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AS Level

Data Booklet

**Cambridge International Advanced Subsidiary Level
in Physical Science (8780)**

**For use from 2016 in all papers for the above syllabus,
except practical examination.**

CSTxxx



Important values, constants and standards

molar gas constant	R	$= 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$
the Avogadro constant	N_A, L	$= 6.02 \times 10^{23} \text{ mol}^{-1}$
speed of light in a vacuum	c	$= 3.00 \times 10^8 \text{ m s}^{-1}$
rest mass of electron, ${}_{-1}^0\text{e}$	m_e	$= 9.11 \times 10^{-31} \text{ kg}$
electronic charge	e	$= -1.60 \times 10^{-19} \text{ C}$
specific heat capacity of water		$= 4.18 \text{ kJ kg}^{-1} \text{ K}^{-1}$ $= 4.18 \text{ J g}^{-1} \text{ K}^{-1}$
acceleration of free fall	g	$= 9.81 \text{ m s}^{-2}$

Formulae

uniformly accelerated motion	s	$= ut + \frac{1}{2}at^2$
	v^2	$= u^2 + 2as$
hydrostatic pressure	p	$= \rho gh$
resistors in series	R	$= R_1 + R_2 + \dots$
resistors in parallel	$1/R$	$= 1/R_1 + 1/R_2 + \dots$

Ionisation energies (1st, 2nd, 3rd and 4th) of selected elements, in kJ mol⁻¹

	Proton Number	First	Second	Third	Fourth
H	1	1310	–	–	–
He	2	2370	5250	–	–
Li	3	519	7300	11800	–
Be	4	900	1760	14800	21000
B	5	799	2420	3660	25000
C	6	1090	2350	4610	6220
N	7	1400	2860	4590	7480
O	8	1310	3390	5320	7450
F	9	1680	3370	6040	8410
Ne	10	2080	3950	6150	9290
Na	11	494	4560	6940	9540
Mg	12	736	1450	7740	10500
Al	13	577	1820	2740	11600
Si	14	786	1580	3230	4360
P	15	1060	1900	2920	4960
S	16	1000	2260	3390	4540
Cl	17	1260	2300	3850	5150
Ar	18	1520	2660	3950	5770
K	19	418	3070	4600	5860
Ca	20	590	1150	4940	6480
Sc	21	632	1240	2390	7110
Ti	22	661	1310	2720	4170
V	23	648	1370	2870	4600
Cr	24	653	1590	2990	4770
Mn	25	716	1510	3250	5190
Fe	26	762	1560	2960	5400
Co	27	757	1640	3230	5100
Ni	28	736	1750	3390	5400
Cu	29	745	1960	3350	5690
Zn	30	908	1730	3828	5980
Ga	31	577	1980	2960	6190
Ge	32	762	1540	3300	4390
Br	35	1140	2080	3460	4850
Sr	38	548	1060	4120	5440
Sn	50	707	1410	2940	3930
I	53	1010	1840	2040	4030
Ba	56	502	966	3390	–
Pb	82	716	1450	3080	4080

Bond energies

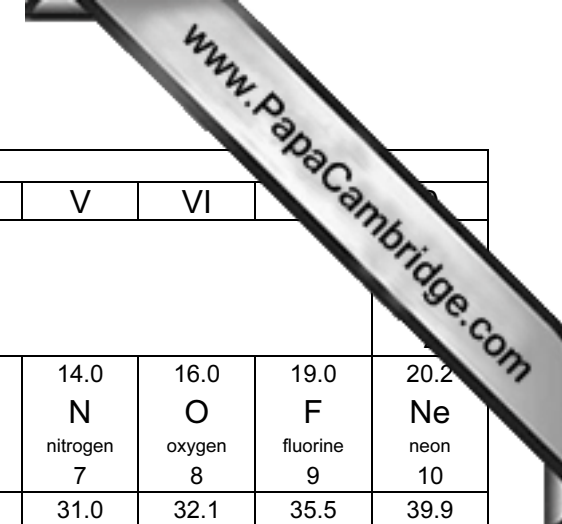
(a) Diatomic molecules

Bond	Energy / kJ mol ⁻¹
H—H	436
D—D	442
N≡N	944
O=O	496
F—F	158
Cl—Cl	242
Br—Br	193
I—I	151
H—F	562
H—Cl	431
H—Br	366
H—I	299

