



NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

QUALIFY FOR THE FUTURE WORLD
KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

Scholarship 2020 Chemistry

9.30 a.m. Tuesday 17 November 2020

RESOURCE BOOKLET

Refer to this booklet to answer the questions for Scholarship Chemistry 93102.

Check that this booklet has pages 2–4 in the correct order, and that none of these pages is blank.

YOU MAY KEEP THIS BOOKLET AT THE END OF THE EXAMINATION.

STANDARD ELECTRODE POTENTIALS, E°

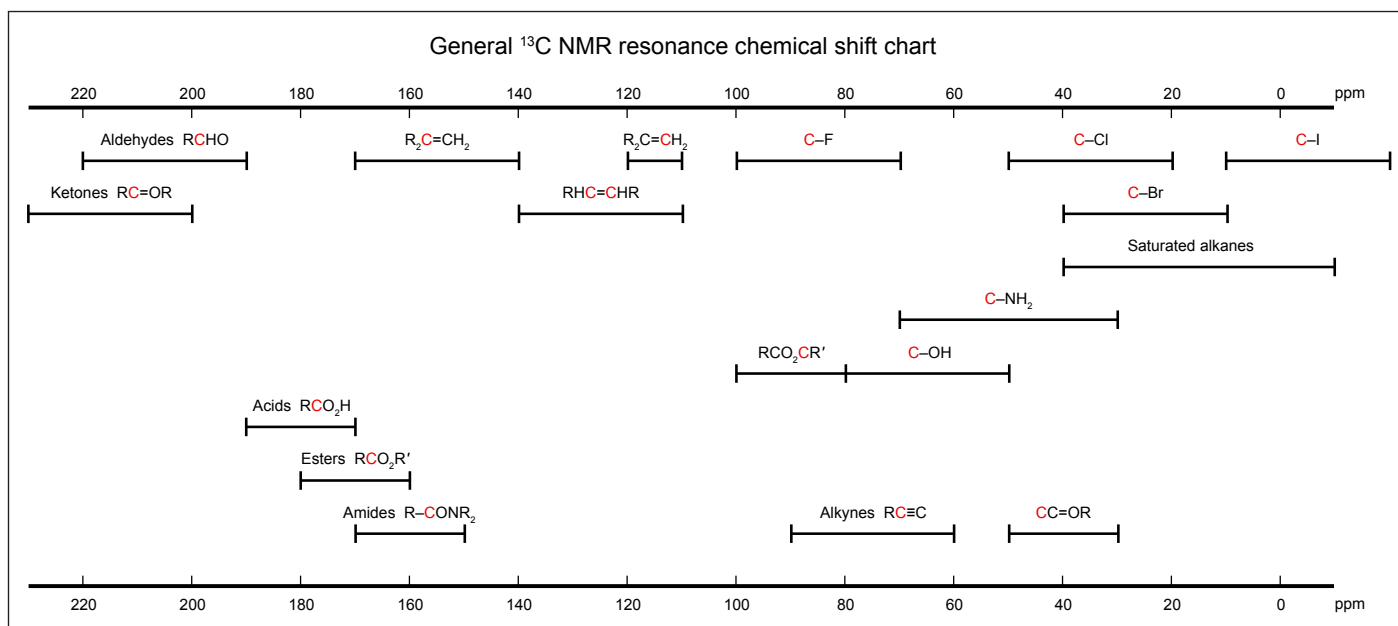
	E° / V
$2\text{H}_2\text{O}(\ell) + 2\text{e}^- \rightarrow \text{H}_2(\text{g}) + 2\text{OH}^-(\text{aq})$	−0.83
$\text{Zn}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Zn}(\text{s})$	−0.76
$\text{Fe}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Fe}(\text{s})$	−0.44
$\text{O}_2(\text{g}) + 4\text{H}^+(\text{aq}) + 4\text{e}^- \rightarrow 2\text{H}_2\text{O}(\ell)$	+1.23
$\text{Cl}_2(\text{g}) + 2\text{e}^- \rightarrow 2\text{Cl}^-(\text{aq})$	+1.36
$\text{Fe}^{3+}(\text{aq}) + \text{e}^- \rightarrow \text{Fe}^{2+}(\text{aq})$	+0.77
$\text{NO}_3^-(\text{aq}) + 4\text{H}^+(\text{aq}) + 3\text{e}^- \rightarrow \text{NO}(\text{g}) + 2\text{H}_2\text{O}(\ell)$	+1.23
$\text{I}_2(\text{s}) + 2\text{e}^- \rightarrow 2\text{I}^-(\text{aq})$	+0.62
$\text{Br}_2(\ell) + 2\text{e}^- \rightarrow 2\text{Br}^-(\text{aq})$	+1.08
$\text{Ag}^+(\text{aq}) + \text{e}^- \rightarrow \text{Ag}(\text{s})$	+0.80
$\text{S}_2\text{O}_8^{2-}(\text{aq}) + 2\text{e}^- \rightarrow 2\text{SO}_4^{2-}(\text{aq})$	+2.01
$\text{Sn}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Sn}(\text{s})$	−0.14

