



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 ⁻¹
C=O	aldehydes, ketones, carboxylic acids, esters	1680 – 1750 cm ⁻¹
O–H	hydrogen bonded in carboxylic acids	2500 – 3300 cm ⁻¹ (broad)
N–H	primary amines	3100 – 3500 cm ⁻¹
O–H	hydrogen bonded in alcohols, phenols	3230 – 3550 cm ⁻¹
O–H	free	3580 – 3670 cm ⁻¹

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, δ
$\text{R}-\text{CH}_3$	0.7 – 1.6
$\text{R}-\text{CH}_2-\text{R}$	1.2 – 1.4
R_3CH	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	Key															
		1.0 H hydrogen 1															
		relative atomic mass atomic symbol atomic number															
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 sulphur 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	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	209 Po polonium 84	209 At astatine 85	210 Rn radon 86
Fr francium 87	Ra radium 88	Ac actinium 89	Rf rutherfordium 104	Db dubnium 105	Sg seaborgium 106	Bh bohrium 107	Hs hassium 108	Mt meitnerium 109	Unn ununnilium 110	Uuu unununium 111	Uub ununbium 112	Uut ununtrium 113	Uuq ununquadium 114	Uuh ununhexium 116	Uuo ununoctium 118	Uus ununseptium 119	Uu119 unun119ium 119

lanthanides	140	Ce	cerium	58	141	Pr	praseodymium	59	144	Nd	neodymium	60	–	Pm	promethium	61	150	Sm	samarium	62	152	Eu	euporium	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	
	actinides	–	Th	thorium	90	–	Pa	protactinium	91	–	U	uranium	92	–	Np	neptunium	93	–	Pu	plutonium	94	–	Am	americium	95	–	Cm	curium	96	–	Bk	berkelium	97	–	Cf	californium	98	–	Es	einsteinium	99	–	Fm	fermium	100	–	Md	mendelevium	101	–	No	nobelium	102	–	Lw	lawrencium	103

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.