

# Data Sheet for Chemistry B (Salters)

(version 2.2)

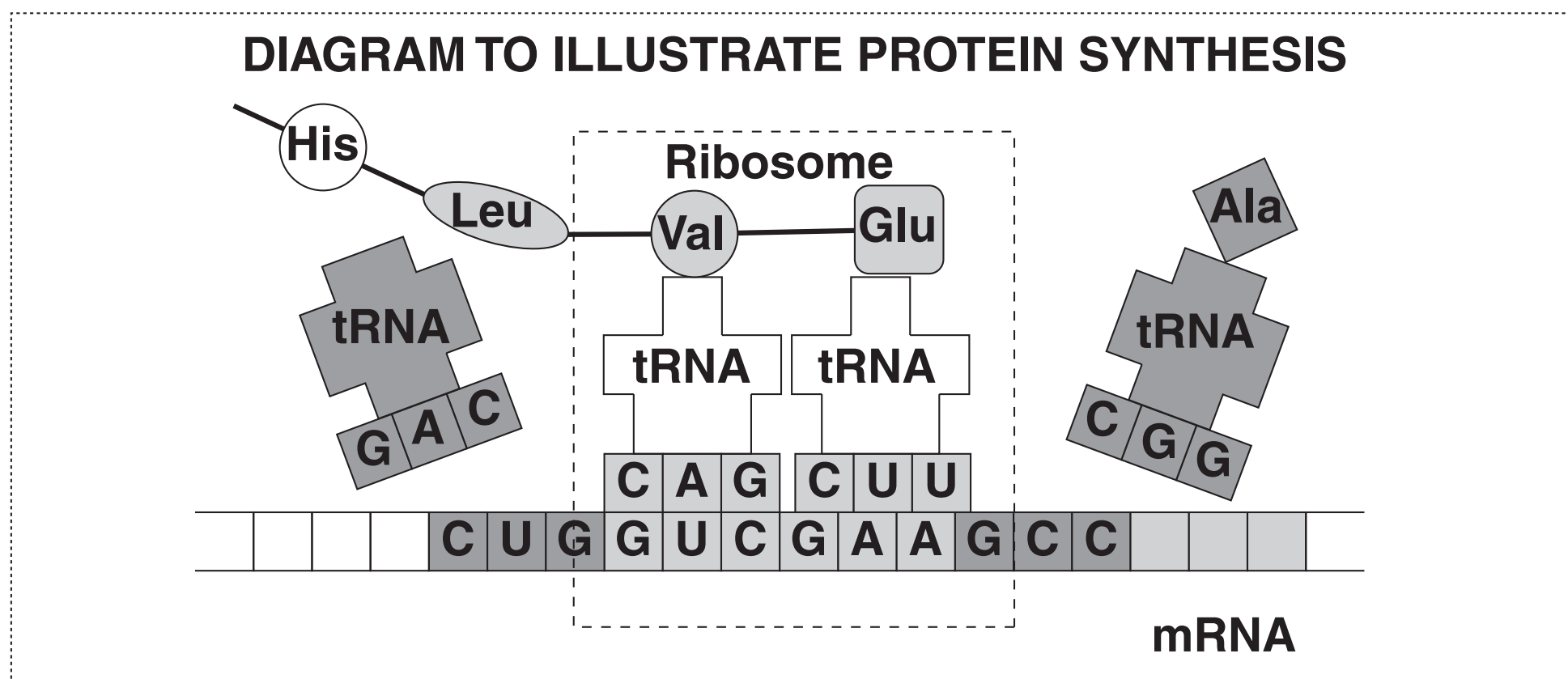
## GCE Advanced Level and Advanced Subsidiary Chemistry B (Salters) (H035, H435)

### Chemistry units F331–F336

The information in this sheet is for the use of candidates following Chemistry B (Salters) (H035/H435). Copies of this sheet may be used for teaching.

