

93102R



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New Zealand Qualifications Authority

Scholarship 2023 Chemistry

RESOURCE BOOKLET

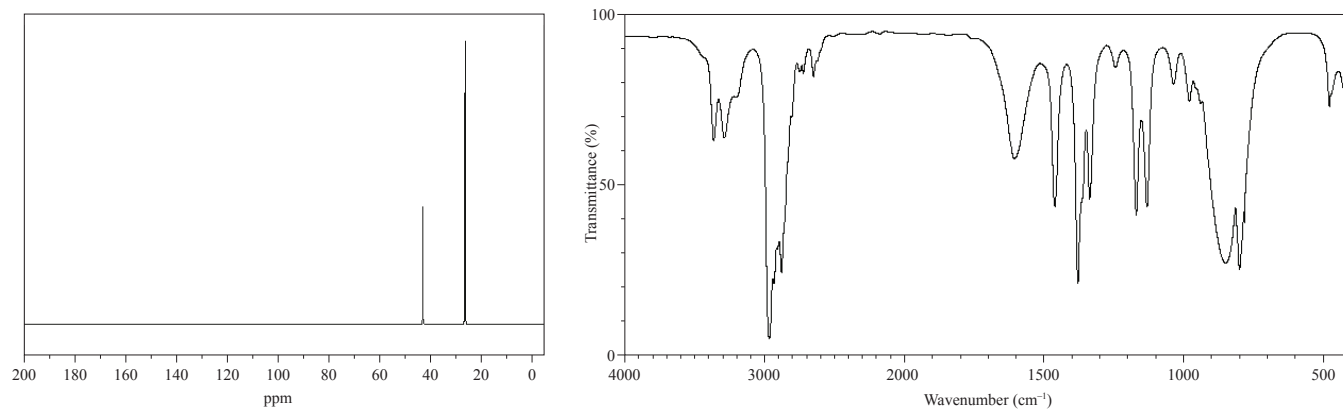
Refer to this booklet to answer the questions for Scholarship Chemistry.

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

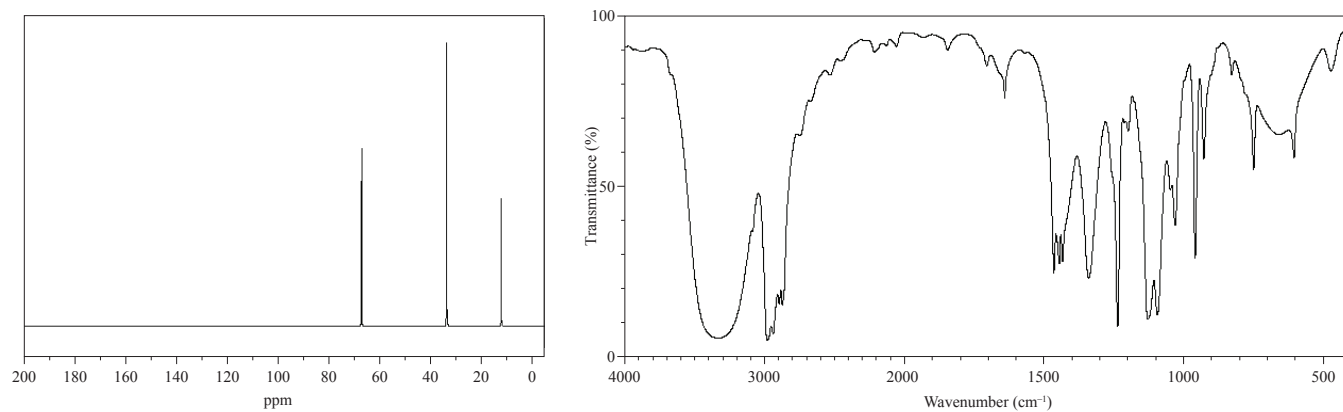
YOU MAY KEEP THIS BOOKLET AT THE END OF THE EXAMINATION.

IR AND ^{13}C NMR SPECTRA FOR QUESTION TWO (b)

