

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.

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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

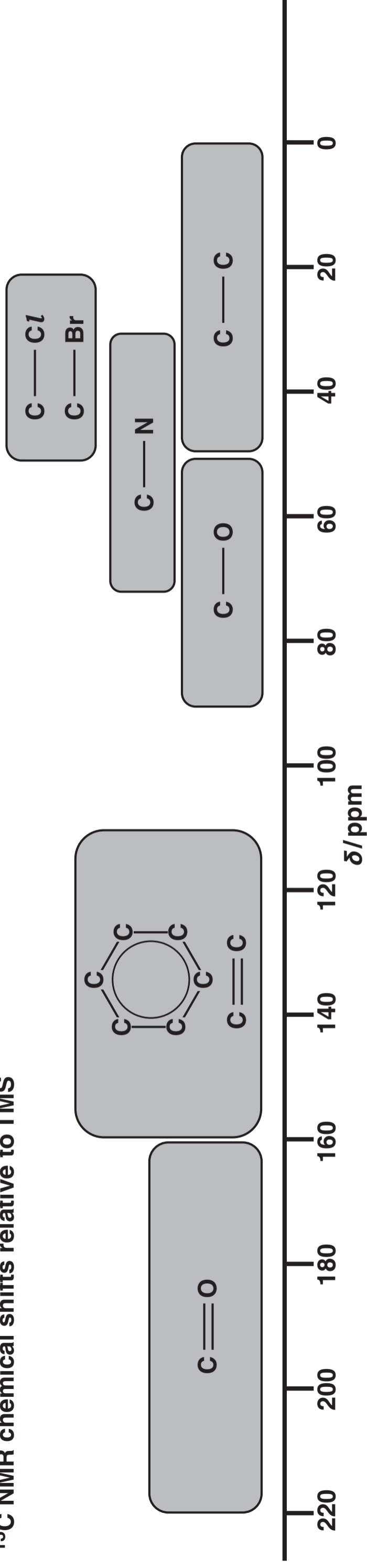
Arrhenius equation: $k = Ae^{-E_a/RT}$ or $\ln k = -E_a/RT + \ln A$

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

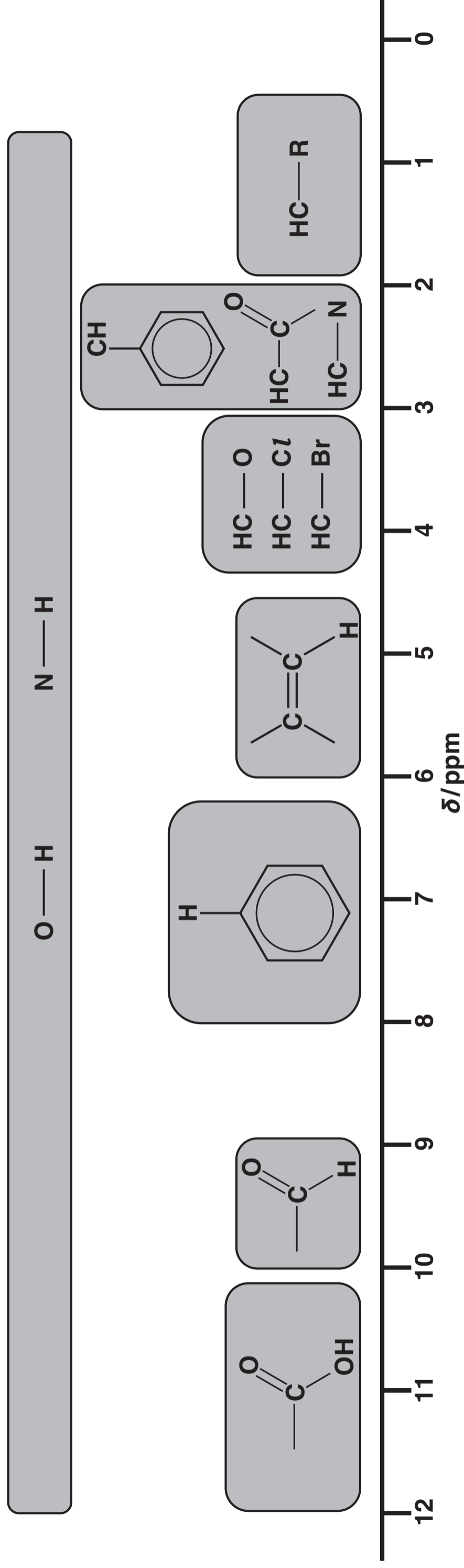
CHARACTERISTIC INFRARED ABSORPTIONS IN ORGANIC MOLECULES

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.

