

Advanced Subsidiary GCE (H033) Advanced GCE (H433)

Data Sheet for Chemistry B



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General Information

Molar gas volume = $24.0 \text{ dm}^3 \text{ mol}^{-1}$ at RTP

Avogadro constant, $N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$

Specific heat capacity of water, $c = 4.18 \text{ J g}^{-1} \text{ K}^{-1}$

Planck constant, $h = 6.63 \times 10^{-34} \text{ J Hz}^{-1}$

Speed of light in a vacuum, $c = 3.00 \times 10^8 \text{ m s}^{-1}$

Ionic product of water, $K_w = 1.00 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6}$ at 298 K

1 tonne = 10^6 g

Arrhenius equation: $k = Ae^{-E_a/RT}$ or $\ln k = -E_a/RT + \ln A$

Gas constant, $R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$

Triplet base codes (codons) for some amino acids used in mRNA

Glycine	GGU
Alanine	GCC
Leucine	CUG
Serine	UCG
Aspartic acid	GAU
Glutamine	CAA
Valine	GUC

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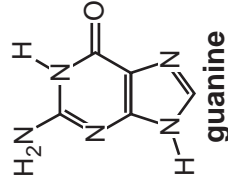
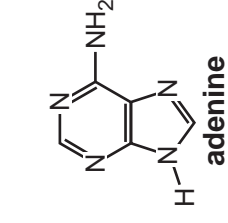
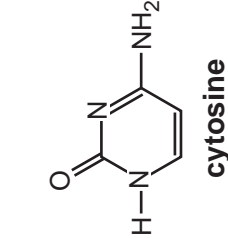
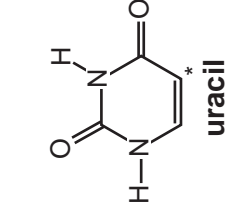
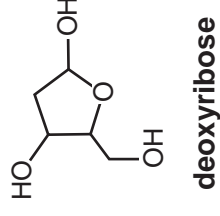
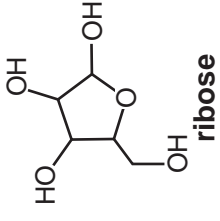
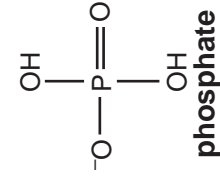
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Characteristic infrared absorptions in organic molecules

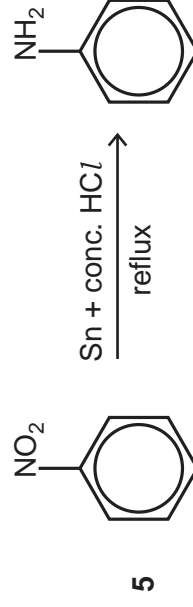
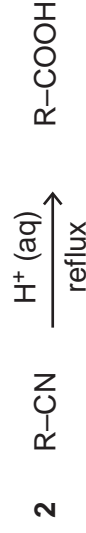
Bond	Location	Wavenumber/cm ⁻¹
C-H	Alkanes	2850–2950
	Alkenes, arenes	3000–3100
	Alkanes	750–1100
C=C	Alkenes	1620–1680
aromatic C=C	Arenes	Several peaks in range 1450–1650 (variable)
C=O	Aldehydes	1720–1740
	Ketones	1705–1725
	Carboxylic acids	1700–1725
	Esters	1735–1750
	Amides	1630–1700
C-O	Acyl chlorides and acid anhydrides	1750–1820
	Alcohols, ethers, esters and carboxylic acids	1000–1300
C≡N	Nitriles	2220–2260
C-X	Fluoroalkanes	1000–1350
	Chloroalkanes	600–800
	Bromoalkanes	500–600
O-H	Alcohols, phenols	3200–3600 (broad)
	Carboxylic acids	2500–3300 (broad)
N-H	Primary amines	3300–3500
	Amides	ca. 3500

