

OCR

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 =  $24.0 \text{ dm}^3 \text{ mol}^{-1}$  at RTP

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

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

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

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

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

#### 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 |

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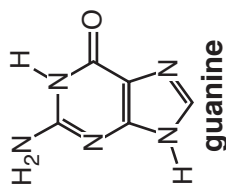
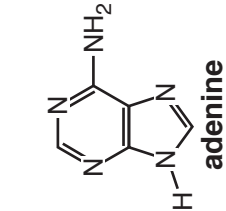
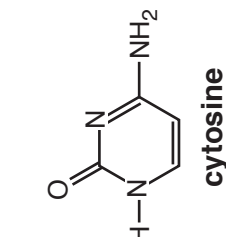
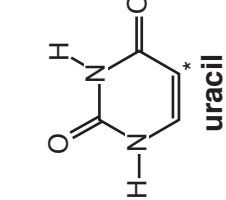
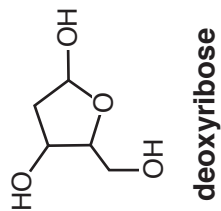
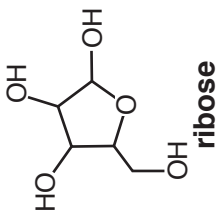
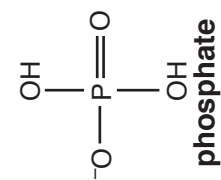
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### Characteristic infrared absorptions in organic molecules

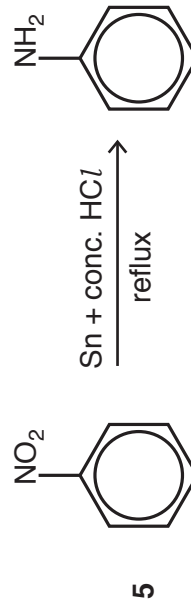
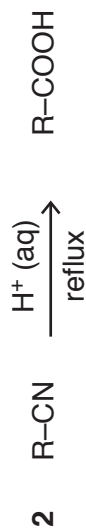
| Bond            | Location  | Wavenumber/cm <sup>-1</sup>  |
|-----------------|---|--|
| C-H             | Alkanes<br>Alkenes, arenes  | 2850–2950<br>3000–3100   |
| C-C             | Alkanes   | 750–1100   |
| C=C             | Alkenes   | 1620–1680  |
| aromatic<br>C=C | Arenes  | Several peaks in range<br>1450–1650 (variable)                             |
| C=O             | Aldehydes<br>Ketones<br>Carboxylic acids<br>Esters<br>Amides<br>Acyl chlorides<br>and acid anhydrides | 1720–1740<br>1705–1725<br>1700–1725<br>1735–1750<br>1630–1700<br>1750–1820 |
| C-O             | Alcohols, ethers, esters<br>and carboxylic acids  | 1000–1300  |
| C≡N             | Nitriles  | 2220–2260  |
| C-X             | Fluoroalkanes<br>Chloroalkanes<br>Bromoalkanes  | 1000–1350<br>600–800<br>500–600  |
| O-H             | Alcohols, phenols<br>Carboxylic acids   | 3200–3600 (broad)<br>2500–3300 (broad)                                     |
| N-H             | Primary amines<br>Amides  | 3300–3500<br>ca. 3500  |