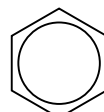
#### INSTRUCTIONS TO EXAMS OFFICER/INVIGILATOR

- A copy of this Data Sheet will be included as an insert with each question paper. This should be given up to the Invigilator at the end of the examination.
- DO NOT SEND THIS DATA SHEET FOR MARKING; IT SHOULD BE RETAINED IN THE CENTRE OR DESTROYED.

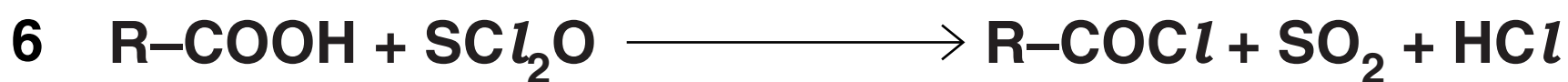
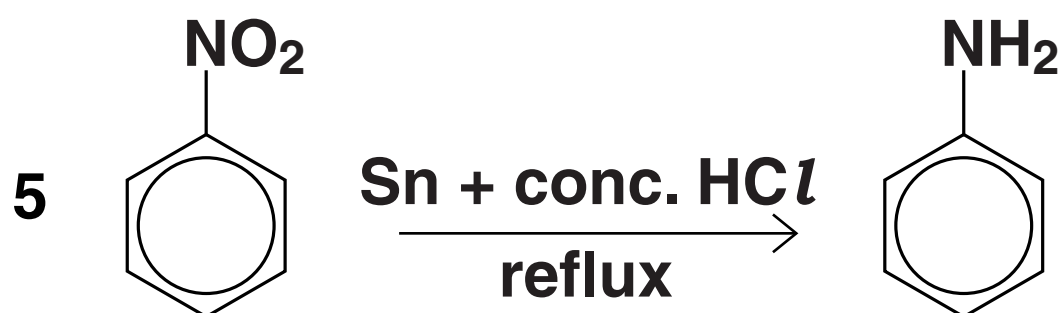
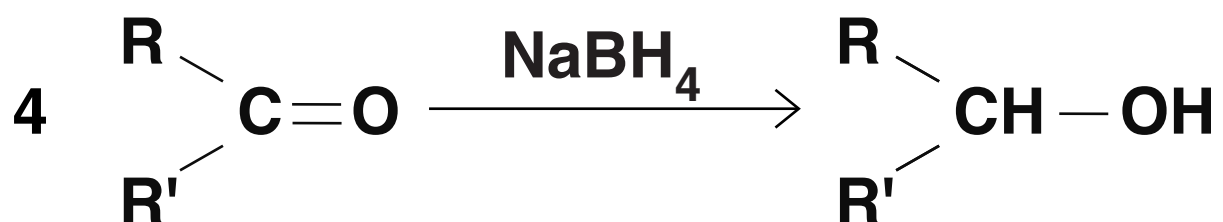
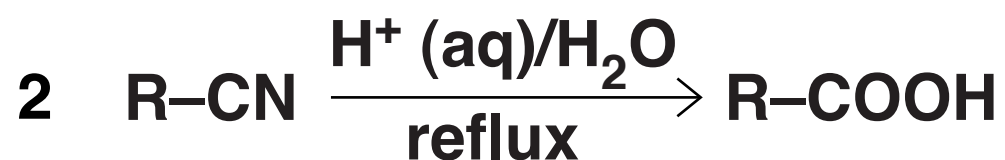
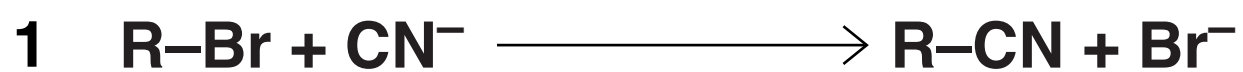


