

Contents

- 1 States of matter**
 - 1.1 Everything is made of particles 6
 - 1.2 Solids, liquids, and gases 8
 - 1.3 Particles in solids, liquids, and gases 10
 - 1.4 A closer look at gases 12
 - 1.5 Mixtures, solutions and solvents 14
 - 1.6 Pure substances and impurities 16
 - 1.7 Separation methods (I) 18
 - 1.8 Separation methods (II) 20
 - 1.9 More about chromatography 22
 - Questions on Chapter 1 24
- 2 The atom**
 - 2.1 Atoms, elements, and compounds 26
 - 2.2 More about atoms 28
 - 2.3 Isotopes and radioactivity 30
 - 2.4 How electrons are arranged 32
 - Questions on Chapter 2 34
- 3 Atoms combining**
 - 3.1 Why compounds form 36
 - 3.2 The ionic bond 38
 - 3.3 More about ions 40
 - 3.4 Ionic compounds and their properties 42
 - 3.5 The covalent bond 44
 - 3.6 Covalent compounds 46
 - 3.7 Molecular substances 48
 - 3.8 Giant covalent structures 50
 - 3.9 The bonding in metals 52
 - 3.10 Bonding, structure and properties: a review 54
 - Questions on Chapter 3 56
- 4 The Periodic Table**
 - 4.1 An overview of the Periodic Table 58
 - 4.2 Group 1: the alkali metals 60
 - 4.3 The patterns within Group 1 62
 - 4.4 Group 7: the halogens 64
 - 4.5 Group 0: the noble gases 66
 - 4.6 The transition elements 68
 - 4.7 Across the Periodic Table 70
 - Questions on Chapter 4 72
- 5 The mole**
 - 5.1 The names and formulae of compounds 74
 - 5.2 The masses of atoms, molecules, and ions 76
 - 5.3 Percentage composition of a compound 78
 - 5.4 The mole 80
 - 5.5 The empirical formula 82
 - 5.6 From empirical to final formula 84
 - 5.7 The concentration of a solution 86
 - Questions on Chapter 5 88
- 6 Chemical equations**
 - 6.1 Physical and chemical change 90
 - 6.2 Equations for chemical reactions 92
 - 6.3 Calculations from equations 94
 - 6.4 Reactions involving gases 96
 - 6.5 Finding % yield and % purity 98
 - Questions on Chapter 6 100
- 7 Redox reactions**
 - 7.1 Different types of reaction 102
 - 7.2 Oxidation and reduction 104
 - 7.3 Redox and electron transfer 106
 - 7.4 Changes in oxidation state 108
 - 7.5 Oxidising and reducing agents 110
 - Questions on Chapter 7 112
- 8 Acids and bases**
 - 8.1 Acids and alkalis 114
 - 8.2 A closer look at acids and alkalis 116
 - 8.3 The reactions of acids and bases 118
 - 8.4 A closer look at neutralisation 120
 - 8.5 Acids and bases outside the lab 122
 - 8.6 Making salts 124
 - 8.7 Making insoluble salts by precipitation 126
 - 8.8 Finding concentrations by titration 128
 - Questions on Chapter 8 130
- 9 Electricity and chemical change**
 - 9.1 Conductors and insulators 132
 - 9.2 The principles of electrolysis 134
 - 9.3 The electrolysis of solutions 136
 - 9.4 The electrolysis of brine 138
 - 9.5 Two more uses of electrolysis 140
 - Questions on Chapter 9 142
- 10 How fast are reactions?**
 - 10.1 Rates of reaction 144
 - 10.2 Measuring the rate of a reaction 146
 - 10.3 Changing the rate of a reaction (I) 148
 - 10.4 Changing the rate of a reaction (II) 150

- 10.5 Explaining rates 152
- 10.6 Catalysts 154
- 10.7 Enzymes: biological catalysts 156
- Questions on Chapter 10 158

- 11 Energy changes, and reversible reactions**
- 11.1 Energy changes in reactions 160
- 11.2 Explaining energy changes 162
- 11.3 Energy from fuels 164
- 11.4 Reversible reactions 166
- 11.5 Shifting the equilibrium 168
- Questions on Chapter 11 170

- 12 The behaviour of metals**
- 12.1 Metals and non-metals 172
- 12.2 Comparing metals for reactivity (I) 174
- 12.3 Comparing metals for reactivity (II) 176
- 12.4 The reactivity series 178
- 12.5 Making use of the reactivity series 180
- Questions on Chapter 12 182

- 13 Making use of metals**
- 13.1 Metals in the Earth's crust 184
- 13.2 Extracting metals from their ores 186
- 13.3 Extracting iron 188
- 13.4 Extracting aluminium 190
- 13.5 Making use of metals 192
- 13.6 Steels and other alloys 194
- 13.7 Corrosion 196
- 13.8 Mining, using, and recycling metals 198
- Questions on Chapter 13 200

- 14 Air and water**
- 14.1 What is air? 202
- 14.2 Making use of air 204
- 14.3 Pollution alert! 206
- 14.4 Water supply 208
- Questions on Chapter 14 210

- 15 Non-metals: hydrogen and nitrogen**
- 15.1 Hydrogen 212
- 15.2 Nitrogen and ammonia 214
- 15.3 Making ammonia in industry 216
- 15.4 Fertilisers 218
- Questions on Chapter 15 220

- 16 Non-metals: oxygen, sulphur, chlorine, and carbon**
- 16.1 Oxygen 222
- 16.2 Oxides 224
- 16.3 Sulphur and sulphur dioxide 226
- 16.4 Sulphuric acid 228
- 16.5 Chlorine 230
- 16.6 Carbon and its compounds 232
- 16.8 Limestone 234
- Questions on Chapter 16 236

- 17 Organic chemistry**
- 17.1 Oil: a source of useful compounds 238
- 17.2 Separating oil into fractions 240
- 17.3 Cracking hydrocarbons 242
- 17.4 The alkanes 244
- 17.5 The alkenes 246
- 17.6 The alcohols 248
- 17.7 The manufacture of ethanol 250
- 17.8 Carboxylic acids, and esters 252
- Questions on Chapter 17 254

- 18 Polymers**
- 18.1 Introducing polymers 256
- 18.2 Addition polymerisation 258
- 18.3 Condensation polymerisation 260
- 18.4 Making use of synthetic polymers 262
- 18.5 Plastics: here to stay? 264
- 18.6 The macromolecules in food (I) 266
- 18.7 The macromolecules in food (II) 268
- 18.8 Breaking down the macromolecules 270
- Questions on Chapter 18 272

- Cambridge IGCSE exam questions**
- Core material 274
- Extended material 282

- Working in the lab**
- Working with gases in the lab 288
- Testing for ions in the lab 290
- Safety first! 292

- Reference**
- Answers to numerical questions 293
- Glossary 294
- The Periodic Table and atomic masses 298
- Index 300