Scheme of Work
for the
Academic Year 2015/2016

AS Chemistry

Unit 1: The Core Principles of Chemistry

1.3 Formulae, equations and amounts of substance

Lesson number	Lesson title	Month	No. of Periods	Specification references
1	Introduction to Advanced GCE in Chemistry and links with GCSE in Science (atoms, elements, ions, molecules, compounds and balanced equations)	June	20	1.3a, b
2	Displacement reactions and reactions of acids			1.3b, k
3	Precipitation reactions			1.3b, k
4	Reacting quantities: molar mass			1.3c
5	The Avogadro constant			1.3h
6	Empirical and molecular formulae			1.3a
7	Linking reacting quantities to chemical equations			1.3e
8	Reacting quantities: volumes of gases			1.3f
9	How much hydrogen is produced when lithium reacts with water?			1.3i
10	Describing concentrations in gases and solutions			1.3c, d
11	The percentage yield of a chemical reaction	July	10	1.3g
12	Calculating the percentage yield from the preparation of a salt ***(internal assessment opportunity: activity ASD1)*** ***(internal assessment opportunity: activity ASD2)***			1.3j
13	The importance of atom economy			1.3g

1.4 Energetics

Lesson number	Lesson title	Month	No. Of Periods	Specification references
1	Enthalpy change and exothermic and endothermic reactions	July	30	1.4a, b, c
2	Standard enthalpy changes			1.4d
3	An introduction to measuring enthalpy changes			1.4d, f
4	Measuring enthalpy change in an insulated container ***(internal assessment opportunity: activity ASC2)***			1.4f(i)
5	Measuring enthalpy of combustion			1.4f(ii)
6	An introduction to Hess's Law			1.4e
7	Hess's Law calculations			1.4e
8	Measuring an enthalpy change indirectly ***(internal assessment opportunity: activity ASC4)***			1.4e, f(iii)
9	Using bond enthalpy to find enthalpy changes			1.4g
10	Making predictions about reactions using bond enthalpy data			1.4g

1.5 Atomic structure and the periodic table

Lesson number	Lesson title	Month	No. Of Periods	Specification references
1	Relative masses in chemistry	September	30	1.5a
2	Measuring relative isotopic mass, relative atomic mass and relative molecular mass using a mass spectrometer, and further uses of mass spectrometers			1.5b, c
3	Ionisation energy			1.5d
4	Evidence for quantum shells			1.5e(i)
5	Evidence for electron sub-shells – the trend in ionisation energy across a period			1.5e(ii), k(ii)
6	The shapes of s and p orbitals			1.5f
7	The electronic configuration of the atoms from hydrogen to krypton			1.5g
8	The relationship between electronic structure and chemical properties			1.5h
9	The periodic table and periodic properties and explaining trends in melting temperature across the period			1.5i, j, k(i, ii)

1.6 Bonding

Lesson number	Lesson title	Month	No. Of Periods	Specification references
1	What are ions and what evidence is there for them?	Sep/Oct	30	1.6.1a, b, c
2	Ionic compounds			1.6.1a, d, e
3	Trends in the sizes of ions			1.6.1f
4	Measuring the energy formation of an ionic lattice			1.6.1g
5	Why don't experimental values always match with theoretical predictions of lattice energy?			1.6.1h, i, j, k
6	Predicting the formula of ionic compounds			1.6.1l
7	What are covalent bonds and what evidence is there for them?			1.6.2a
8	Diagrams for simple covalent molecules			1.6.2b
9	What is metallic bonding?			1.6.3a, b, c

1.7 Introductory organic chemistry

Lesson number	Lesson title	Month	No. Of Periods	Specification references
1	How do we deal with hazards and risks in organic chemistry?	Oct/Nov	30	1.7.1c, d
2	Naming organic molecules			1.7.1a, b
3	An introduction to alkanes and their use as fuels			1.7.2a, b, c
4	Where are alkanes obtained from?			1.7.2c
5	The need for alternative fuels			1.7.2d
6	The mechanism for the reaction of alkanes with halogens			1.7.2e
7	Bonding in alkenes: σ and π bonds			1.7.3a
8	Geometric isomerism in alkenes			1.7.3b, c
9	Reactions of alkenes and testing for alkenes ***(internal assessment opportunity: activity ASB3)***			1.7.3d, f
10	Mechanisms for addition reactions of alkenes			1.7.3e
11	Addition polymerisation of alkenes			1.7.3g
12	More sustainable production of polymers			1.7.3h

Unit 2: Application of Core Principles of Chemistry

2.3 Shapes of molecules and ions

Lesson number	Lesson title	Month	No. of Periods	Specification references
1	An introduction to electron-pair repulsion theory	Jan	10	2.3a
2	Shapes of common molecules			2.3b, c, d
3	Giant structures of carbon			2.3e

2.4 Intermediate bonding and bond polarity

Lesson number	Lesson title	Month	No. of Periods	Specification references
1	Ionic to covalent: a continuum	Jan	10	2.4a, b
2	Polar molecules			2.4c, d