SPECTROSCOPY DATA SHEET

INFRARED SPECTROSCOPY

Functional group	Vibration	Wavenumber / cm^{-1}	Functional group	Vibration	Wavenumber / cm^{-1}
Alkane	C–H stretch	2950–2800 (s)	Aldehyde	C=O stretch	1725 (s)
Alkene	C=C–H stretch	3100–3010 (s)	Ketone	C=O stretch	1715 (s)
	C=C stretch	1690–1630 (m)	Carboxylic acid	O–H stretch	3400 (s)
Alkyl halide	C–F stretch	1400–1000 (s)		C=O stretch	1730–1700 (s)
	C–Cl stretch	785–540 (m-w)		C–O stretch	1320–1210 (s)
	C–Br stretch	650–510 (s-m)	Acid chloride	C=O stretch	1810–1775 (s)
	C–I stretch	600–485 (s-m)		C–Cl stretch	730–550 (s-m)
Alcohol	O–H stretch	3600–3300 (s)	Ester	C=O stretch	1750–1735 (s)
	C–O stretch	1260–1000 (s)		C–O stretch	1260–1160 (s)
Amine	N–H stretch (1 per bond)	3500–3300 (s-w)	Amide	N–H stretch	3500–3200 (s)
	N–H bend	1640–1500 (s)		C=O stretch	1680–1630 (s)
	C–N stretch	1200–1025 (s)			

^{13}C NMR RESONANCE SHIFTS



PERIODIC TABLE OF THE ELEMENTS

Atomic number																																			
1		2		1														2																	
3	Li 6.9	4	Be 9.0															He 4.0																	
11	Na 23.0	12	Mg 24.3																																
19	K 39.1	20	Ca 40.1	21	Sc 45.0	22	Ti 47.9	23	V 50.9	24	Cr 52.0	25	Mn 54.9	26	Fe 55.9	27	Co 58.9	28	Ni 58.7	29	Cu 63.6	30	Zn 65.4	31	Ga 69.7	32	Ge 72.6	33	As 74.9	34	Se 79.0	35	Br 79.9	36	Kr 83.8
37	Rb 85.5	38	Sr 87.6	39	Y 88.9	40	Zr 91.2	41	Nb 92.9	42	Mo 95.9	43	Tc 98.9	44	Ru 101	45	Rh 103	46	Pd 106	47	Ag 108	48	Cd 112	49	In 115	50	Sn 119	51	Sb 122	52	Te 128	53	I 127	54	Xe 131
55	Cs 133	56	Ba 137	71	Lu 175	72	Hf 179	73	Ta 181	74	W 184	75	Re 186	76	Os 190	77	Ir 192	78	Pt 195	79	Au 197	80	Hg 201	81	Tl 204	82	Pb 207	83	Bi 209	84	Po 210	85	At 210	86	Rn 222
87	Fr 223	88	Ra 226	103	Lr 262	104	Rf 261	105	Db 262	106	Sg 263	107	Bh 264	108	Hs 265	109	Mt 268	110	Ds 271	111	Rg 272	112	Cn 277	113	Nh 270	114	Fl 270	115	Mc 270	116	Lv 270	117	Ts 270	118	Og 270