



GCE A LEVEL

1410U50-1G



S25-1410U50-1G

FRIDAY, 9 MAY 2025 – MORNING

CHEMISTRY – A2 unit 5

Practical Methods and Analysis Task

Data Booklet

Avogadro constant
molar gas constant
molar gas volume at 273 K and 1 atm
molar gas volume at 298 K and 1 atm
Planck constant
speed of light
density of water
specific heat capacity of water
ionic product of water at 298 K
fundamental electronic charge

$N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$
 $R = 8.31 \text{ J mol}^{-1} \text{ K}^{-1}$
 $V_m = 22.4 \text{ dm}^3 \text{ mol}^{-1}$
 $V_m = 24.5 \text{ dm}^3 \text{ mol}^{-1}$
 $h = 6.63 \times 10^{-34} \text{ Js}$
 $c = 3.00 \times 10^8 \text{ ms}^{-1}$
 $d = 1.00 \text{ g cm}^{-3}$
 $c = 4.18 \text{ J g}^{-1} \text{ K}^{-1}$
 $K_w = 1.00 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6}$
 $e = 1.60 \times 10^{-19} \text{ C}$

temperature (K) = temperature (°C) + 273

$1 \text{ dm}^3 = 1000 \text{ cm}^3$
 $1 \text{ m}^3 = 1000 \text{ dm}^3$
 $1 \text{ tonne} = 1000 \text{ kg}$
 $1 \text{ atm} = 1.01 \times 10^5 \text{ Pa}$

Multiple	Prefix	Symbol
10^{-9}	nano	n
10^{-6}	micro	μ
10^{-3}	milli	m

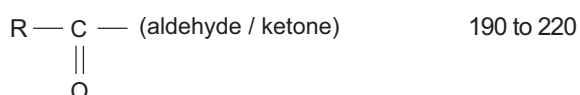
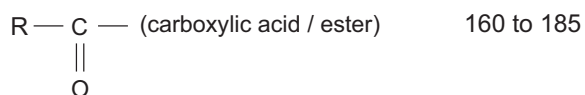
Multiple	Prefix	Symbol
10^3	kilo	k
10^6	mega	M
10^9	giga	G

Infrared absorption values

Bond	Wavenumber / cm^{-1}
C — Br	500 to 600
C — Cl	650 to 800
C — O	1000 to 1300
C = C	1620 to 1670
C = O	1650 to 1750
C $\equiv$ N	2100 to 2250
C — H	2800 to 3100
O — H (carboxylic acid)	2500 to 3200 (very broad)
O — H (alcohol / phenol)	3200 to 3550 (broad)
N — H	3300 to 3500

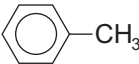
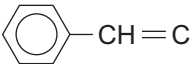
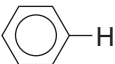
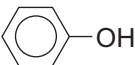
 ^{13}C NMR chemical shifts relative to TMS = 0

Type of carbon	Chemical shift, δ (ppm)
----------------	--------------------------------



^1H NMR chemical shifts relative to TMS = 0

Type of proton	Chemical shift, δ (ppm)
----------------	--------------------------------

$-\text{CH}_3$	0.1 to 2.0
$\text{R}-\text{CH}_3$	0.9
$\text{R}-\text{CH}_2-\text{R}$	1.3
$\text{CH}_3-\text{C}\equiv\text{N}$	2.0
$\text{CH}_3-\text{C}(=\text{O})$	2.0 to 2.5
$-\text{CH}_2-\text{C}(=\text{O})$	2.0 to 3.0
	2.2 to 2.3
$\text{HC}-\text{Cl}$ or $\text{HC}-\text{Br}$	3.1 to 4.3
$\text{HC}-\text{O}$	3.3 to 4.3
$\text{R}-\text{OH}$	4.5 *
$-\text{C}=\text{CH}$	4.5 to 6.3
$-\text{C}=\text{CH}-\text{CO}$	5.8 to 6.5
	6.5 to 7.5
	6.5 to 8.0
	7.0 *
$\text{R}-\text{C}(=\text{O})\text{H}$	9.8 *
$\text{R}-\text{C}(=\text{O})\text{OH}$	11.0 *

*variable figure dependent on concentration and solvent

THE PERIODIC TABLE

Period 1 2 1 2 3 4 5 6 7 0

Group

Period	← s block →		← p block →																																	
	1.01 H Hydrogen 1		4.00 He Helium 2																																	
	1																																			
	6.94 Li Lithium 3		9.01 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 Sulfur 16		35.5 Cl Chlorine 17		40.0 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		127 Te Tellurium 52		127 I Iodine 53		131 Xe Xenon 54	
133 Cs Caesium 55		137 Ba Barium 56		139 La Lanthanum 57		179 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		(210) Po Polonium 84		(210) At Astatine 85		(222) Rn Radon 86		
(223) Fr Francium 87		(226) Ra Radium 88		(227) Ac Actinium 89		f block																														
		▶ Lanthanoid elements		140 Ce Cerium 58		141 Pr Praseodymium 59		144 Nd Neodymium 60		(147) Pm Promethium 61		150 Sm Samarium 62		(153) 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						
		▶▶ Actinoid elements		232 Th Thorium 90		(231) Pa Protactinium 91		238 U Uranium 92		(237) Np Neptunium 93		(242) Pu Plutonium 94		(243) Am Americium 95		(247) Cm Curium 96		(245) Bk Berkelium 97		(251) Cf Californium 98		(254) Es Einsteinium 99		(253) Fm Fermium 100		(256) Md Mendelevium 101		(254) No Nobelium 102		(257) Lr Lawrencium 103						