Monomers of DNA and RNA

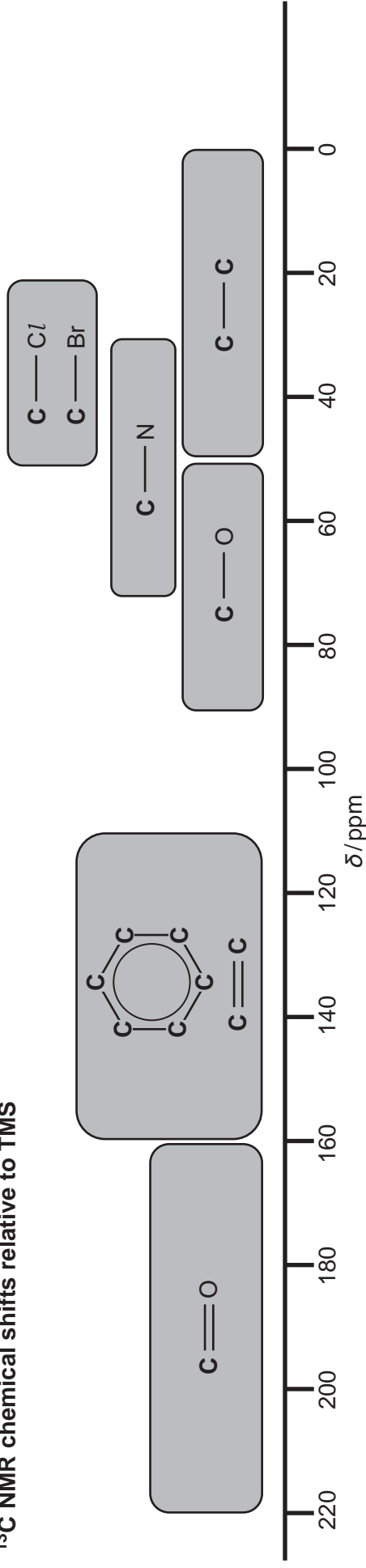


(thymine has a CH₃ at position *)

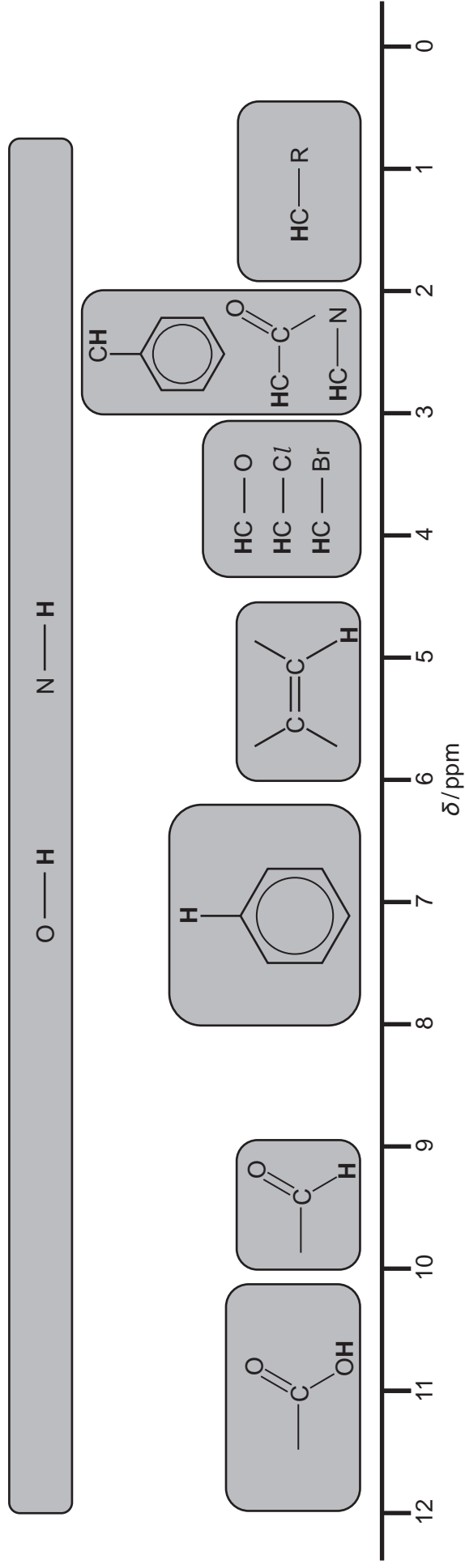
Some useful organic reactions



¹³C NMR chemical shifts relative to TMS



¹H NMR chemical shifts relative to TMS



Chemical shifts are variable and can vary depending on the solvent, concentration and substituents. As a result, shifts may be outside the ranges indicated above.

