



A-level
CHEMISTRY

7405

Data Booklet

This Data Booklet is provided with AQA A-level Chemistry question papers.

The Periodic Table of the Elements

| 1 | 2 | | | | | | | | | | | 3 | 4 | 5 | 6 | 7 | 0 | | |
|--------------------------------------|--------------------------------------|---|--|--------------------------------------|---|---------------------------------------|---------------------------------------|---|---|--|--|---------------------------------------|--|--|--|---|---------------------------------------|------|---------------------------------|
| | | | | | | | | | | | | | | | | | | (18) | |
| | | | | | | | | | | | | | | | | | | | 4.0 He helium 2 |
| (1) | (2) | Key relative atomic mass symbol name atomic (proton) number | | | | | | | | | | (13) | (14) | (15) | (16) | (17) | | | |
| 6.9 Li lithium 3 | 9.0 Be beryllium 4 | | | | | | | | | | | 10.8 B boron 5 | 12.0 C carbon 6 | 14.0 N nitrogen 7 | 16.0 O oxygen 8 | 19.0 F fluorine 9 | 20.2 Ne neon 10 | | |
| 23.0 Na sodium 11 | 24.3 Mg magnesium 12 | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | 27.0 Al aluminium 13 | 28.1 Si silicon 14 | 31.0 P phosphorus 15 | 32.1 S sulfur 16 | 35.5 Cl chlorine 17 | 39.9 Ar argon 18 | | |
| 39.1 K potassium 19 | 40.1 Ca calcium 20 | 45.0 Sc scandium 21 | 47.9 Ti titanium 22 | 50.9 V vanadium 23 | 52.0 Cr chromium 24 | 54.9 Mn manganese 25 | 55.8 Fe iron 26 | 58.9 Co cobalt 27 | 58.7 Ni nickel 28 | 63.5 Cu copper 29 | 65.4 Zn zinc 30 | 69.7 Ga gallium 31 | 72.6 Ge germanium 32 | 74.9 As arsenic 33 | 79.0 Se selenium 34 | 79.9 Br bromine 35 | 83.8 Kr krypton 36 | | |
| 85.5 Rb rubidium 37 | 87.6 Sr strontium 38 | 88.9 Y yttrium 39 | 91.2 Zr zirconium 40 | 92.9 Nb niobium 41 | 96.0 Mo molybdenum 42 | [97] Tc technetium 43 | 101.1 Ru ruthenium 44 | 102.9 Rh rhodium 45 | 106.4 Pd palladium 46 | 107.9 Ag silver 47 | 112.4 Cd cadmium 48 | 114.8 In indium 49 | 118.7 Sn tin 50 | 121.8 Sb antimony 51 | 127.6 Te tellurium 52 | 126.9 I iodine 53 | 131.3 Xe xenon 54 | | |
| 132.9 Cs caesium 55 | 137.3 Ba barium 56 | 138.9 La * lanthanum 57 | 178.5 Hf hafnium 72 | 180.9 Ta tantalum 73 | 183.8 W tungsten 74 | 186.2 Re rhenium 75 | 190.2 Os osmium 76 | 192.2 Ir iridium 77 | 195.1 Pt platinum 78 | 197.0 Au gold 79 | 200.6 Hg mercury 80 | 204.4 Tl thallium 81 | 207.2 Pb lead 82 | 209.0 Bi bismuth 83 | [209] Po polonium 84 | [210] At astatine 85 | [222] Rn radon 86 | | |
| [223] Fr francium 87 | [226] Ra radium 88 | [227] Ac † actinium 89 | [267] Rf rutherfordium 104 | [270] Db dubnium 105 | [269] Sg seaborgium 106 | [270] Bh bohrium 107 | [270] Hs hassium 108 | [278] Mt meitnerium 109 | [281] Ds darmstadtium 110 | [281] Rg roentgenium 111 | [285] Cn copernicium 112 | [286] Nh nihonium 113 | [289] Fl flerovium 114 | [289] Mc moscovium 115 | [293] Lv livermorium 116 | [294] Ts tennessine 117 | [294] Og oganeson 118 | | |

* 58 – 71 Lanthanides

† 90 – 103 Actinides

| | | | | | | | | | | | | | |
|-------------------------------------|--|---------------------------------------|--|---------------------------------------|---------------------------------------|--|---------------------------------------|---|---|--------------------------------------|--|---------------------------------------|---|
| 140.1 Ce cerium 58 | 140.9 Pr praseodymium 59 | 144.2 Nd neodymium 60 | [145] Pm promethium 61 | 150.4 Sm samarium 62 | 152.0 Eu europium 63 | 157.3 Gd gadolinium 64 | 158.9 Tb terbium 65 | 162.5 Dy dysprosium 66 | 164.9 Ho holmium 67 | 167.3 Er erbium 68 | 168.9 Tm thulium 69 | 173.0 Yb ytterbium 70 | 175.0 Lu lutetium 71 |
| 232.0 Th thorium 90 | 231.0 Pa protactinium 91 | 238.0 U uranium 92 | [237] Np neptunium 93 | [244] Pu plutonium 94 | [243] Am americium 95 | [247] Cm curium 96 | [247] Bk berkelium 97 | [251] Cf californium 98 | [252] Es einsteinium 99 | [257] Fm fermium 100 | [258] Md mendelevium 101 | [259] No nobelium 102 | [262] Lr lawrencium 103 |