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# CHARACTERISTIC INFRARED ABSORPTION IN ORGANIC MOLECULES

BOND	LOCATION	WAVENUMBER/ cm <sup>-1</sup>	INTENSITY	
C—H	alkanes	2850–2950	M–S	M medium S strong
	alkenes, arenes	3000–3100	M–S	
	alkynes	<i>ca.</i> 3300	S	* hydrogen bonded
C=C	alkenes	1620–1680	M	
	arenes	several peaks in range 1450–1650	variable	
C≡C	alkynes	2100–2260	M	
C=O	aldehydes	1720–1740	S	
	ketones	1705–1725	S	
	carboxylic acids	1700–1725	S	
	esters	1735–1750	S	
	amides	1630–1700	M	
C—O	alcohols, ethers, esters	1050–1300	S	
C≡N	nitriles	2200–2260	M	
C—F	fluoroalkanes	1000–1400	S	
	chloroalkanes	600–800	S	
	bromoalkanes	500–600	S	
O—H	alcohols, phenols	3600–3640	S	
	*alcohols, phenols	3200–3600	S (broad)	
	*carboxylic acids	2500–3200	M (broad)	
N—H	primary amines	3300–3500	M–S	
	amides	<i>ca.</i> 3500	M	

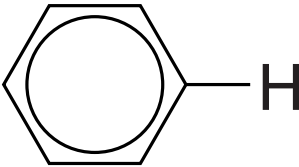
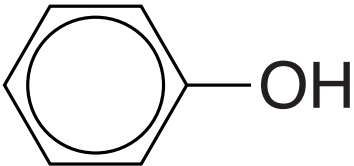
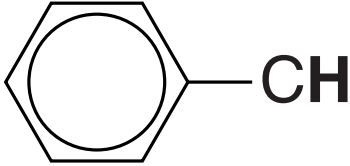
## SOME USEFUL ORGANIC REACTIONS



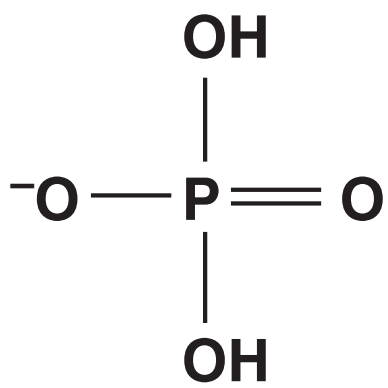
# CHEMICAL SHIFTS FOR SOME TYPES OF PROTONS ( $^1\text{H}$ ) IN NMR SPECTRA

Chemical shifts are for hydrogen ( $^1\text{H}$ ) relative to TMS (tetramethylsilane).

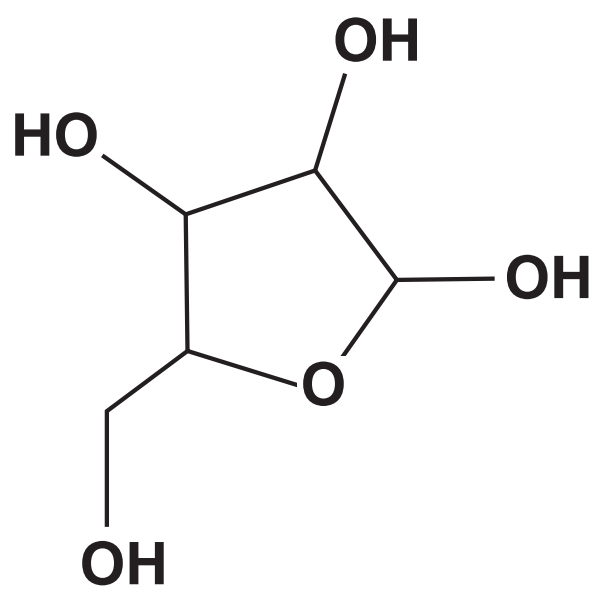
They are typical values and can vary slightly depending on the solvent, concentration and substituents.