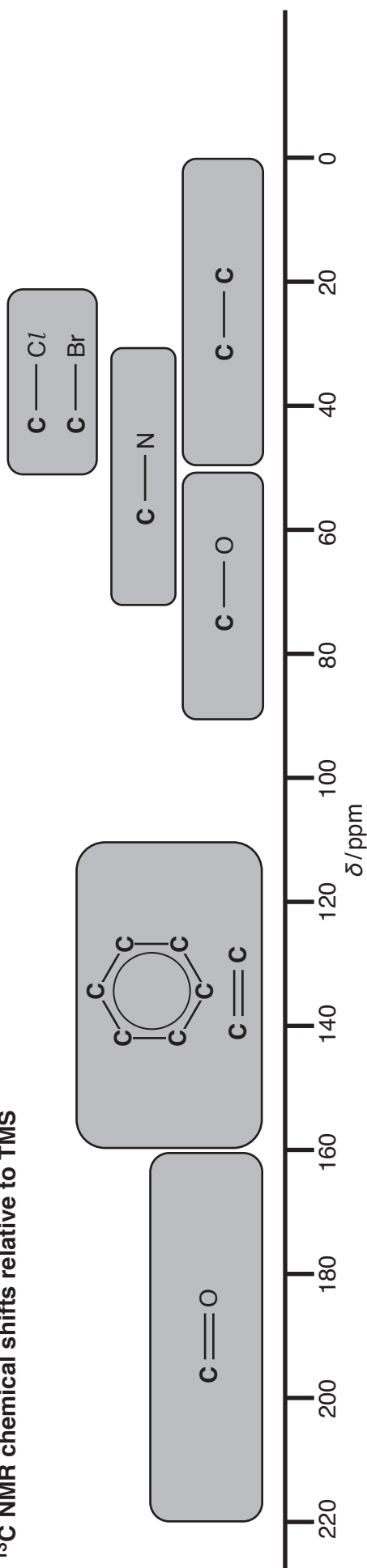
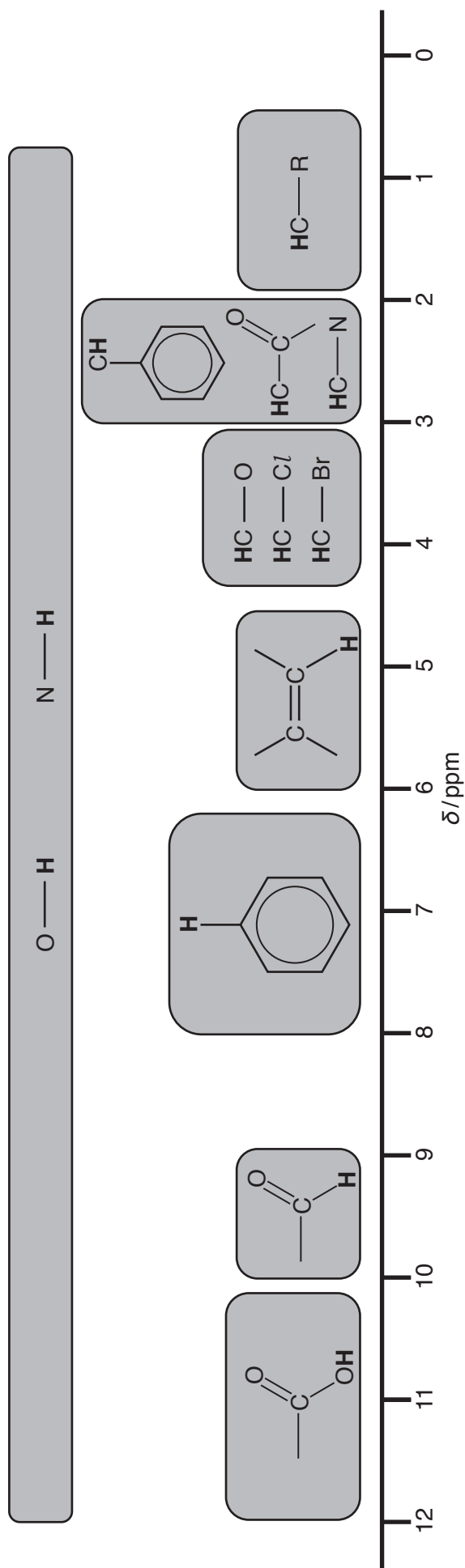
### Monomers of DNA and RNA



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

### Some useful organic reactions



**$^{13}\text{C}$  NMR chemical shifts relative to TMS** **$^1\text{H}$  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.  $\text{O}-\text{CH}_2-\text{C}=\text{O}$ , may be shifted more than indicated above.