The Periodic Table of the Elements

(1)

(2)

(3)

(4)

(5)

(6)

(7)

(0)

<div>Key</div> <div>atomic number</div> <div>Symbol</div> <div>name</div> <div>relative atomic mass</div>																																			
1		18																																	
1	H	2																																	
hydrogen		helium																																	
1.0		4.0																																	
3	Li	4	Be	5														6	7	8	9	10													
lithium		beryllium		boron														carbon	nitrogen	oxygen	fluorine	neon													
6.9		9.0		10.8														12.0	14.0	16.0	19.0	20.2													
11	Na	12	Mg	13														14	15	16	17	18													
sodium		magnesium		aluminium														silicon	phosphorus	sulfur	chlorine	argon													
23.0		24.3		27.0														28.1	31.0	32.1	35.5	39.9													
19	K	20	Ca	21	Sc	22	Ti	23	V	24	Cr	25	Mn	26	Fe	27	Co	28	Ni	29	Cu	30	Zn	31	Ga	32	Ge	33	As	34	Se	35	Br	36	Kr
potassium		calcium		scandium		titanium		vanadium		chromium		manganese		iron		cobalt		nickel		copper		zinc		gallium		germanium		arsenic		selenium		bromine		krypton	
39.1		40.1		45.0		47.9		50.9		52.0		54.9		55.8		58.9		58.7		63.5		65.4		69.7		72.6		74.9		79.0		79.9		83.8	
37	Rb	38	Sr	39	Y	40	Zr	41	Nb	42	Mo	43	Tc	44	Ru	45	Rh	46	Pd	47	Ag	48	Cd	49	In	50	Sn	51	Sb	52	Te	53	I	54	Xe
rubidium		strontium		yttrium		zirconium		niobium		molybdenum		technetium		ruthenium		rhodium		palladium		silver		cadmium		indium		tin		antimony		tellurium		iodine		xenon	
85.5		87.6		88.9		91.2		92.9		95.9				101.1		102.9		106.4		107.9		112.4		114.8		118.7		121.8		127.6		126.9		131.3	
55	Cs	56	Ba	57–71		73	Ta	74	W	75	Re	76	Os	77	Ir	78	Pt	79	Au	80	Hg	81	Tl	82	Pb	83	Bi	84	Po	85	At	86	Rn		
caesium		barium		lanthanoids		tantalum		tungsten		rhenium		osmium		iridium		platinum		gold		mercury		thallium		lead		bismuth		polonium		astatine		radon			
132.9		137.3				180.9		183.8		186.2		190.2		192.2		195.1		197.0		200.6		204.4		207.2		209.0									
87	Fr	88	Ra	89–103		105	Db	106	Sg	107	Bh	108	Hs	109	Mt	110	Ds	111	Rg	112	Cn			114	Fl			116		Lv					
francium		radium		actinoids		rutherfordium		seaborgium		bohrium		hassium		meitnerium		darmstadtium		roentgenium		copernicium				flerovium				livermorium							
57	La	58	Ce	59	Pr	60	Nd	61	Pm	62	Sm	63	Eu	64	Gd	65	Tb	66	Dy	67	Ho	68	Er	69	Tm	70	Yb	71	Lu						
lanthanum		cerium		praseodymium		neodymium		promethium		samarium		europium		gadolinium		terbium		dysprosium		holmium		erbium		thulium		ytterbium		lutetium							
138.9		140.1		140.9		144.2		144.9		150.4		152.0		157.2		158.9		162.5		164.9		167.3		168.9		173.0		175.0							
89	Ac	90	Th	91	Pa	92	U	93	Np	94	Pu	95	Am	96	Cm	97	Bk	98	Cf	99	Es	100	Fm	101	Md	102	No	103	Lr						
actinium		thorium		protactinium		uranium		neptunium		plutonium		americium		curium		berkelium		californium		einsteinium		fermium		mendelevium		nobelium		lawrencium							
232.0		238.1		238.1		238.1		238.1		238.1		238.1		238.1		238.1		238.1		238.1		238.1		238.1		238.1		238.1		238.1					