(b) Polyatomic molecules

Bond	Energy / kJ mol ⁻¹
C—C	350
C=C	610
C≡C	840
C—C (benzene)	520
C—H	410
C—Cl	340
C—Br	280
C—I	240
C—O	360
C=O	740
C—N	305
C=N	610
C≡N	890
N—H	390
N—N	160
N=N	410
O—H	460
O—O	150
Si—Cl	359
Si—H	320
Si—O	444
Si—Si	222
S—Cl	250
S—H	347
S—S	264

The Periodic Table of the Elements



Group																	
I	II											III	IV	V	VI	VII	VIII
												<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> Key relative atomic mass atomic symbol name atomic number </div>					
6.9 Li lithium 3	9.0 Be beryllium 4											10.8 B boron 5	12.0 C carbon 6	14.0 N nitrogen 7	16.0 O oxygen 8	19.0 F fluorine 9	20.2 Ne neon 10
23.0 Na sodium 11	24.3 Mg magnesium 12											27.0 Al aluminium 13	28.1 Si silicon 14	31.0 P phosphorus 15	32.1 S sulfur 16	35.5 Cl chlorine 17	39.9 Ar argon 18
39.1 K potassium 19	40.1 Ca calcium 20	45.0 Sc scandium 21	47.9 Ti titanium 22	50.9 V vanadium 23	52.0 Cr chromium 24	54.9 Mn manganese 25	55.8 Fe iron 26	58.9 Co cobalt 27	58.7 Ni nickel 28	63.5 Cu copper 29	65.4 Zn zinc 30	69.7 Ga gallium 31	72.6 Ge germanium 32	74.9 As arsenic 33	79.0 Se selenium 34	79.9 Br bromine 35	83.8 Kr krypton 36
85.5 Rb rubidium 37	87.6 Sr strontium 38	88.9 Y yttrium 39	91.2 Zr zirconium 40	92.9 Nb niobium 41	95.9 Mo molybdenum 42	– Tc technetium 43	101.1 Ru ruthenium 44	102.9 Rh rhodium 45	106.4 Pd palladium 46	107.9 Ag silver 47	112.4 Cd cadmium 48	114.8 In indium 49	118.7 Sn tin 50	121.8 Sb antimony 51	127.6 Te tellurium 52	126.9 I iodine 53	131.3 Xe xenon 54
132.9 Cs caesium 55	137.3 Ba barium 56	lanthanoids 57–71	178.5 Hf hafnium 72	180.9 Ta tantalum 73	183.8 W tungsten 74	186.2 Re rhenium 75	190.2 Os osmium 76	192.2 Ir iridium 77	195.1 Pt platinum 78	197.0 Au gold 79	200.6 Hg mercury 80	204.4 Tl thallium 81	207.2 Pb lead 82	209.0 Bi bismuth 83	– Po polonium 84	– At astatine 85	– Rn radon 86
– Fr francium 87	– Ra radium 88	actinoids 89–103	– Rf rutherfordium 104	– Db dubnium 105	– Sg seaborgium 106	– Bh bohrium 107	– Hs hassium 108	– Mt meitnerium 109	– Ds darmstadtium 110	– Rg roentgenium 111	– Cn copernicium 112		– Fl flerovium 114		– Lv livermorium 116		

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lanthanoids	138.9 La lanthanum 57	140.1 Ce cerium 58	140.9 Pr praseodymium 59	144.4 Nd neodymium 60	– Pm promethium 61	150.4 Sm samarium 62	152.0 Eu europium 63	157.3 Gd gadolinium 64	158.9 Tb terbium 65	162.5 Dy dysprosium 66	164.9 Ho holmium 67	167.3 Er erbium 68	168.9 Tm thulium 69	173.1 Yb ytterbium 70	175.0 Lu lutetium 71
actinoids	– Ac actinium 89	232.0 Th thorium 90	231.0 Pa protactinium 91	238.0 U uranium 92	– Np neptunium	– Pu plutonium	– Am americium	– Cm curium	– Bk berkelium	– Cf californium	– Es einsteinium 99	– Fm fermium 100	– Md mendelevium 101	– No nobelium 102	– Lr lawrencium 103

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