# The Periodic Table of the Elements

(1) (2) (3) (4) (5) (6) (7) (0)

**Key**  
atomic number  
**Symbol**  
name  
relative atomic mass

|                                     |                                      |                                    |                                      |                                      |                                       |                                     |                                       |                                     |                                       |                                    |                                     |                                      |                                      |                                      |                                       |                                    |                                     |                                  |
|-------------------------------------|--------------------------------------|------------------------------------|--------------------------------------|--------------------------------------|---------------------------------------|-------------------------------------|---------------------------------------|-------------------------------------|---------------------------------------|------------------------------------|-------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|---------------------------------------|------------------------------------|-------------------------------------|----------------------------------|
| 1<br><b>H</b><br>hydrogen<br>1.0    |                                      |                                    |                                      |                                      |                                       |                                     |                                       |                                     |                                       |                                    |                                     |                                      |                                      |                                      |                                       |                                    | 18<br><b>He</b><br>helium<br>4.0    |                                  |
| 3<br><b>Li</b><br>lithium<br>6.9    | 4<br><b>Be</b><br>beryllium<br>9.0   |                                    |                                      |                                      |                                       |                                     |                                       |                                     |                                       |                                    |                                     |                                      |                                      |                                      |                                       | 9<br><b>F</b><br>fluorine<br>19.0  | 10<br><b>Ne</b><br>neon<br>20.2     |                                  |
| 11<br><b>Na</b><br>sodium<br>23.0   | 12<br><b>Mg</b><br>magnesium<br>24.3 |                                    |                                      |                                      |                                       |                                     |                                       |                                     |                                       |                                    |                                     |                                      |                                      |                                      |                                       | 16<br><b>S</b><br>sulfur<br>32.1   | 17<br><b>Cl</b><br>chlorine<br>35.5 | 18<br><b>Ar</b><br>argon<br>39.9 |
| 19<br><b>K</b><br>potassium<br>39.1 | 20<br><b>Ca</b><br>calcium<br>40.1   | 3<br><b>Sc</b><br>scandium<br>45.0 | 4<br><b>Ti</b><br>titanium<br>47.9   | 5<br><b>V</b><br>vanadium<br>50.9    | 6<br><b>Cr</b><br>chromium<br>52.0    | 7<br><b>Mn</b><br>manganese<br>54.9 | 8<br><b>Fe</b><br>iron<br>55.8        | 9<br><b>Co</b><br>cobalt<br>58.9    | 10<br><b>Ni</b><br>nickel<br>58.7     | 11<br><b>Cu</b><br>copper<br>63.5  | 12<br><b>Zn</b><br>zinc<br>65.4     | 13<br><b>B</b><br>boron<br>10.8      | 14<br><b>C</b><br>carbon<br>12.0     | 15<br><b>N</b><br>nitrogen<br>14.0   | 16<br><b>O</b><br>oxygen<br>16.0      | 17<br><b>F</b><br>fluorine<br>19.0 | 18<br><b>Ne</b><br>neon<br>20.2     |                                  |
| 37<br><b>Rb</b><br>rubidium<br>85.5 | 38<br><b>Sr</b><br>strontium<br>87.6 | 39<br><b>Y</b><br>yttrium<br>88.9  | 40<br><b>Zr</b><br>zirconium<br>91.2 | 41<br><b>Nb</b><br>niobium<br>92.9   | 42<br><b>Mo</b><br>molybdenum<br>95.9 | 43<br><b>Tc</b><br>technetium       | 44<br><b>Ru</b><br>ruthenium<br>101.1 | 45<br><b>Rh</b><br>rhodium<br>102.9 | 46<br><b>Pd</b><br>palladium<br>106.4 | 47<br><b>Ag</b><br>silver<br>107.9 | 48<br><b>Cd</b><br>cadmium<br>112.4 | 31<br><b>Ga</b><br>gallium<br>69.7   | 32<br><b>Ge</b><br>germanium<br>72.6 | 33<br><b>As</b><br>arsenic<br>74.9   | 34<br><b>Se</b><br>selenium<br>79.0   | 35<br><b>Br</b><br>bromine<br>79.9 | 36<br><b>Kr</b><br>krypton<br>83.8  |                                  |
| 55<br><b>Cs</b><br>caesium<br>132.9 | 56<br><b>Ba</b><br>barium<br>137.3   | 57-71<br>lanthanoids               | 72<br><b>Hf</b><br>hafnium<br>178.5  | 73<br><b>Ta</b><br>tantalum<br>180.9 | 74<br><b>W</b><br>tungsten<br>183.8   | 75<br><b>Re</b><br>rhenium<br>186.2 | 76<br><b>Os</b><br>osmium<br>190.2    | 77<br><b>Ir</b><br>iridium<br>192.2 | 78<br><b>Pt</b><br>platinum<br>195.1  | 79<br><b>Au</b><br>gold<br>197.0   | 80<br><b>Hg</b><br>mercury<br>200.6 | 49<br><b>In</b><br>indium<br>114.8   | 50<br><b>Sn</b><br>tin<br>118.7      | 51<br><b>Sb</b><br>antimony<br>121.8 | 52<br><b>Te</b><br>tellurium<br>127.6 | 53<br><b>I</b><br>iodine<br>126.9  | 54<br><b>Xe</b><br>xenon<br>131.3   |                                  |
| 87<br><b>Fr</b><br>francium         | 88<br><b>Ra</b><br>radium            | 89-103<br>actinoids                | 104<br><b>Rf</b><br>rutherfordium    | 105<br><b>Db</b><br>dubnium          | 106<br><b>Sg</b><br>seaborgium        | 107<br><b>Bh</b><br>bohrium         | 108<br><b>Hs</b><br>hassium           | 109<br><b>Mt</b><br>meitnerium      | 110<br><b>Ds</b><br>darmstadtium      | 111<br><b>Rg</b><br>roentgenium    | 112<br><b>Cn</b><br>copernicium     | 81<br><b>Tl</b><br>thallium<br>204.4 | 82<br><b>Pb</b><br>lead<br>207.2     | 83<br><b>Bi</b><br>bismuth<br>209.0  | 84<br><b>Po</b><br>polonium           | 85<br><b>At</b><br>astatine        | 86<br><b>Rn</b><br>radon            |                                  |

