → salt + water

acid + reactive metal → salt + hydrogen

acid + carbonate/ hydrogen carbonate → salt + water + carbon dioxide

SOLUBILITY TABLE FOR SOME IONIC COMPOUNDS

Negative ions (anions)	Solubility of compounds
ethanoates (acetates) (CH_3COO^-)	All soluble
nitrates (NO_3^-)	All soluble
chlorides (Cl^-)	All soluble except $AgCl$, $PbCl_2$
bromides (Br^-)	All soluble except $AgBr$, $PbBr_2$
iodides (I^-)	All soluble except AgI, PbI_2
sulfates (SO_4^{2-})	All soluble except $BaSO_4$, $CaSO_4$, $SrSO_4$, $PbSO_4$, Ag_2SO_4
hydroxides (OH^-)	Insoluble except $LiOH$, $NaOH$, KOH, $RbOH$, NH_4OH, $Sr(OH)_2$, $Ba(OH)_2$
sulfides (S^{2-})	Insoluble except Li_2S, Na_2S, K_2S, Rb_2S, $(NH_4)_2S$, MgS, CaS, SrS, BaS
carbonates (CO_3^{2-})	Insoluble except Li_2CO_3, Na_2CO_3, K_2CO_3, Rb_2CO_3, $(NH_4)_2CO_3$
phosphates (PO_4^{3-})	Insoluble except Li_3PO_4, Na_3PO_4, K_3PO_4, Rb_3PO_4, $(NH_4)_3PO_4$
sulfites (SO_3^{2-})	Insoluble except Li_2SO_3, Na_2SO_3, K_2SO_3, Rb_2SO_3, $(NH_4)_2SO_3$

QUANTITIVE CHEMISTRY

Avogadro's Number: $N_A = 6.02 \times 10^{23}\ mol^{-1}$

$N = n \times N_A$

$c = \frac{n}{V}$

$n = \frac{m}{M}$

N = number of particles, etc

n = amount of substance (mol)

m = mass (g)

M = molar mass (g mol^{-1})

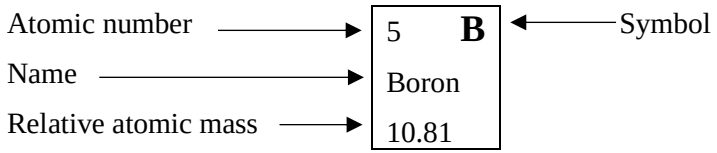
c = concentration (mol L^{-1})

V = volume (L)

TABLE OF RELATIVE ATOMIC MASSES (BASED ON $^{12}C = 12.00$)

Name	Symbol	Atomic Number	Relative Atomic Mass
actinium	Ac	89	-
aluminium	Al	13	26.98
americium	Am	95	-
antimony	Sb	51	121.8
argon	Ar	18	39.95
arsenic	As	33	74.92
astatine	At	85	-
barium	Ba	56	137.3
berkelium	Bk	97	-
beryllium	Be	4	9.012
bismuth	Bi	83	209.0
boron	B	5	10.81
bromine	Br	35	79.90
cadmium	Cd	48	112.4
caesium	Cs	55	132.9
calcium	Ca	20	40.08
californium	Cf	98	-
carbon	C	6	12.01
cerium	Ce	58	140.1
chlorine	Cl	17	35.45
chromium	Cr	24	52.00
cobalt	Co	27	58.93
copper	Cu	29	63.55
curium	Cm	96	-
dysprosium	Dy	66	162.5
einsteinium	Es	99	-
erbium	Er	68	167.3
europium	Eu	63	152.0
fermium	Fm	100	-
fluorine	F	9	19.00
francium	Fr	87	-
gadolinium	Gd	64	157.3
gallium	Ga	31	69.72
germanium	Ge	32	72.63
gold	Au	79	197.0
hafnium	Hf	72	178.5
helium	He	2	4.003
holmium	Ho	67	164.9
hydrogen	H	1	1.008
indium	In	49	114.8
iodine	I	53	126.9
iridium	Ir	77	192.2
iron	Fe	26	55.85
krypton	Kr	36	83.80
lanthanum	La	57	138.9
lawrencium	Lr	103	-
lead	Pb	82	207.2
lithium	Li	3	6.941
lutetium	Lu	71	175.0
magnesium	Mg	12	24.31
manganese	Mn	25	54.94
mendelevium	Md	101	-
mercury	Hg	80	200.6
molybdenum	Mo	42	95.94
neodymium	Nd	60	144.2
neon	Ne	10	20.18
neptunium	Np	93	-
nickel	Ni	28	58.69
niobium	Nb	41	92.91
nitrogen	N	7	14.01
nobelium	No	102	-
osmium	Os	76	190.2
oxygen	O	8	16.00
palladium	Pd	46	106.4
phosphorus	P	15	30.97
platinum	Pt	78	195.1
plutonium	Pu	94	-
polonium	Po	84	-
potassium	K	19	39.10
praseodymium	Pr	59	140.9
promethium	Pm	61	-
protactinium	Pa	91	-
radium	Ra	88	-
radon	Rn	86	-
rhenium	Re	75	186.2
rhodium	Rh	45	102.9
rubidium	Rb	37	85.47
ruthenium	Ru	44	101.1
samarium	Sm	62	150.4
scandium	Sc	21	44.96
selenium	Se	34	78.96
silicon	Si	14	28.09
silver	Ag	47	107.9
sodium	Na	11	22.99
strontium	Sr	38	87.62
sulfur	S	16	32.06
tantalum	Ta	73	180.9
technetium	Tc	43	-
tellurium	Te	52	127.6
terbium	Tb	65	158.9
thallium	Tl	81	204.4
thorium	Th	90	232.0
thulium	Tm	69	168.9
tin	Sn	50	118.7
titanium	Ti	22	47.87
tungsten	W	74	183.8
uranium	U	92	238.0
vanadium	V	23	50.94
xenon	Xe	54	131.3
ytterbium	Yb	70	173.0
yttrium	Y	39	88.91
zinc	Zn	30	65.38
zirconium	Zr	40	91.22

PERIODIC TABLE OF ELEMENTS



Atomic radii decreases →

Atomic radii increases ↓

I	II											III	IV	V	VI	VII	VIII
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 47.87	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 78.96	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 **La** Lanthanum 138.9	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 **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	113 **Nh** Nihonium	114 **Fl** Flerovium	115 **Mc** Moscovium	116 **Lv** Livermorium	117 **Ts** Tennessine	118 **Og** Oganesson

58–71 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
90–103 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