

**Advanced (Subsidiary) GCE
CHEMISTRY B (SALTERS)**

Data Sheet

Specimen

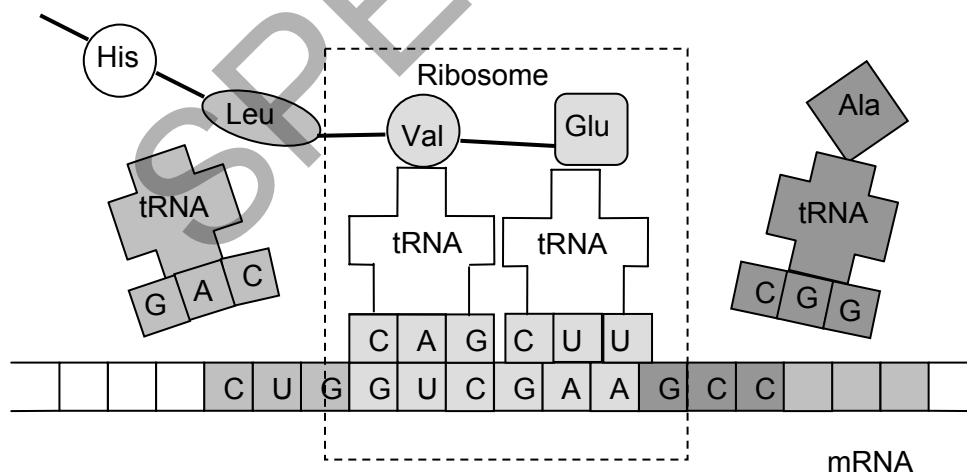


The information in this Sheet is for the use of candidates following Chemistry B (Salters) H035 and H435.

A copy of this sheet is included as an insert with each question paper.

Copies of this sheet may be used for teaching.


Diagram to illustrate protein synthesis



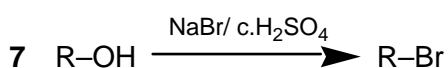
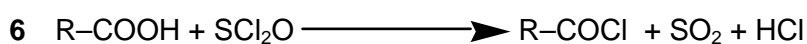
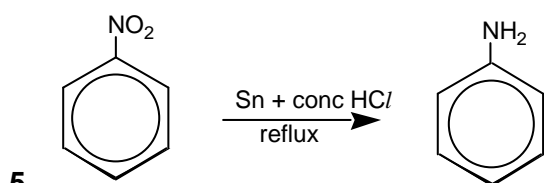
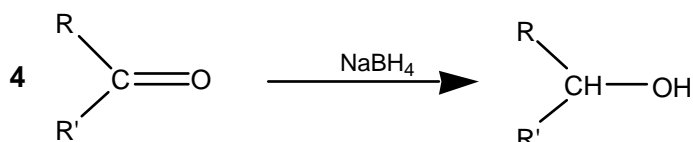
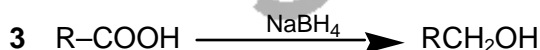
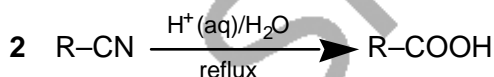
Adapted from Salters' Advanced Chemistry: Chemical Storylines by George Burton. Reprinted by permission of Harcourt Education.

This document consists of 4 printed pages.

Characteristic infrared absorption in organic molecules

| Bond | Location | Wavenumber/cm ⁻¹ | Intensity |
|------------|--|-------------------------------------|-----------|
| C-H | alkanes | 2850–2950 | M-S |
| | alkenes, arenes | 3000–3100 | M-S |
| | alkynes | ca. 3300 | S |
| 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 | ca. 3500 | M |




Some useful organic reactions



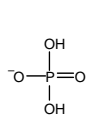
Chemical shifts for some types of protons (¹H) in NMR spectra

Chemical shifts are for hydrogen (¹H) relative to TMS (tetramethylsilane).

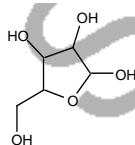
They are typical values and can vary slightly depending on the solvent, concentration and substituents.

| Type of proton | Chemical shift, δ ppm | Type of proton | Chemical shift, δ ppm |
|---|------------------------------|---|------------------------------|
| CH ₃ -C | 0.7-1.6 | —  H | 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 | -C-CHO | 9.4-10.0 |
| >CH-C $\begin{array}{c} \text{O} \\ \\ \text{C} \end{array}$ carbonyls esters amides acids | 2.0-2.7 | -C-OH | 0.5-4.5* |
| -CH-N amines amides | 2.3-2.9 | —  OH | 4.5-10.0* |
|  -CH | 2.3-3.0 | -C-NH | 1.0-5.0* |
| -O-CH alcohols esters ethers | 3.3-4.8 | -CO-NH | 5.0-12.0* |
| -CH-Cl or Br | 3.0-4.2 | -CO-OH | 9.0-15.0* |
| -CH=CH- | 4.5-6.0 | *these signals are <i>very</i> variable (sometimes outside these limits) and often broad. | |

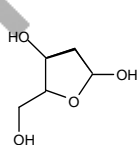
Monomers of DNA and RNA



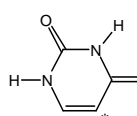
phosphate



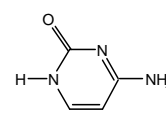
ribose



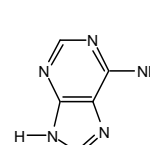
deoxyribose



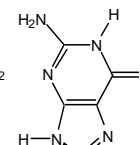
uracil



cytosine



adenine



guanine

(thymine has a -CH₃ at position *)

Copyright Acknowledgements:

Sources

Diagram to illustrate protein synthesis adapted from Salters' Advanced Chemistry: Chemical Storylines by George Burton. Reprinted by permission of Harcourt Education.

