

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**

**Advanced Subsidiary GCE (H032)**

**Advanced GCE (H432)**

**Data Sheet for Chemistry A**

**MODIFIED ENLARGED**

The information in this sheet is for the use of candidates following the Advanced Subsidiary GCE in Chemistry A (H032) course and Advanced GCE in Chemistry A (H432) course.

The data in this sheet will be printed for distribution with the examination papers.

Copies of this sheet may be used for teaching.

**INSTRUCTIONS TO EXAMS OFFICER/INVIGILATOR**

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CST263



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## GENERAL INFORMATION

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Molar gas volume =  $24.0 \text{ dm}^3 \text{ mol}^{-1}$  at room temperature and pressure, RTP

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

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

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

1 tonne =  $10^6 \text{ g}$

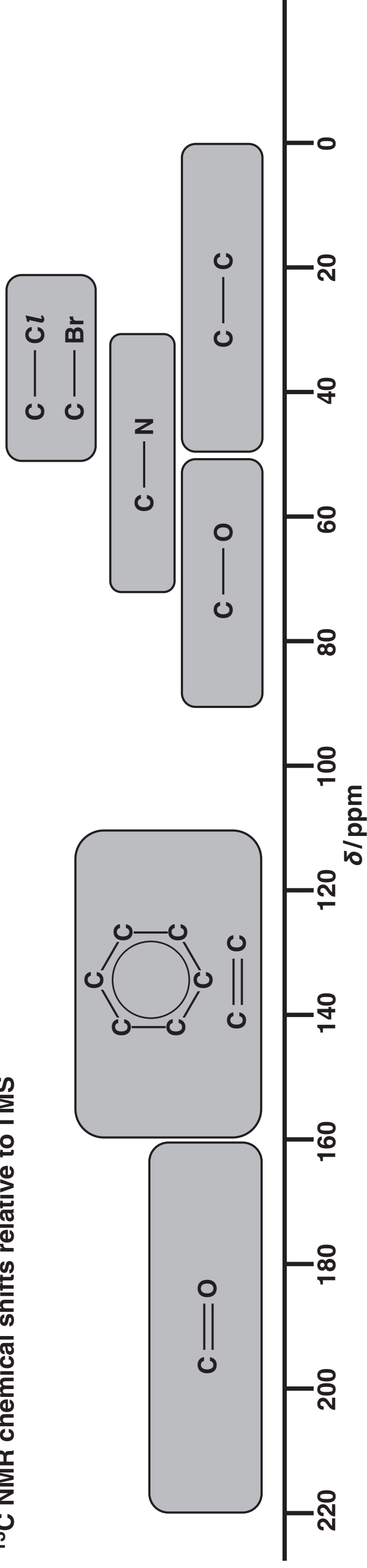
Arrhenius equation:  $k = Ae^{-E_a/RT}$  or  $\ln k = -E_a/RT + \ln A$

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

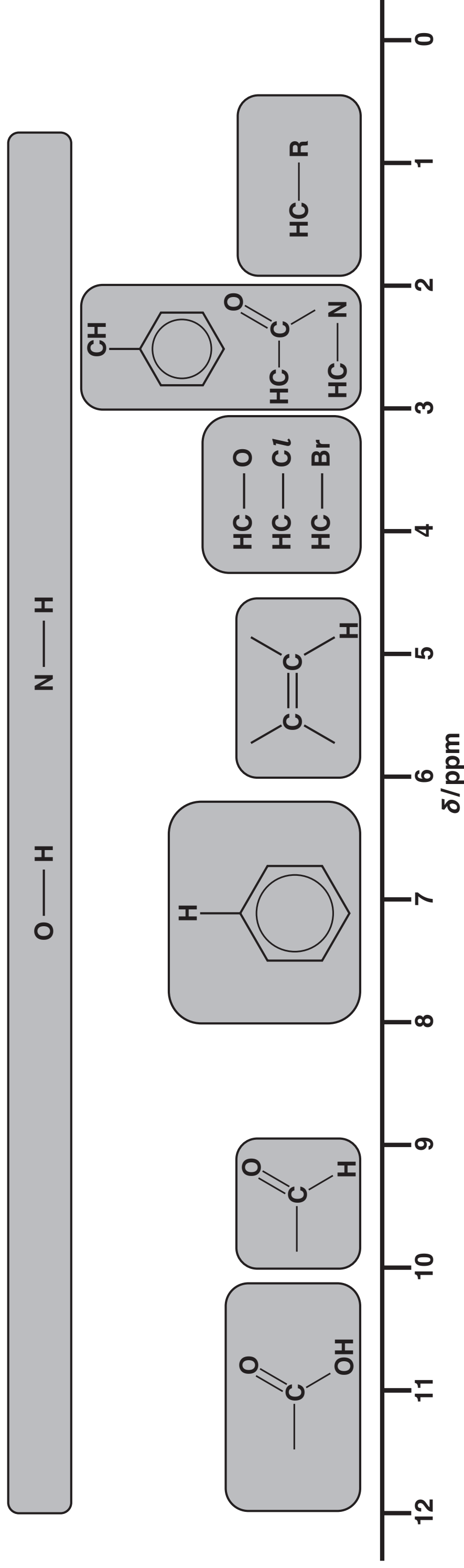
## CHARACTERISTIC INFRARED ABSORPTIONS IN ORGANIC MOLECULES

BOND	LOCATION	WAVENUMBER/ $\text{cm}^{-1}$
C–C	Alkanes, alkyl chains	750–1100
C–X	Haloalkanes (X = Cl, Br, I)	500–800
C–F	Fluoroalkanes	1000–1350
C–O	Alcohols, esters, carboxylic acids	1000–1300
C=C	Alkenes	1620–1680
C=O	Aldehydes, ketones, carboxylic acids, esters, amides, acyl chlorides and acid anhydrides	1630–1820
aromatic C=C	Arenes	Several peaks in range 1450–1650 (variable)
C≡N	Nitriles	2220–2260
C–H	Alkyl groups, alkenes, arenes	2850–3100
O–H	Carboxylic acids	2500–3300 (broad)
N–H	Amines, amides	3300–3500
O–H	Alcohols, phenols	3200–3600

### <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)

(3)

(4)

(5)

(6)

(7)

(0)

1			Key atomic number Symbol name relative atomic mass										2										18				
1 H hydrogen 1.0													2 He helium 4.0														
3 Li lithium 6.9			4 Be beryllium 9.0										9 F fluorine 19.0										17				
11 Na sodium 23.0			12 Mg magnesium 24.3										7 N nitrogen 14.0										15	16	17		
19 K potassium 39.1			20 Ca calcium 40.1										31 Ga gallium 69.7										32	33	34	35	36
37 Rb rubidium 85.5			38 Sr strontium 87.6										49 In indium 114.8										50	51	52	53	54
55 Cs caesium 132.9			56 Ba barium 137.3										81 Tl thallium 204.4										82	83	84	85	86
87 Fr francium			88 Ra radium																				114 Fl flerovium		116 Lv livermorium		