

# Advanced Subsidiary GCE (H033) Advanced GCE (H433)

## Data Sheet for Chemistry B



The information in this sheet is for the use of candidates following the Advanced Subsidiary GCE in Chemistry B (H033) course and Advanced GCE in Chemistry B (H433) course.

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Copies of this sheet may be used for teaching.

This document consists of 4 pages.

### 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 =  $10^6 \text{ g}$

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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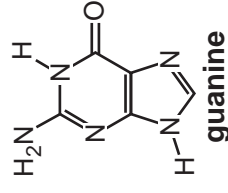
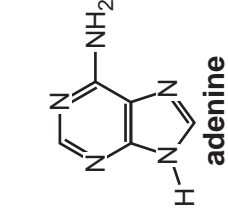
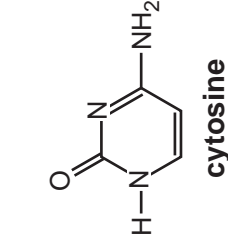
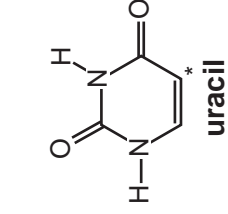
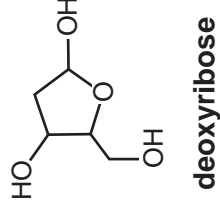
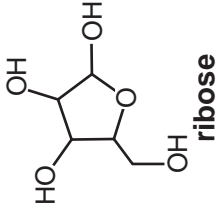
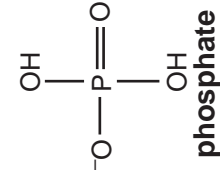
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### Characteristic infrared absorptions in organic molecules

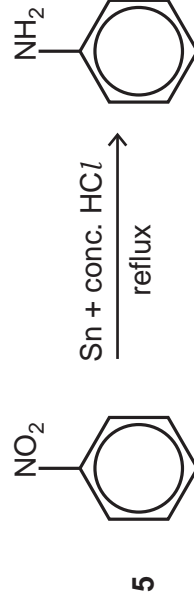
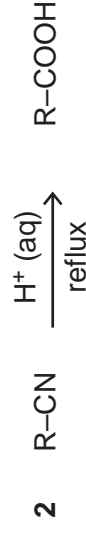
Bond	Location	Wavenumber/cm <sup>-1</sup>
C-H	Alkanes	2850–2950
	Alkenes, arenes	3000–3100
	Alkanes	750–1100
C=C	Alkenes	1620–1680
aromatic C=C	Arenes	Several peaks in range 1450–1650 (variable)
C=O	Aldehydes	1720–1740
	Ketones	1705–1725
	Carboxylic acids	1700–1725
	Esters	1735–1750
	Amides	1630–1700
	Acyl chlorides and acid anhydrides	1750–1820
C-O	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

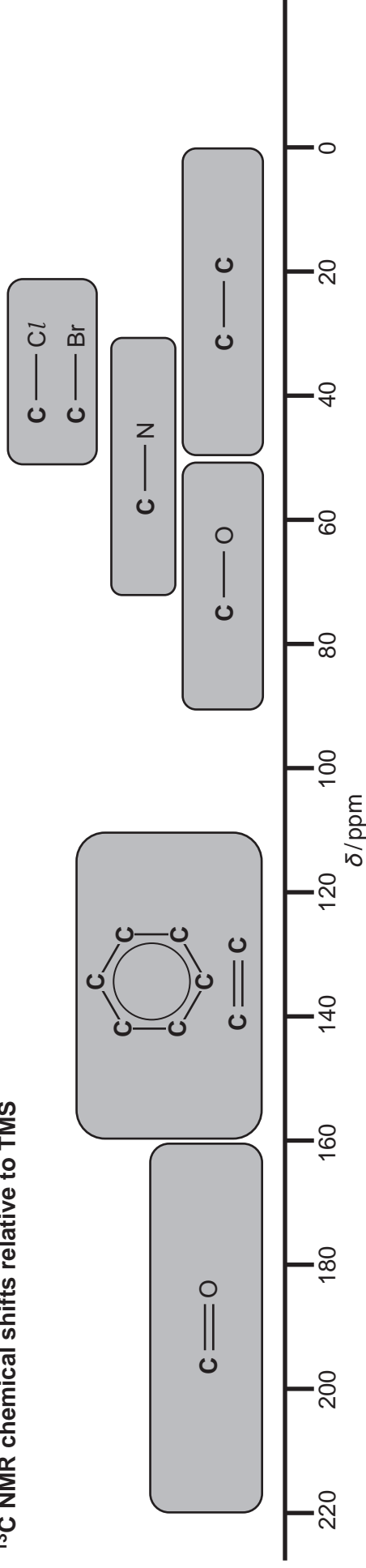


(thymine has a CH<sub>3</sub> at position \*)