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The Periodic Table of the Elements

| 1 | 2 | | | | | | | | | | | 3 | 4 | 5 | 6 | 7 | 0 | | |
|---|---|---|---|---|--|--|--|--|--|---|--|---|---|---|--|---|---|--|---|
| | | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 1.0 H hydrogen 1 </div> | | | | | | | | | | | | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 4.0 He helium 2 </div> | | | | | |
| | | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> Key relative atomic mass atomic symbol <small>name</small> atomic (proton) number </div> | | | | | | | | | | | | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 10.8 B boron 5 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 12.0 C carbon 6 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 14.0 N nitrogen 7 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 16.0 O oxygen 8 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 19.0 F fluorine 9 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 20.2 Ne neon 10 </div> |
| | | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 23.0 Na sodium 11 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 24.3 Mg magnesium 12 </div> | | | | | | | | | | | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 27.0 Al aluminium 13 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 28.1 Si silicon 14 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 31.0 P phosphorus 15 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 32.1 S sulfur 16 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 35.5 Cl chlorine 17 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 39.9 Ar argon 18 </div> |
| <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 39.1 K potassium 19 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 40.1 Ca calcium 20 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 45.0 Sc scandium 21 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 47.9 Ti titanium 22 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 50.9 V vanadium 23 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 52.0 Cr chromium 24 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 54.9 Mn manganese 25 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 55.8 Fe iron 26 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 58.9 Co cobalt 27 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 58.7 Ni nickel 28 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 63.5 Cu copper 29 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 65.4 Zn zinc 30 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 69.7 Ga gallium 31 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 72.6 Ge germanium 32 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 74.9 As arsenic 33 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 79.0 Se selenium 34 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 79.9 Br bromine 35 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 83.8 Kr krypton 36 </div> | | |
| <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 85.5 Rb rubidium 37 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 87.6 Sr strontium 38 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 88.9 Y yttrium 39 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 91.2 Zr zirconium 40 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 92.9 Nb niobium 41 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 95.9 Mo molybdenum 42 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> [98] Tc technetium 43 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 101.1 Ru ruthenium 44 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 102.9 Rh rhodium 45 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 106.4 Pd palladium 46 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 107.9 Ag silver 47 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 112.4 Cd cadmium 48 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 114.8 In indium 49 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 118.7 Sn tin 50 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 121.8 Sb antimony 51 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 127.6 Te tellurium 52 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 126.9 I iodine 53 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 131.3 Xe xenon 54 </div> | | |
| <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 132.9 Cs caesium 55 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 137.3 Ba barium 56 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 138.9 La* lanthanum 57 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 178.5 Hf hafnium 72 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 180.9 Ta tantalum 73 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 183.8 W tungsten 74 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 186.2 Re rhenium 75 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 190.2 Os osmium 76 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 192.2 Ir iridium 77 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 195.1 Pt platinum 78 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 197.0 Au gold 79 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 200.6 Hg mercury 80 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 204.4 Tl thallium 81 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 207.2 Pb lead 82 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 209.0 Bi bismuth 83 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> [209] Po polonium 84 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> [210] At astatine 85 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> [222] Rn radon 86 </div> | | |
| <div style="border: 1px solid black; padding: 5px; display: inline-block;"> [223] Fr francium 87 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> [226] Ra radium 88 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> [227] Ac* actinium 89 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> [261] Rf rutherfordium 104 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> [262] Db dubnium 105 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> [266] Sg seaborgium 106 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> [264] Bh bohrium 107 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> [277] Hs hassium 108 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> [268] Mt meitnerium 109 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> [271] Ds darmstadtium 110 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> [272] Rg roentgenium 111 </div> | Elements with atomic numbers 112–116 have been reported but not fully authenticated | | | | | | | | |

| | | | | | | | | | | | | | |
|--|---|--|---|--|--|---|--|--|--|---|---|--|--|
| <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 140.1 Ce cerium 58 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 140.9 Pr praseodymium 59 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 144.2 Nd neodymium 60 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 144.9 Pm promethium 61 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 150.4 Sm samarium 62 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 152.0 Eu europium 63 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 157.2 Gd gadolinium 64 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 158.9 Tb terbium 65 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 162.5 Dy dysprosium 66 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 164.9 Ho holmium 67 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 167.3 Er erbium 68 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 168.9 Tm thulium 69 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 173.0 Yb ytterbium 70 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 175.0 Lu lutetium 71 </div> |
| <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 232.0 Th thorium 90 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> [231] Pa protactinium 91 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 238.1 U uranium 92 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> [237] Np neptunium 93 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> [242] Pu plutonium 94 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> [243] Am americium 95 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> [247] Cm curium 96 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> [245] Bk berkelium 97 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> [251] Cf californium 98 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> [254] Es einsteinium 99 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> [253] Fm fermium 100 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> [256] Md mendelevium 101 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> [254] No nobelium 102 </div> | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> [257] Lr lawrencium 103 </div> |