TYPE OF PROTON	CHEMICAL SHIFT, $\delta/\text{ppm}$	TYPE OF PROTON	CHEMICAL SHIFT, $\delta/\text{ppm}$
$\text{CH}_3-\text{C}$	0.7–1.6		6.4–8.2
$\begin{array}{c} \text{C}-\text{CH}_2-\text{C} \\   \quad   \\ \text{C}-\text{CH}-\text{C} \\   \\ \text{C} \end{array}$	1.4–2.3	$-\text{C}-\text{CHO}$	9.4–10.0
$\begin{array}{c} \diagup \text{CH}-\text{C}-\diagdown \\    \\ \text{O} \end{array}$ carbonyls esters amides acids	2.0–2.7	$-\text{C}-\text{OH}$	0.5–4.5*
$-\text{CH}-\text{N}$ amines amides	2.3–2.9		4.5–10.0*
	2.3–3.0	$-\text{C}-\text{NH}$	1.0–5.0*
$-\text{O}-\text{CH}$ alcohols esters ethers	3.3–4.8	$-\text{CO}-\text{NH}$	5.0–12.0*
$-\text{CH}-\text{Cl}$ or Br	3.0–4.2	$-\text{CO}-\text{OH}$	9.0–15.0*
$-\text{CH}=\text{CH}-$	4.5–6.0	*these signals are <i>very</i> variable (sometimes outside these limits) and often broad.	

