OCR
RECOGNISING ACHIEVEMENT

Data Sheet for Chemistry (Salters)

GCE Advanced level and Advanced Subsidiary

Chemistry (Salters) 3887, 7887

Chemistry units 2848–2855

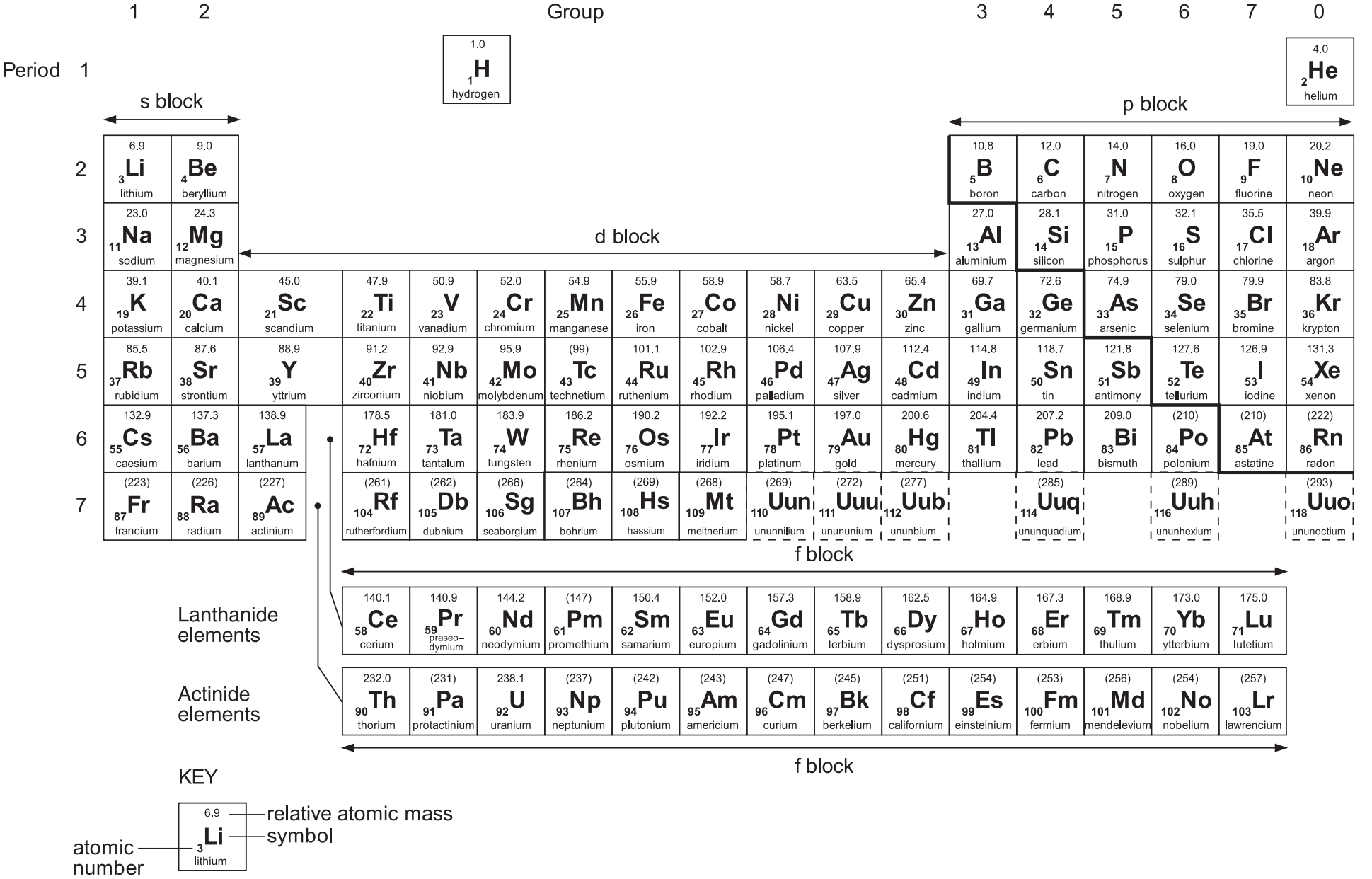
The information in this Sheet is for the use of candidates following Chemistry (Salters) 3887 or 7887.

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.

SP (SHW 00164 2/08) T73440/3
CST244 (Green) 2009

The Periodic Table



An entry in brackets indicates the mass number of the longest-lived isotope of an element with no stable isotopes.