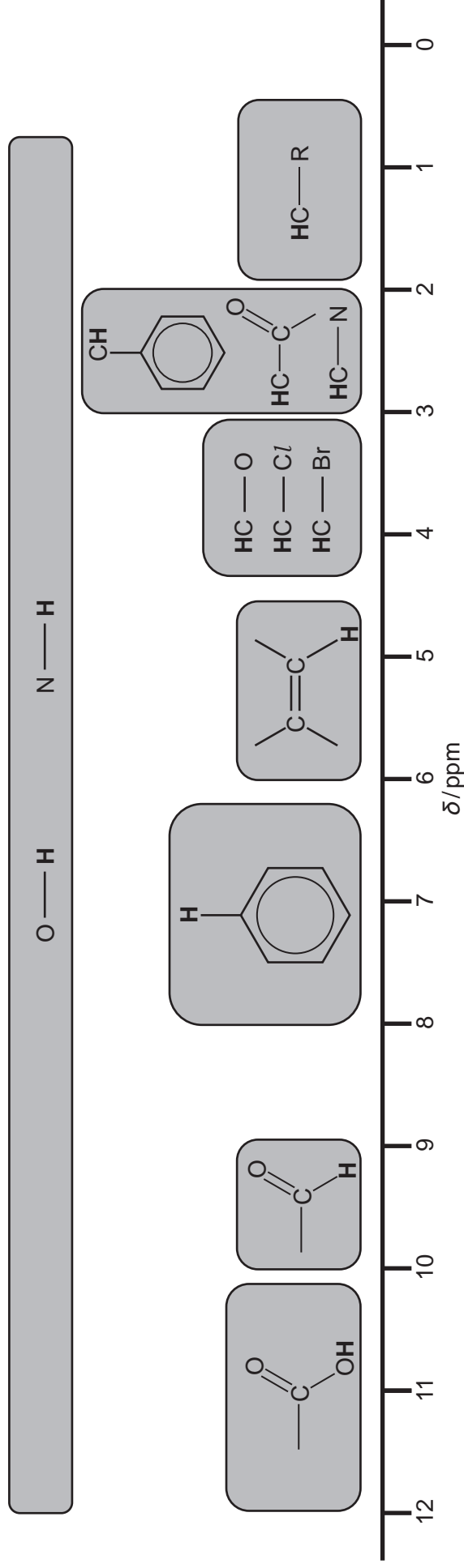
### Some useful organic reactions



### <sup>13</sup>C NMR chemical shifts relative to TMS



### <sup>1</sup>H 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—CH<sub>2</sub>—C=O, may be shifted more than indicated above.

# The Periodic Table of the Elements

(1)	(2)	Key										(3)	(4)	(5)	(6)	(7)	(0)											
1	2	atomic number										13	14	15	16	17	18											
1	2	Symbol										5	6	7	8	9	10	11	12									
1	2	name										B	C	N	O	F	Ne											
1.0	9.0	relative atomic mass										10.8	12.0	14.0	16.0	19.0	20.2											
H hydrogen	He helium	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18											
Li lithium	Be beryllium	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
Na sodium	Mg magnesium	K potassium	Ca calcium	Sc scandium	Ti titanium	V vanadium	Cr chromium	Mn manganese	Fe iron	Co cobalt	Ni nickel	Cu copper	Zn zinc	Ga gallium	Ge germanium	As arsenic	Se selenium	Br bromine	Kr krypton									
Rb rubidium	Sr strontium	Y yttrium	Zr zirconium	Nb niobium	Mo molybdenum	Tc technetium	Ru ruthenium	Rh rhodium	Pd palladium	Ag silver	Cd cadmium	In indium	Sn tin	Sb antimony	Te tellurium	I iodine	Xe xenon											
Cs caesium	Ba barium	57-71 lanthanoids	Hf hafnium	Ta tantalum	W tungsten	Re rhenium	Os osmium	Ir iridium	Pt platinum	Au gold	Hg mercury	Tl thallium	Pb lead	Bi bismuth	Po polonium	At astatine	Rn radon											
Fr francium	Ra radium	89-103 actinoids	Rf rutherfordium	Db dubnium	Sg seaborgium	Bh bohrium	Hs hassium	Mt meitnerium	Ds darmstadtium	Rg roentgenium	Cn copernicium	Fl flerovium	Lv livermorium															

57	La lanthanum	138.9	58	Ce cerium	140.1	59	Pr praseodymium	140.9	60	Nd neodymium	144.2	61	Pm promethium	144.9	62	Sm samarium	150.4	63	Eu europium	152.0	64	Gd gadolinium	157.2	65	Tb terbium	158.9	66	Dy dysprosium	162.5	67	Ho holmium	164.9	68	Er erbium	167.3	69	Tm thulium	168.9	70	Yb ytterbium	173.0	71	Lu lutetium	175.0
89	Ac actinium	232.0	90	Th thorium	232.0	91	Pa protactinium	238.1	92	U uranium	238.1	93	Np neptunium	238.1	94	Pu plutonium	238.1	95	Am americium	238.1	96	Cm curium	238.1	97	Bk berkelium	238.1	98	Cf californium	238.1	99	Es einsteinium	238.1	100	Fm fermium	238.1	101	Md mendelevium	238.1	102	No nobelium	238.1	103	Lr lawrencium	238.1