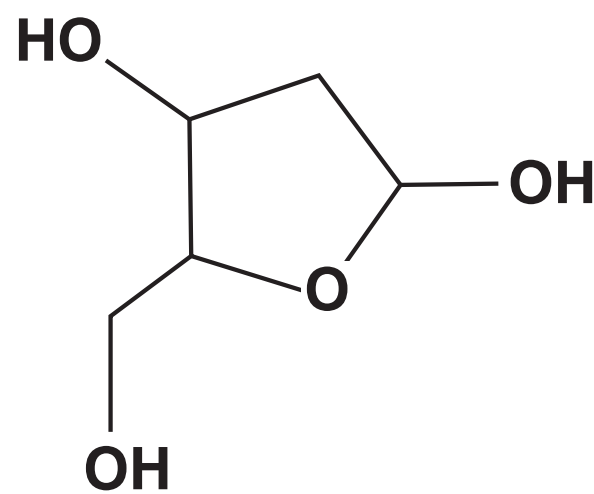
# MONOMERS OF DNA AND RNA



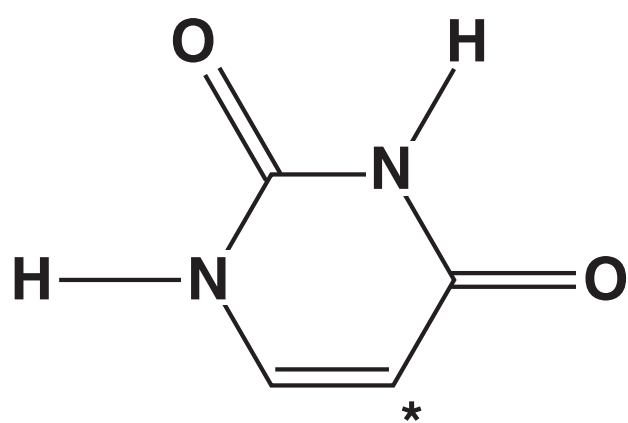
**phosphate**



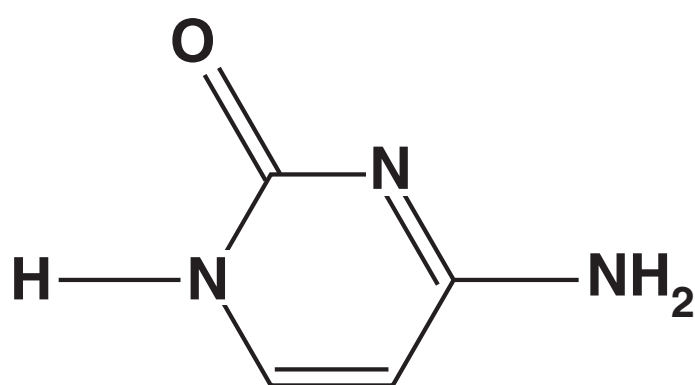
**ribose**



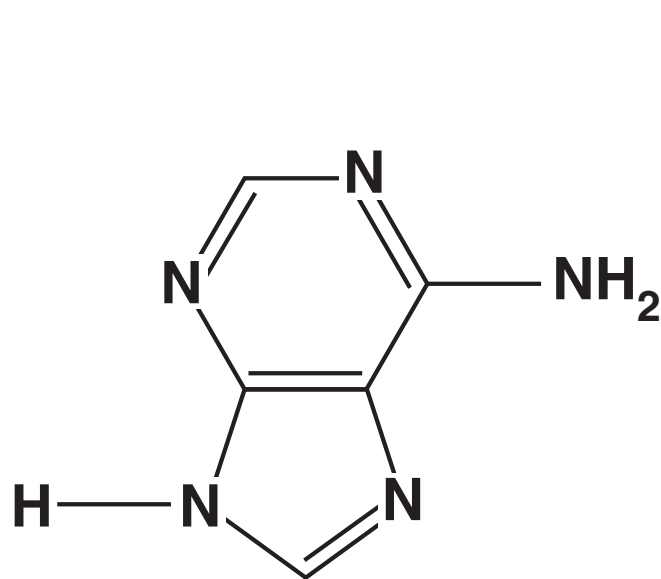
**deoxyribose**



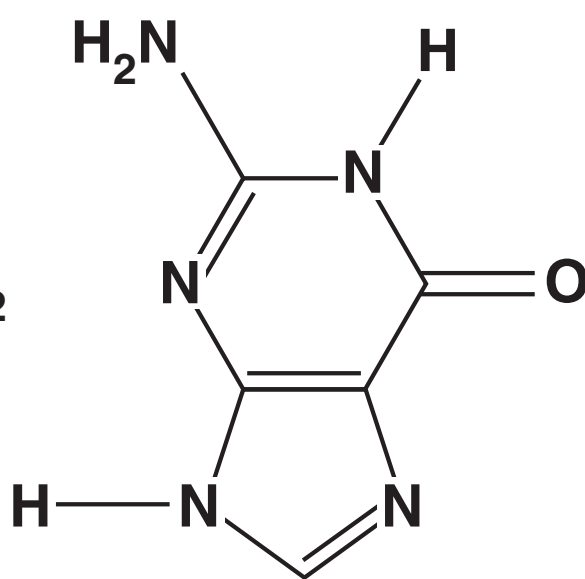
**uracil**



**cytosine**



**adenine**



**guanine**

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

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The Periodic Table of the Elements