Characteristic i.r. absorptions in organic molecules

Bond	Location	Wavenumber/cm^{-1}	Intensity
C — H	alkanes	2850–2950	M–S
	alkenes, arenes	3000–3100	M–S
	alkynes	*ca* 3300	S
C = C	alkenes	1620–1680	M
	arenes	several peaks in range 1450–1650	variable
C ≡ C	alkynes	2100–2260	M
C = O	aldehydes	1720–1740	S
	ketones	1705–1725	S
	carboxylic acids	1700–1725	S
	esters	1735–1750	S
	amides	1630–1700	M
C — O	alcohols, ethers, esters	1050–1300	S
C ≡ N	nitriles	2200–2260	M
C — F	fluoroalkanes	1000–1400	S
C — C*l*	chloroalkanes	600–800	S
C — Br	bromoalkanes	500–600	S
O — H	alcohols, phenols	3600–3640	S
	* alcohols, phenols	3200–3600	S (broad)
	* carboxylic acids	2500–3200	M (broad)
N — H	primary amines	3300–3500	M–S
	amides	*ca* 3500	M

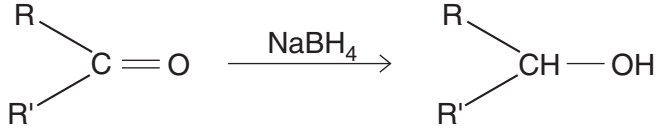
M Medium
S Strong
* hydrogen-bonded

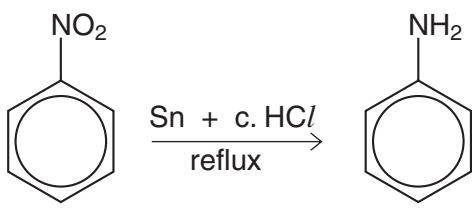
Some useful organic reactions

1. $R-Br + CN^- \longrightarrow R-CN + Br^-$

2. $R-CN \xrightarrow[\text{reflux}]{H^+(aq)/H_2O} R-COOH$

3. $R-CHO \xrightarrow{NaBH_4} R-CH_2OH$

4. 

5. 

6. $R-COOH + SCl_2O \longrightarrow R-COCl + SO_2 + HCl$

Chemical shifts for some type of protons (^1H) in n.m.r. spectra

Chemical shifts are for hydrogen (^1H) relative to TMS (tetramethylsilane).
R represents an alkyl group.

Type of proton	Chemical shift (δ) in approximate region of
R — C**H**$_3$	0.8–1.2
R — C**H**$_2$ — R	1.4
R — C**H**(R) — R	1.5
>C = C — C**H**$_3$	1.6
>C = C — C**H**$_2$ — R	2.3
C$_6$H$_5$ — C**H**$_3$	2.3
R — C(=O) — C**H**$_3$	2.2
R — C(=O) — C**H**$_2$ — R	2.4
C$_6$H$_5$ — C(=O) — C**H**$_3$	2.6
>N — C**H**$_3$ (amine)	2.3
>N — C**H**$_2$ — R (amine)	2.5
R — C(=O) — N(—C**H**$_3$) — R (amide)	2.9

Type of proton		Chemical shift (δ) in approximate region of
—O — C**H**$_3$	(alcohol)	3.3
—O — C**H**$_2$ — R	(alcohol)	3.6
R — C(=O) — O — C**H**$_3$	(ester)	3.7
R — C**H**$_2$ — C*l*		3.6
R — C**H**$_2$ — Br		3.5
R — C**H** = C**H** — R		4.5–6.0
R — C**H** = C**H** — C(=O) —		6.0–8.0
C$_6$H$_5$ — **H**		6.0–9.0
R — C(=O) — **H**	(aldehyde)	10.0
R — O**H**		0.5–4.5*
C$_6$H$_5$ — O**H**		4.5–10.0*
R — N**H**$_2$	(amine)	0.5–6.0*
R — C(=O) — N**H**$_2$	(amide)	5–12*
R — C(=O) — O**H**	(acid)	9–15*

* Signals from hydrogens in —— OH and —— NH—— groups in alcohols, phenols, carboxylic acids, amines and amides are very variable and often broad. The chemical shift is sensitive to temperature, nature of the solvent and the concentration. The stronger the hydrogen bonding the larger the chemical shift.