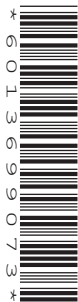


Advanced Subsidiary GCE (H032) Advanced GCE (H432)

Data Sheet for Chemistry A



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.

This document consists of **4** pages.

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General Information

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 g

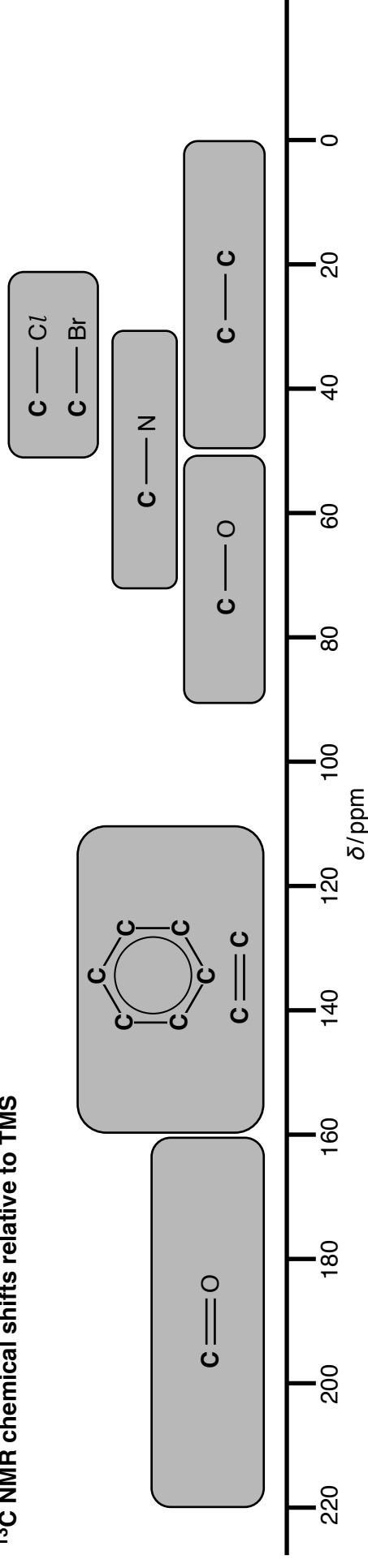
Arrhenius equation: $k = Ae^{-E_a/RT}$ or $\ln k = -E_a/RT + \ln A$

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

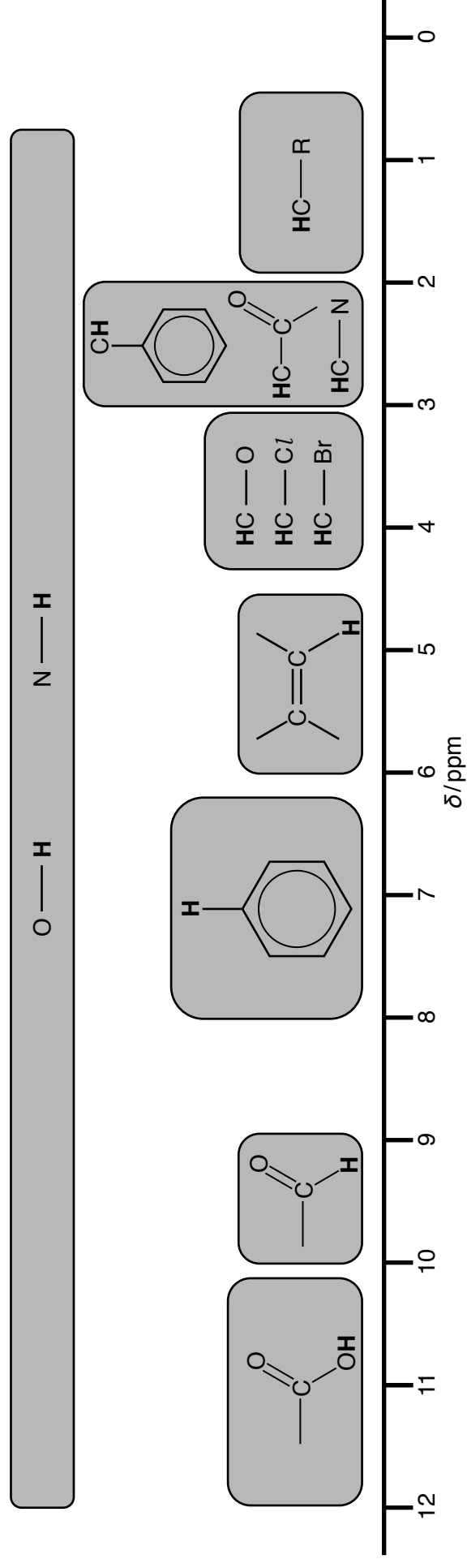
Characteristic infrared absorptions in organic molecules

Bond	Location	Wavenumber / 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

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.

- (1)
- (2)
- (3)
- (4)
- (5)
- (6)
- (7)
- (8)

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