Data Sheet

Table A

Infrared absorption data

| Bond | Wavenumber /cm ⁻¹ |
|-------------------|------------------------------|
| N-H (amines) | 3300-3500 |
| O-H (alcohols) | 3230-3550 |
| C-H | 2850-3300 |
| O-H (acids) | 2500-3000 |
| C≡N | 2220-2260 |
| C=O | 1680-1750 |
| C=C | 1620-1680 |
| C-O | 1000-1300 |
| C-C | 750-1100 |


Table B

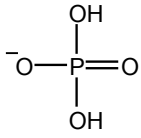
¹H NMR chemical shift data

| Type of proton | δ/ppm |
|---|-----------|
| ROH | 0.5-5.0 |
| RCH ₃ | 0.7-1.2 |
| RNH ₂ | 1.0-4.5 |
| R ₂ CH ₂ | 1.2-1.4 |
| R ₃ CH | 1.4-1.6 |
| $\begin{array}{c} \\ \text{R}-\text{C}-\text{C}- \\ \quad \\ \text{O} \quad \text{H} \end{array}$ | 2.1-2.6 |
| $\begin{array}{c} \text{R}-\text{O}-\text{C}- \\ \\ \text{H} \end{array}$ | 3.1-3.9 |
| RCH ₂ Cl or Br | 3.1-4.2 |
| $\begin{array}{c} \\ \text{R}-\text{C}-\text{O}-\text{C}- \\ \quad \\ \text{O} \quad \text{H} \end{array}$ | 3.7-4.1 |
| $\begin{array}{c} \text{R} \quad \text{H} \\ \diagdown \quad / \\ \text{C}=\text{C} \\ / \quad \diagdown \end{array}$ | 4.5-6.0 |
| $\begin{array}{c} \text{O} \\ // \\ \text{R}-\text{C} \\ \backslash \\ \text{H} \end{array}$ | 9.0-10.0 |
| $\begin{array}{c} \text{O} \\ // \\ \text{R}-\text{C} \\ \backslash \\ \text{O}-\text{H} \end{array}$ | 10.0-12.0 |

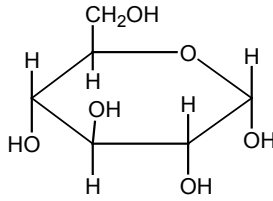
Table C

¹³C NMR chemical shift data

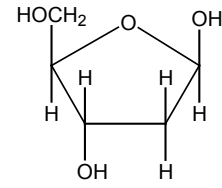
| Type of carbon | δ/ppm |
|--|---------|
| $\begin{array}{c} \quad \\ -\text{C}-\text{C}- \\ \quad \end{array}$ | 5-40 |
| $\begin{array}{c} \\ \text{R}-\text{C}-\text{Cl or Br} \\ \end{array}$ | 10-70 |
| $\begin{array}{c} \\ \text{R}-\text{C}-\text{C}- \\ \quad \\ \text{O} \quad \end{array}$ | 20-50 |
| $\begin{array}{c} \quad / \\ \text{R}-\text{C}-\text{N} \\ \quad \backslash \end{array}$ | 25-60 |
| $\begin{array}{c} \\ -\text{C}-\text{O}- \\ \end{array}$ alcohols, ethers or esters | 50-90 |
| $\begin{array}{c} \diagdown \quad / \\ \text{C}=\text{C} \\ \diagup \quad \diagdown \end{array}$ | 90-150 |
| R-C≡N | 110-125 |
|  | 110-160 |
| $\begin{array}{c} \text{O} \\ // \\ \text{R}-\text{C}- \\ \backslash \\ \text{O} \end{array}$ esters or acids | 160-185 |
| $\begin{array}{c} \text{O} \\ // \\ \text{R}-\text{C}- \\ \backslash \\ \text{O} \end{array}$ aldehydes or ketones | 190-220 |

Phosphate and sugars

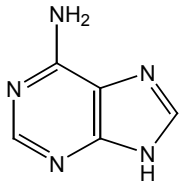
phosphate



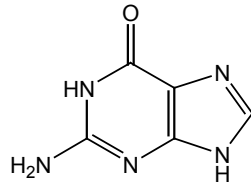
glucose



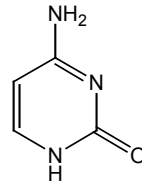
2-deoxyribose

Bases

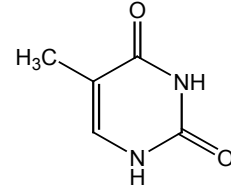
adenine



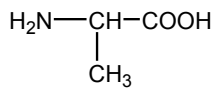
guanine



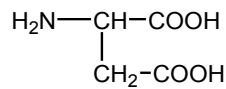
cytosine



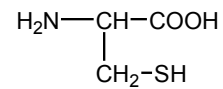
thymine

Amino acids

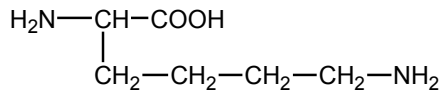
alanine



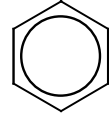
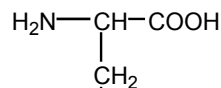
aspartic acid



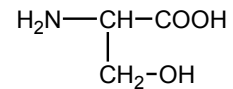
cysteine



lysine



phenylalanine



serine

Haem B