



## **Data Sheet for Chemistry**

GCE Advanced level and Advanced Subsidiary

**Chemistry 3882, 7882**

Chemistry units 2811 – 2816

These data are for the use of candidates following Chemistry 3882 or 7882.

Clean copies of this sheet must be issued to candidates in the examination room, and must be given up to the invigilator at the end of the examination.

Copies of this sheet may be used for teaching.

## Characteristic infra-red absorptions in organic molecules

bond	location	wavenumber
C–O	alcohols, esters	1000 – 1300 cm <sup>-1</sup>
C=O	aldehydes, ketones, carboxylic acids, esters	1680 – 1750 cm <sup>-1</sup>
O–H	hydrogen bonded in carboxylic acids	2500 – 3300 cm <sup>-1</sup> (broad)
N–H	primary amines	3100 – 3500 cm <sup>-1</sup>
O–H	hydrogen bonded in alcohols, phenols	3230 – 3550 cm <sup>-1</sup>
O–H	free	3580 – 3670 cm <sup>-1</sup>

## Chemical shifts for some types of protons in n.m.r. spectra

- Chemical shifts are for hydrogen relative to TMS (tetramethylsilane)
- Chemical shifts are typical values and can vary slightly depending on the solvent, concentration and substituents.

type of proton	chemical shift, $\delta$
$\text{R}-\text{CH}_3$	0.7 – 1.6
$\text{R}-\text{CH}_2-\text{R}$	1.2 – 1.4
$\text{R}_3\text{CH}$	1.6 – 2.0
$\begin{array}{c} \text{O} \\ \parallel \\ -\text{C}-\text{CH}_3 \end{array}$ $\begin{array}{c} \text{O} \\ \parallel \\ -\text{C}-\text{CH}_2-\text{R} \end{array}$	2.0 – 2.9
$\text{C}_6\text{H}_5-\text{CH}_3$ $\text{C}_6\text{H}_5-\text{CH}_2-\text{R}$	2.3 – 2.7
$-\text{O}-\text{CH}_3$ $-\text{O}-\text{CH}_2-\text{R}$	3.3 – 4.3
$\text{R}-\text{OH}$	3.5 – 5.5
$\text{C}_6\text{H}_5-\text{OH}$	6.5 – 7.0
$\text{C}_6\text{H}_5-\text{H}$	7.1 – 7.7
$\begin{array}{c} \text{O} \\ \parallel \\ \text{R}-\text{C}-\text{H} \end{array}$ $\begin{array}{c} \text{O} \\ \parallel \\ \text{C}_6\text{H}_5-\text{C}-\text{H} \end{array}$	9.5 – 10
$\begin{array}{c} \text{O} \\ \parallel \\ -\text{C}-\text{OH} \end{array}$	11.0 – 11.7

# The Periodic Table of the Elements

Group																	
1	2	3							4	5	6	7	0				
Key																	
		1.0 H hydrogen 1															
6.9 Li lithium 3	9.0 Be beryllium 4	relative atomic mass atomic symbol name atomic number															
	23.0 Na sodium 11	24.3 Mg magnesium 12	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
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	98.9 Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	210 Po polonium 84	210 At astatine 85	222 Rn radon 86
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 Unn ununilium	111 Uuu unununium	112 Uub ununbium		114 Uuq ununquadium		116 Uuh ununhexium		118 Uuo ununoctium

lanthanides \*

actinides \*

140 Ce cerium 58	141 Pr praseodymium 59	144 Nd neodymium 60	152 Eu europium 63	157 Gd gadolinium 64	159 Tb terbium 65	163 Dy dysprosium 66	165 Ho holmium 67	167 Er erbium 68	169 Tm thulium 69	173 Yb ytterbium 70	175 Lu lutetium 71
90 Th thorium	91 Pa protactinium	92 U uranium	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 Lw lawrencium

---

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (OCR) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

OCR is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.