Contents

Unit 1: How can the diversity of materials be explained?

AREA OF STUDY 1: How can knowledge of elements explain the properties of matter?

Key knowledge 2

Worksheets

Worksheet 1 Crossword—atomic theory 12
Worksheet 2 Protons, neutrons and electrons—structure of the atom 13
Worksheet 3 Filling shells—electronic configuration 14
Worksheet 4 Organising elements—the modern periodic table 15
Worksheet 5 Tracking trends—patterns in properties in the periodic table 16
Worksheet 6 Particles and properties—materials 17
Worksheet 7 The inside story on metals—metallic bonding model 18
Worksheet 8 Mining and modifying metals—properties by design 19
Worksheet 9 The inside story on salts—ionic bonding model 20
Worksheet 10 Charged particles—ions and ionic formulas 21
Worksheet 11 Exploring relative mass—a sweet student activity 22
Worksheet 12 Marvellous moles—the chemist's unit of measurement 23
Worksheet 13 A teaspoon of sugar—mole and mass calculations 24

Practical activities

Activity 1 Particle theory of matter 25
Activity 2 Flame colours of selected metals 28
Activity 3 Period 3 elements 30
Activity 4 Periodic variation of properties—analysis of second-hand data 33
Activity 5 Growing metal crystals 36
Activity 6 Investigating ionic compounds 38
Activity 7 Mole simulations and applications 40
Activity 8 Chemical composition of a compound 44

AREA OF STUDY 2: How can the versatility of non-metals be explained?

Key knowledge 48

Worksheets

Worksheet 14 Crossword—covalent bonding 57
Worksheet 15 The inside story on molecules—covalent molecular compounds 58
Worksheet 16 Asymmetrical molecules—electronegativity and polarity 59
Worksheet 17 Compositions of compounds—empirical and molecular formulas 60
Worksheet 18 Comparing structures—metallic, ionic and covalent bonding models 61
Worksheet 19 Allotropes of carbon—different faces of an element 62
Worksheet 20 Families of hydrocarbons—alkanes, alkenes and alkynes 63
Worksheet 21 Families of organic molecules—alcohols, carboxylic acids and esters 65
Worksheet 22 Making giant molecules—monomers to polymers 66
Worksheet 23 Polymers by design—modifying properties 67
Worksheet 24 Maintaining balance—chemical formulas and equations 68

Practical activities

Activity 9 Making molecular models 69
Activity 10 Comparing the physical properties of three covalent lattices 72
Activity 11 Investigating hydrocarbons 75
Activity 12 Modelling functional groups 78
Activity 13 Reactions and properties of some organic compounds 81
Activity 14 Modelling polymers 84
Activity 15 Making Ghostbuster slime 86

AREA OF STUDY 3: Research investigation

Research project presentation template 90
Skills worksheet: Analysing articles, websites and other sources 92

Sample pages

Contents

Unit 2: What makes water such a unique chemical?

AREA OF STUDY 1: How do substances interact with water?

Key knowledge 96

Worksheets

Worksheet 25 Wonderful water—structure and properties 104
Worksheet 26 Specific heat capacity—calculating energy 105
Worksheet 27 Latent heat—calculating energy 106
Worksheet 28 Dissolving compounds—predicting how solutes will disperse 107
Worksheet 29 Solving solubility—predicting precipitation reactions 108
Worksheet 30 Recording reactions—full and ionic chemical equations 109
Worksheet 31 Concentration and strength—picturing acids and bases 110
Worksheet 32 Crossword—acids and bases 111
Worksheet 33 Reactions of acids—predicting products 112
Worksheet 34 Molarity—measuring moles in solution 113
Worksheet 35 Acidity of solutions—calculating pH 114
Worksheet 36 Solving complex calculations—using more than one formula 116
Worksheet 37 Matchmaker—redox reactions 117
Worksheet 38 Metals and their cations—writing half-equations 118
Worksheet 39 Reactivity series of metals—writing equations 119

Practical activities

Activity 16 Determination of solubility of a salt 120
Activity 17 Precipitation reactions 123
Activity 18 Relative strengths of acids 127
Activity 19 Amphiprotic substances in water 129
Activity 20 Reactions of HCl 131
Activity 21 Reactivity series of metals 135
Activity 22 Corrosion 137

AREA OF STUDY 2: How are substances in water measured and analysed?

Key knowledge 142

Worksheets

Worksheet 40 What's in a glass of water?—Find out what you are drinking 150
Worksheet 41 Water sampling protocols—choose your chemical 151
Worksheet 42 Measuring concentration—conversion of units 152
Worksheet 43 Stoichiometry 1—mass–mass calculations 153
Worksheet 44 Stoichiometry 2—excess reactants 154
Worksheet 45 Gravimetric analysis—measurements of mass 155
Worksheet 46 Analysis with light—colorimetry and UV-visible spectroscopy 156
Worksheet 47 Atomic absorption spectroscopy 158
Worksheet 48 Particles on the move—chromatography 159
Worksheet 49 Knowing the concentration—standard solutions 160
Worksheet 50 Matchmaker—volumetric analysis techniques 161
Worksheet 51 Acid–base titrations—calculations using volume 162
Worksheet 52 Crossword—measuring and analysing substances in water 163

Practical activities

Activity 23 Products of a decomposition reaction 164
Activity 24 Gravimetric determination of sulfur as sulfate in fertiliser 166
Activity 25 Chomatography of Smarties 169
Activity 26 Preparation of a standard solution 171
Activity 27 Analysis of HCl content in brick cleaner 173

AREA OF STUDY 3: Practical investigation

Scientific poster template 178
Skills worksheet: Developing practical investigation skills 180

APPENDIX

Appendix 1 The periodic table 183

Sample pages