



RECOGNISING ACHIEVEMENT

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.

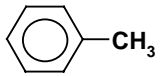
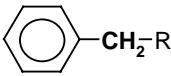
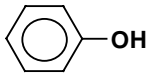
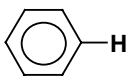
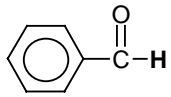
Copies of this sheet may be used for teaching.

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
R-CH ₃	0.7–1.6
R-CH ₂ -R	1.2–1.4
R ₃ CH	1.6–2.0
$\begin{array}{c} \text{O} \\ \parallel \\ \text{---C---CH}_3 \end{array}$ $\begin{array}{c} \text{O} \\ \parallel \\ \text{---C---CH}_2\text{---R} \end{array}$	2.0–2.9
 	2.3–2.7
---O---CH_3 $\text{---O---CH}_2\text{---R}$	3.3–4.3
R-OH	3.5–5.5
	6.5–7.0
	7.1–7.7
$\begin{array}{c} \text{O} \\ \parallel \\ \text{R---C---H} \end{array}$ 	9.5–10
$\begin{array}{c} \text{O} \\ \parallel \\ \text{---C---OH} \end{array}$	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						4.0 He helium 2																	
6.9 Li lithium 3		9.0 Be beryllium 4		relative atomic mass atomic symbol name atomic number								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		– 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		– Po polonium 84		– At astatine 85		– 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		– Uuq ununquadium 114		– Uuh ununhexium 116		– Uuo ununoctium 118							

lanthanides

	140 Ce cerium 58	141 Pr praseodymium 59	144 Nd neodymium 60	– Pm promethium 61	150 Sm samarium 62	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
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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
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