OH and NH chemical shifts are very variable and are often broad. Signals are not usually seen as split peaks.

Note that CH bonded to 'shifting groups' on either side, e.g. O—CH₂—C=O, may be shifted more than indicated above.

The Periodic Table of the Elements

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(0)
1 H hydrogen 1.0	2 He helium 4.0	13 B boron 10.8	14 C carbon 12.0	15 N nitrogen 14.0	16 O oxygen 16.0	17 F fluorine 19.0	18 Ne neon 20.2
3 Li lithium 6.9	4 Be beryllium 9.0	13 Al aluminium 27.0	14 Si silicon 28.1	15 P phosphorus 31.0	16 S sulfur 32.1	17 Cl chlorine 35.5	18 Ar argon 39.9
11 Na sodium 23.0	12 Mg magnesium 24.3	19 K potassium 39.1	20 Ca calcium 40.1	37 Rb rubidium 85.5	38 Sr strontium 87.6	55 Cs caesium 132.9	87 Fr francium
19 K potassium 39.1	20 Ca calcium 40.1	37 Rb rubidium 85.5	38 Sr strontium 87.6	55 Cs caesium 132.9	87 Fr francium	55 Cs caesium 132.9	87 Fr francium
39 Y yttrium 88.9	39 Y yttrium 88.9	39 Y yttrium 88.9	39 Y yttrium 88.9	39 Y yttrium 88.9	39 Y yttrium 88.9	39 Y yttrium 88.9	39 Y yttrium 88.9
21 Sc scandium 45.0	22 Ti titanium 47.9	23 V vanadium 50.9	24 Cr chromium 52.0	25 Mn manganese 54.9	26 Fe iron 55.8	27 Co cobalt 58.9	28 Ni nickel 58.7
39 Y yttrium 88.9	40 Zr zirconium 91.2	41 Nb niobium 92.9	42 Mo molybdenum 95.9	43 Tc technetium	44 Ru ruthenium 101.1	45 Rh rhodium 102.9	46 Pd palladium 106.4
57-71 lanthanoids	72 Hf hafnium 178.5	73 Ta tantalum 180.9	74 W tungsten 183.8	75 Re rhenium 186.2	76 Os osmium 190.2	77 Ir iridium 192.2	78 Pt platinum 195.1
89-103 actinoids	104 Rf rutherfordium	105 Db dubnium	106 Sg seaborgium	107 Bh bohrium	108 Hs hassium	109 Mt meitnerium	110 Ds darmstadtium
104 Rf rutherfordium	104 Rf rutherfordium	104 Rf rutherfordium	104 Rf rutherfordium	104 Rf rutherfordium	104 Rf rutherfordium	104 Rf rutherfordium	104 Rf rutherfordium
81 Tl thallium 204.4	82 Pb lead 207.2	83 Bi bismuth 209.0	84 Po polonium	85 At astatine	86 Rn radon	81 Tl thallium 204.4	82 Pb lead 207.2
49 In indium 114.8	50 Sn tin 118.7	51 Sb antimony 121.8	52 Te tellurium 127.6	53 I iodine 126.9	54 Xe xenon 131.3	49 In indium 114.8	50 Sn tin 118.7
47 Cu copper 63.5	48 Zn zinc 65.4	49 In indium 114.8	50 Sn tin 118.7	51 Sb antimony 121.8	52 Te tellurium 127.6	47 Cu copper 63.5	48 Zn zinc 65.4
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