|                                       |                                     |  |                                       |  |                                      |                                      |  |                                     |  |                                     |                                    |                                     |                                       |                                      |
|---------------------------------------|-------------------------------------|--|---------------------------------------|--|--------------------------------------|--------------------------------------|--|-------------------------------------|--|-------------------------------------|------------------------------------|-------------------------------------|---------------------------------------|--------------------------------------|
| 57<br><b>La</b><br>lanthanum<br>138.9 | 58<br><b>Ce</b><br>cerium<br>140.1  | 59<br><b>Pr</b><br>praseodymium<br>140.9 | 60<br><b>Nd</b><br>neodymium<br>144.2 | 61<br><b>Pm</b><br>promethium<br>144.9 | 62<br><b>Sm</b><br>samarium<br>150.4 | 63<br><b>Eu</b><br>europium<br>152.0 | 64<br><b>Gd</b><br>gadolinium<br>157.2 | 65<br><b>Tb</b><br>terbium<br>158.9 | 66<br><b>Dy</b><br>dysprosium<br>162.5 | 67<br><b>Ho</b><br>holmium<br>164.9 | 68<br><b>Er</b><br>erbium<br>167.3 | 69<br><b>Tm</b><br>thulium<br>168.9 | 70<br><b>Yb</b><br>ytterbium<br>173.0 | 71<br><b>Lu</b><br>lutetium<br>175.0 |
| 89<br><b>Ac</b><br>actinium           | 90<br><b>Th</b><br>thorium<br>232.0 | 91<br><b>Pa</b><br>protactinium          | 92<br><b>U</b><br>uranium<br>238.1    | 93<br><b>Np</b><br>neptunium           | 94<br><b>Pu</b><br>plutonium         | 95<br><b>Am</b><br>americium         | 96<br><b>Cm</b><br>curium              | 97<br><b>Bk</b><br>berkelium        | 98<br><b>Cf</b><br>californium         | 99<br><b>Es</b><br>einsteinium      | 100<br><b>Fm</b><br>fermium        | 101<br><b>Md</b><br>mendelevium     | 102<br><b>No</b><br>nobelium          | 103<br><b>Lr</b><br>lawrencium       |