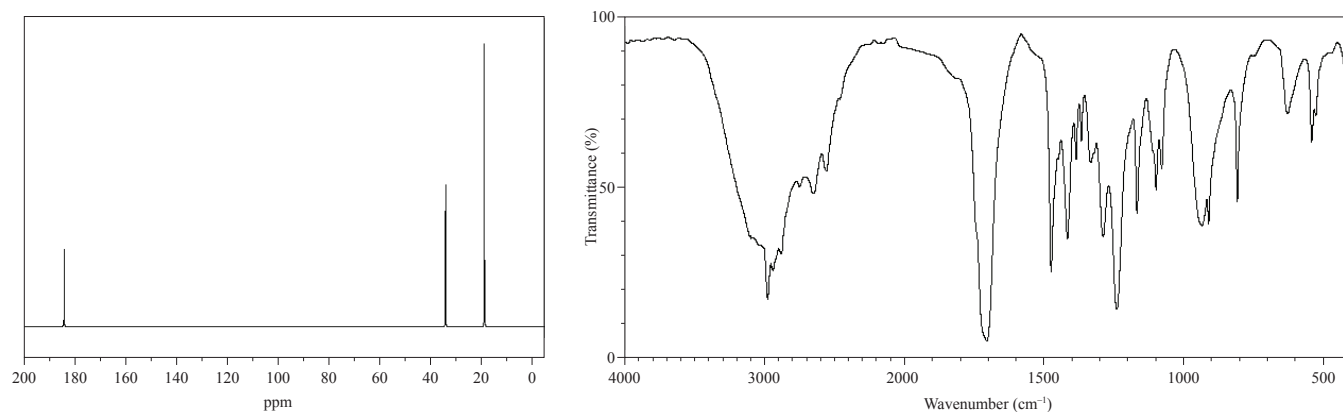
Compound A



Compound B



Compound C

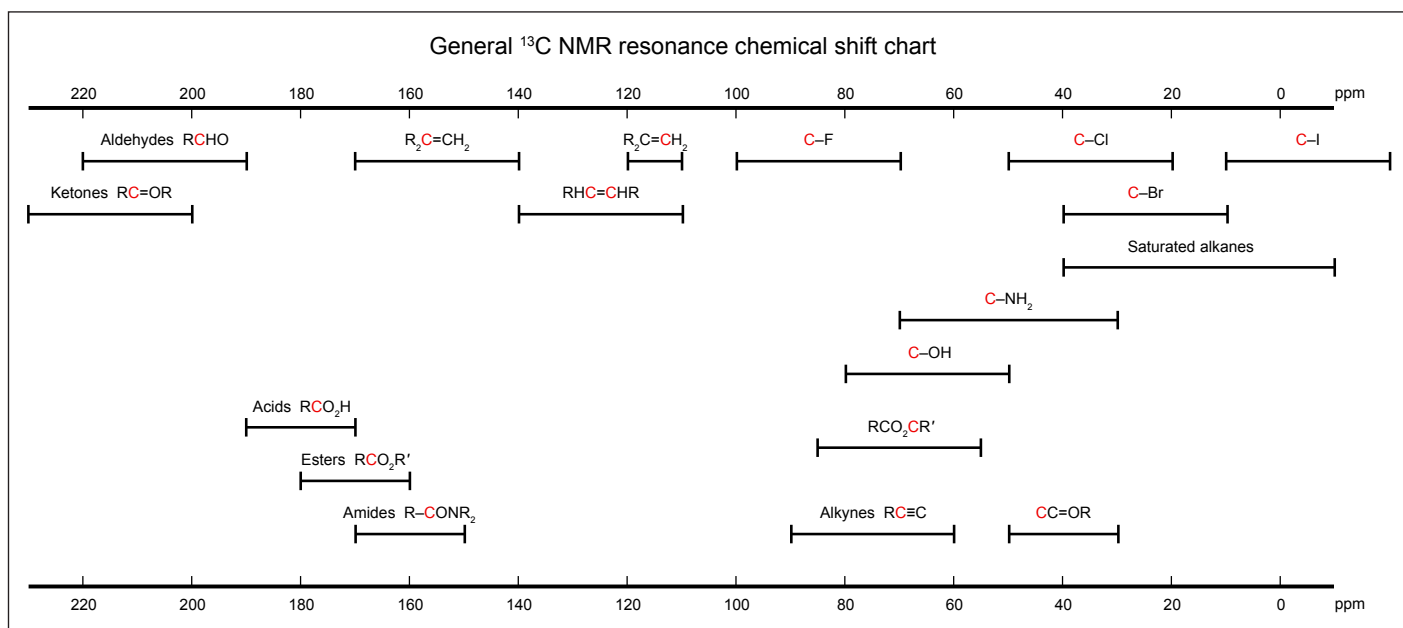


SPECTROSCOPY DATA SHEET

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																		18																				
1																		2																				
H 1.0																		He 4.0																				
Relative atomic mass																																						
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17						
3	Li 6.9	4	Be 9.0																					5	B 10.8	6	C 12.0	7	N 14.0	8	O 16.0	9	F 19.0		10	Ne 20.2		
11	Na 23.0	12	Mg 24.3																					13	Al 27.0	14	Si 28.1	15	P 31.0	16	S 32.1	17	Cl 35.5		18	Ar 40.0		
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 222	114	Fl 226	115	Mc 228	116	Lv 229		117	Ts 231		118	Og 244

Lanthanide Series	57	La	139	58	Ce	140	59	Pr	141	60	Nd	144	61	Pm	147	62	Sm	150	63	Eu	152	64	Gd	157	65	Tb	159	66	Dy	163	67	Ho	165	68	Er	167	69	Tm	169	70	Yb	173
	89	Ac	227	90	Th	232	91	Pa	231	92	U	238	93	Np	237	94	Pu	239	95	Am	241	96	Cm	244	97	Bk	249	98	Cf	251	99	Es	252	100	Fm	257	101	Md	258	102	No	259