12345670

1.0  
H  
hydrogen  
1

Key

relative atomic mass
<b>atomic symbol</b>
name
atomic (proton) number

6.9 <b>Li</b> lithium 3	9.0 <b>Be</b> beryllium 4							10.8 <b>B</b> boron 5	12.0 <b>C</b> carbon 6	14.0 <b>N</b> nitrogen 7	16.0 <b>O</b> oxygen 8	19.0 <b>F</b> fluorine 9	20.2 <b>Ne</b> neon 10
23.0 <b>Na</b> sodium 11	24.3 <b>Mg</b> magnesium 12							27.0 <b>Al</b> aluminium 13	28.1 <b>Si</b> silicon 14	31.0 <b>P</b> phosphorus 15	32.1 <b>S</b> sulfur 16	35.5 <b>Cl</b> chlorine 17	39.9 <b>Ar</b> argon 18
39.1 <b>K</b> potassium 19	40.1 <b>Ca</b> calcium 20	45.0 <b>Sc</b> scandium 21	47.9 <b>Ti</b> titanium 22	50.9 <b>V</b> vanadium 23	52.0 <b>Cr</b> chromium 24	54.9 <b>Mn</b> manganese 25	55.8 <b>Fe</b> iron 26	58.9 <b>Co</b> cobalt 27	58.7 <b>Ni</b> nickel 28	63.5 <b>Cu</b> copper 29	65.4 <b>Zn</b> zinc 30	79.9 <b>Br</b> bromine 35	83.8 <b>Kr</b> krypton 36
85.5 <b>Rb</b> rubidium 37	87.6 <b>Sr</b> strontium 38	88.9 <b>Y</b> yttrium 39	91.2 <b>Zr</b> zirconium 40	92.9 <b>Nb</b> niobium 41	95.9 <b>Mo</b> molybdenum 42	[98] <b>Tc</b> technetium 43	101.1 <b>Ru</b> ruthenium 44	102.9 <b>Rh</b> rhodium 45	106.4 <b>Pd</b> palladium 46	107.9 <b>Ag</b> silver 47	112.4 <b>Cd</b> cadmium 48	126.9 <b>I</b> iodine 53	131.3 <b>Xe</b> xenon 54
132.9 <b>Cs</b> caesium 55	137.3 <b>Ba</b> barium 56	138.9 <b>La*</b> lanthanum 57	178.5 <b>Hf</b> hafnium 72	180.9 <b>Ta</b> tantalum 73	183.8 <b>W</b> tungsten 74	186.2 <b>Re</b> rhenium 75	190.2 <b>Os</b> osmium 76	192.2 <b>Ir</b> iridium 77	195.1 <b>Pt</b> platinum 78	197.0 <b>Au</b> gold 79	200.6 <b>Hg</b> mercury 80	209.0 <b>Bi</b> bismuth 83	[222] <b>Rn</b> radon 86
[223] <b>Fr</b> francium 87	[226] <b>Ra</b> radium 88	[227] <b>Ac*</b> actinium 89	[261] <b>Rf</b> rutherfordium 104	[262] <b>Db</b> dubnium 105	[266] <b>Sg</b> seaborgium 106	[264] <b>Bh</b> bohrium 107	[277] <b>Hs</b> hassium 108	[268] <b>Mt</b> meitnerium 109	[271] <b>Ds</b> darmstadtium 110	[272] <b>Rg</b> roentgenium 111	Elements with atomic numbers 112–116 have been reported but not fully authenticated		

140.1 <b>Ce</b> cerium 58	140.9 <b>Pr</b> praseodymium 59	144.2 <b>Nd</b> neodymium 60	144.9 <b>Pm</b> promethium 61	150.4 <b>Sm</b> samarium 62	152.0 <b>Eu</b> europium 63	157.2 <b>Gd</b> gadolinium 64	158.9 <b>Tb</b> terbium 65	162.5 <b>Dy</b> dysprosium 66	164.9 <b>Ho</b> holmium 67	167.3 <b>Er</b> erbium 68	168.9 <b>Tm</b> thulium 69	173.0 <b>Yb</b> ytterbium 70	175.0 <b>Lu</b> lutetium 71
232.0 <b>Th</b> thorium 90	[231] <b>Pa</b> protactinium 91	238.1 <b>U</b> uranium 92	[237] <b>Np</b> neptunium 93	[242] <b>Pu</b> plutonium 94	[243] <b>Am</b> americium 95	[247] <b>Cm</b> curium 96	[245] <b>Bk</b> berkelium 97	[251] <b>Cf</b> californium 98	[254] <b>Es</b> einsteinium 99	[253] <b>Fm</b> fermium 100	[256] <b>Md</b> mendelevium 101	[254] <b>No</b> nobelium 102	[257] <b>Lr</b> lawrencium 103