Oxford Cambridge and RSA

AS Level Chemistry B (H033)
A Level Chemistry B (H433)

Data Sheet

INSTRUCTIONS
- Do **not** send this Data Sheet for marking. Keep it in the centre or recycle it.

INFORMATION
- This document has **4** pages.

General Information

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

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

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

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

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

Ionic product of water, $K_w = 1.00 \times 10^{-14}\,mol^2\,dm^{-6}$ 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, $R = 8.314\,J\,mol^{-1}\,K^{-1}$

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

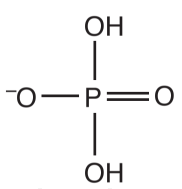
Glycine	GGU
Alanine	GCC
Leucine	CUG
Serine	UCG
Aspartic acid	GAU
Glutamine	CAA
Valine	GUC

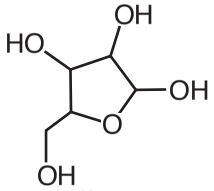
Chemistry B

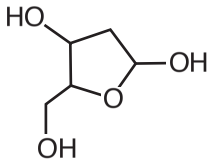
Characteristic infrared absorptions in organic molecules

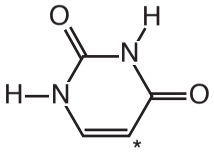
Bond	Location	Wavenumber / cm^{-1}
C–H	Alkanes	2850–2950
	Alkenes, arenes	3000–3100
C–C	Alkanes	750–1100
C=C	Alkenes	1620–1680
aromatic C=C	Arenes	Several peaks in range 1450–1650 (variable)
C=O	Aldehydes	1720–1740
	Ketones	1705–1725
	Carboxylic acids	1700–1725
	Esters	1735–1750
	Amides	1630–1700
	Acyl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

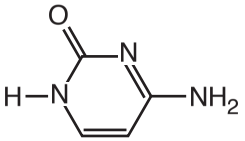
Monomers of DNA and RNA

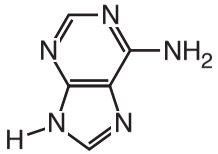

phosphate

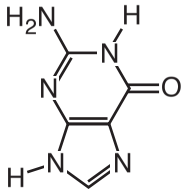

ribose


deoxyribose


uracil


cytosine


adenine


guanine

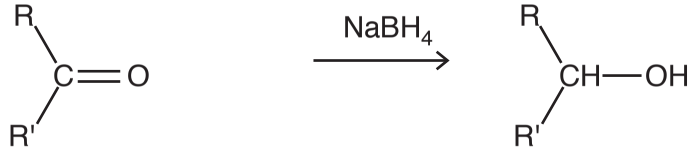
(thymine has a CH_3 at position *)

Some useful organic reactions

1 $R\text{–}Br + CN^- \longrightarrow R\text{–}CN + Br^-$

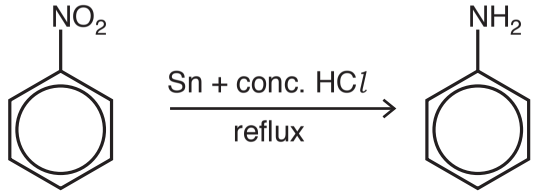
2 $R\text{–}CN \xrightarrow[\text{reflux}]{H^+ (aq)} R\text{–}COOH$

