

## GCE Chemistry Data Sheet


**Table 1**  
Infrared absorption data

Bond	Wavenumber /cm <sup>-1</sup>
N-H (amines)	3300 – 3500
O-H (alcohols)	3230 – 3550
C-H	2850 – 3300
O-H (acids)	2500 – 3000
C≡N	2220 – 2260
C=O	1680 – 1750
C=C	1620 – 1680
C-O	1000 – 1300
C-C	750 – 1100

**Table 2**  
<sup>1</sup>H n.m.r. chemical shift data

Type of proton	δ/ppm
ROH	0.5 – 5.0
RCH <sub>3</sub>	0.7 – 1.2
RNH <sub>2</sub>	1.0 – 4.5
R <sub>2</sub> CH <sub>2</sub>	1.2 – 1.4
R <sub>3</sub> CH	1.4 – 1.6
$\begin{array}{c}   \\ \text{R}-\text{C}-\text{C}- \\    \quad   \\ \text{O} \quad \text{H} \end{array}$	2.1 – 2.6
$\begin{array}{c}   \\ \text{R}-\text{O}-\text{C}- \\   \\ \text{H} \end{array}$	3.1 – 3.9
RCH <sub>2</sub> Cl or Br	3.1 – 4.2
$\begin{array}{c}   \\ \text{R}-\text{C}-\text{O}-\text{C}- \\    \quad   \\ \text{O} \quad \text{H} \end{array}$	3.7 – 4.1
$\begin{array}{c} \text{H} \\   \\ \text{R}-\text{C}=\text{C}- \\   \\ \text{H} \end{array}$	4.5 – 6.0
$\begin{array}{c} \text{O} \\    \\ \text{R}-\text{C}-\text{H} \end{array}$	9.0 – 10.0
$\begin{array}{c} \text{O} \\    \\ \text{R}-\text{C}-\text{O}-\text{H} \end{array}$	10.0 – 12.0

**Table 3**  
<sup>13</sup>C n.m.r. chemical shift data

Type of carbon	δ/ppm
$\begin{array}{c}   \\ -\text{C}-\text{C}- \\   \end{array}$	5 – 40
$\begin{array}{c}   \\ \text{R}-\text{C}-\text{Cl} \text{ or } \text{Br} \\   \end{array}$	10 – 70
$\begin{array}{c}   \\ \text{R}-\text{C}-\text{C}- \\    \quad   \\ \text{O} \end{array}$	20 – 50
$\begin{array}{c}   \\ \text{R}-\text{C}-\text{N}- \\   \end{array}$	25 – 60
$\begin{array}{c}   \\ -\text{C}-\text{O}- \\   \end{array}$ alcohols, ethers or esters	50 – 90
$\begin{array}{c} \diagup \\ \text{C}=\text{C} \\ \diagdown \end{array}$	90 – 150
R-C≡N	110 – 125
	110 – 160
$\begin{array}{c} \text{O} \\    \\ \text{R}-\text{C}- \end{array}$ esters or acids	160 – 185
$\begin{array}{c} \text{O} \\    \\ \text{R}-\text{C}- \end{array}$ aldehydes or ketones	190 – 220



# The Periodic Table of the Elements

1	2	3	4	5	6	7	0	
6.9 <b>Li</b> lithium 3	9.0 <b>Be</b> beryllium 4	10.8 <b>B</b> boron 5	12.0 <b>C</b> carbon 6	14.0 <b>N</b> nitrogen 7	16.0 <b>O</b> oxygen 8	19.0 <b>F</b> fluorine 9	20.2 <b>Ne</b> neon 10	
23.0 <b>Na</b> sodium 11	24.3 <b>Mg</b> magnesium 12	27.0 <b>Al</b> aluminium 13	28.1 <b>Si</b> silicon 14	31.0 <b>P</b> phosphorus 15	32.1 <b>S</b> sulfur 16	35.5 <b>Cl</b> chlorine 17	39.9 <b>Ar</b> argon 18	
39.1 <b>K</b> potassium 19	40.1 <b>Ca</b> calcium 20	69.7 <b>Ga</b> gallium 31	72.6 <b>Ge</b> germanium 32	74.9 <b>As</b> arsenic 33	79.0 <b>Se</b> selenium 34	79.9 <b>Br</b> bromine 35	83.8 <b>Kr</b> krypton 36	
85.5 <b>Rb</b> rubidium 37	87.6 <b>Sr</b> strontium 38	114.8 <b>In</b> indium 49	118.7 <b>Sn</b> tin 50	121.8 <b>Sb</b> antimony 51	127.6 <b>Te</b> tellurium 52	126.9 <b>I</b> iodine 53	131.3 <b>Xe</b> xenon 54	
132.9 <b>Cs</b> caesium 55	137.3 <b>Ba</b> barium 56	204.4 <b>Tl</b> thallium 81	207.2 <b>Pb</b> lead 82	209.0 <b>Bi</b> bismuth 83	[209] <b>Po</b> polonium 84	[210] <b>At</b> astatine 85	[222] <b>Rn</b> radon 86	
[223] <b>Fr</b> francium 87	[226] <b>Ra</b> radium 88	Elements with atomic numbers 112-116 have been reported but not fully authenticated					[222] <b>Rn</b> radon 86	
<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="border: 1px solid black; padding: 5px;">                     1.0 <b>H</b> hydrogen 1                 </div> <div style="border: 1px solid black; padding: 5px;">                     relative atomic mass <b>symbol</b> name atomic (proton) number                 </div> </div>								
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
(13)	(14)	(15)	(16)	(17)	(18)			
162.5 <b>Dy</b> dysprosium 66	164.9 <b>Ho</b> holmium 67	167.3 <b>Er</b> erbium 68	168.9 <b>Tm</b> thulium 69	173.1 <b>Yb</b> ytterbium 70	175.0 <b>Lu</b> lutetium 71			
158.9 <b>Tb</b> terbium 65	157.3 <b>Gd</b> gadolinium 64	152.0 <b>Eu</b> europium 63	150.4 <b>Sm</b> samarium 62	[145] <b>Pm</b> promethium 61	[251] <b>Cf</b> californium 98	[257] <b>Fm</b> fermium 100	[262] <b>Lr</b> lawrencium 103	
153.3 <b>Gd</b> gadolinium 64	152.0 <b>Eu</b> europium 63	150.4 <b>Sm</b> samarium 62	144.2 <b>Nd</b> neodymium 60	[145] <b>Pm</b> promethium 61	[258] <b>Md</b> mendelevium 101	[259] <b>No</b> nobelium 102		
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