3

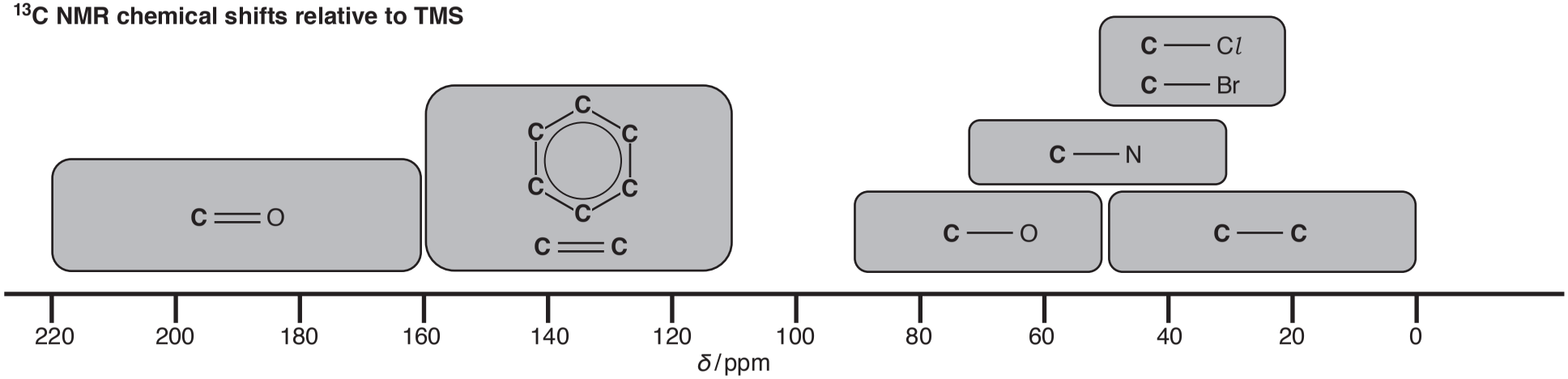


4 $R\text{–}COOH + SOCl_2 \longrightarrow R\text{–}COCl + SO_2 + HCl$

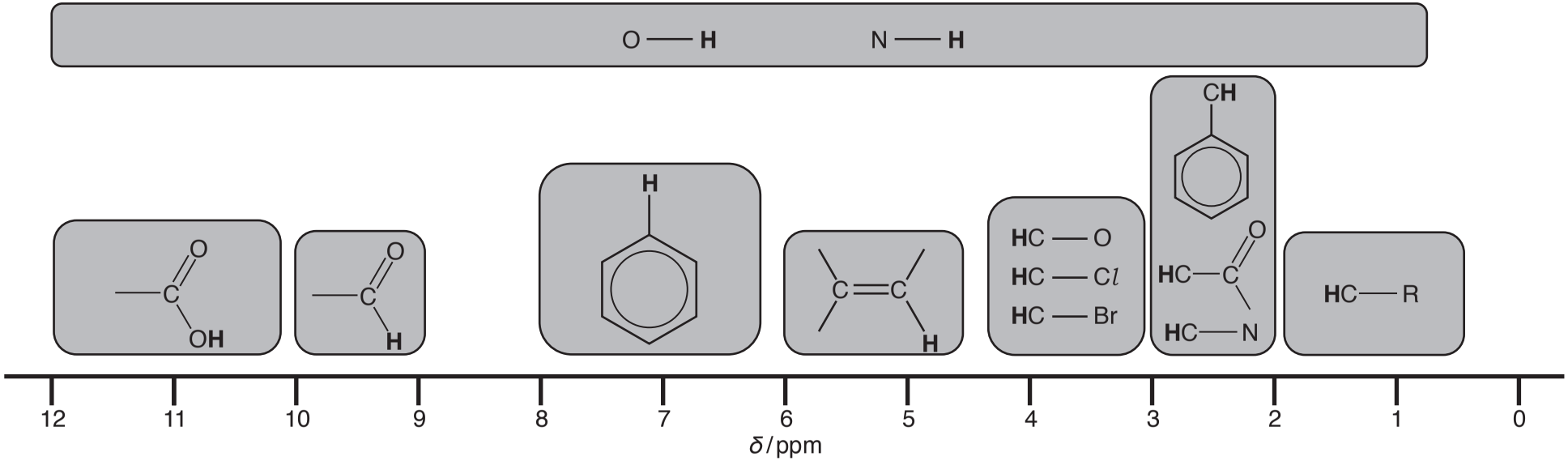
5



^{13}C NMR chemical shifts relative to TMS



^{1}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.

O**H** and N**H** chemical shifts are very variable and are often broad. Signals are not usually seen as split peaks.

Note that C**H** bonded to 'shifting groups' on either side, e.g. O–C**H**$_2$–C=O, may be shifted more than indicated above.

The Periodic Table of the Elements

(1)	(2)											(3)	(4)	(5)	(6)	(7)	(0)
1																	**18**
1 **H** hydrogen 1.0	**2**	**Key** atomic number **Symbol** name relative atomic mass										**13**	**14**	**15**	**16**	**17**	2 **He** helium 4.0
3 **Li** lithium 6.9	4 **Be** beryllium 9.0											5 **B** boron 10.8	6 **C** carbon 12.0	7 **N** nitrogen 14.0	8 **O** oxygen 16.0	9 **F** fluorine 19.0	10 **Ne** neon 20.2
11 **Na** sodium 23.0	12 **Mg** magnesium 24.3	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	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
19 **K** potassium 39.1	20 **Ca** calcium 40.1	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	29 **Cu** copper 63.5	30 **Zn** zinc 65.4	31 **Ga** gallium 69.7	32 **Ge** germanium 72.6	33 **As** arsenic 74.9	34 **Se** selenium 79.0	35 **Br** bromine 79.9	36 **Kr** krypton 83.8
37 **Rb** rubidium 85.5	38 **Sr** strontium 87.6	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	47 **Ag** silver 107.9	48 **Cd** cadmium 112.4	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
55 **Cs** caesium 132.9	56 **Ba** barium 137.3	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	79 **Au** gold 197.0	80 **Hg** mercury 200.6	81 **Tl** thallium 204.4	82 **Pb** lead 207.2	83 **Bi** bismuth 209.0	84 **Po** polonium	85 **At** astatine	86 **Rn** radon
87 **Fr** francium	88 **Ra** radium	89–103 actinoids	104 **Rf** rutherfordium	105 **Db** dubnium	106 **Sg** seaborgium	107 **Bh** bohrium	108 **Hs** hassium	109 **Mt** meitnerium	110 **Ds** darmstadtium	111 **Rg** roentgenium	112 **Cn** copernicium		114 **Fl** flerovium		116 **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	90 **Th** thorium 232.0	91 **Pa** protactinium	92 **U** uranium 238.1	93 **Np** neptunium	94 **Pu** plutonium	95 **Am** americium	96 **Cm** curium	97 **Bk** berkelium	98 **Cf** californium	99 **Es** einsteinium	100 **Fm** fermium	101 **Md** mendelevium	102 **No** nobelium	103 **Lr** lawrencium