2.5 Intermolecular forces

Lesson number	Lesson title	Month	No. of Periods	Specification references
1	Intermolecular forces involving permanent dipoles, instantaneous dipoles and induced dipoles and hydrogen bonding	Jan	10	2.5a
2	Explaining the boiling and melting temperatures of alkanes			2.5b(i, ii)
3	Solubility of molecules in different solvents			2.5c
4	What factors determine solubility?			2.5d

2.6 Redox

Lesson number	*Lesson title*	Month	No. of Periods	Specification references
1	*Using oxidation numbers*	Feb	10	2.6a
2	*Writing half equations and full equations for redox reactions*			2.6b

2.7 The periodic table — groups 2 and 7

Lesson number	Lesson title	Month	No. of Periods	Specification references
1	An introduction to group 2 and the trends in ionisation energy	Feb	20	2.7.1a
2	Flames tests for group 1 and group 2 compounds			2.7.1f, g(ii)
3, 4	Reactions of group 2 elements with oxygen, chlorine and water			2.7.1b
5	Reactions of the oxides and hydroxides of group 2 elements with water and dilute acid			2.7.1c
6	An introduction to volumetric analysis and the uncertainty in volumetric analysis			2.7.1g(iii), h
7	Carrying out titrations ***(internal assessment opportunity: activity ASC1)***			2.7.1g(iii)
8	The stability of group 1 and group 2 carbonates and nitrates			2.7.1e, g(i)
9	Explaining the trends in stability of group 1 and group 2 carbonates and nitrates			2.7.1e
10	An introduction to halogens			2.7.2a, e
11	Oxidation reactions of halogens			2.7.2b(i)
12	An introduction to iodine/thiosulfate titrations			2.7.2c
13	Carrying out an iodine/thiosulfate titration ***(internal assessment opportunity: activity ASC3)***			2.7.2c
14	Disproportionation reactions of halogens			2.7.2b(ii)
15	Silver halides and hydrogen halides			2.7.2d(ii, iii)
16	Reactions of potassium halides with halogens and silver nitrate solution			2.7.2d(i)
17	Observation exercise on three inorganic compounds ***(internal assessment opportunity: activity ASB1)*** ***(internal assessment opportunity: activity ASB2)***			

2.8 Kinetics

Lesson number	Lesson title	Month	No. of Periods	Specification references
1	Factors that affect the rate of a chemical reaction	Feb	10	2.8a
2	Investigating and explaining factors that affect rate			2.8b, f
3	Activation energy and catalysts			2.8d, e
4	The Maxwell-Boltzmann model of distribution			2.8c

2.9 Chemical equilibria

Lesson number	Lesson title	Month	No. of Periods	Specification references
1	An introduction to chemical equilibria and how temperature, pressure and concentration affect them	March	6	2.9a, c(i, ii)
2	Predicting changes in the position of equilibrium			2.9b

2.10 Organic chemistry

Lesson number	Lesson title	Month	No. of Periods	Specification references
1	An introduction to alcohols and how to test for them	March	10	2.10.1a, b, c(i, ii)
2	Reactions of alcohols			2.10.1.c(i, ii, iii, iv)
3	Preparation of an aldehyde			2.10.1.d
4	Preparation of a carboxylic acid ***(internal assessment opportunity: activity ASD3)***			2.10.1.d
5	An introduction to halogenoalkanes and their uses			2.10.2a, f
6	Reactions of halogenoalkanes with aqueous alkali, alcoholic alkali and alcoholic ammonia			2.10.2d(i, ii, iv)
7	The reaction of halogenoalkanes with water containing dissolved silver nitrate: comparing primary, secondary and tertiary			2.10.2b, d(iii)
8	Preparation of halogenoalkanes ***(internal assessment opportunity: activity ASD3)***			2.10.2c

2.11 Mechanisms

Lesson number	Lesson title	Month	No. of Periods	Specification references
1	Classifying reactions	March	4	2.11a
2	Classifying reagents			2.11b, c, d, e
3	Mechanisms in reactions of halogenoalkanes, alkanes and alkenes			2.11f
4	Chemistry in the ozone layer			2.11g

2.12 Mass spectra and IR

Lesson number	Lesson title	Month	No. of Periods	Specification references
1	Identifying organic molecules by mass spectroscopy	March	6	2.12a
2	An introduction to infrared spectroscopy – which molecules absorb infrared?			2.12c, d
3	Using infrared spectroscopy			2.12b
4	Observation exercise on organic compounds *(internal assessment opportunity: activity ASB3)* *(internal assessment opportunity: activity ASB4)*			

2.13 Green chemistry

Lesson number	Lesson title	Month		Specification references
1	Greenhouse gases and global warming	March	6	2.13b, c
2	Carbon footprints and carbon neutrality			2.13d, e
3	CFCs and the ozone layer			2.13f
4	Sustainability in the chemical industry: reducing hazards and pollution			2.13a(i, ii, v)
5	Sustainability in the chemical industry: increasing efficiency			2.13a(iii, iv)

Scheme of Work
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A2 Chemistry

Unit 4: General Principles of Chemistry I — Rates, Equilibria and Further Organic Chemistry

4.3 How fast? — rates

Lesson number	Lesson title	Month	No. of Periods	Specification references
1	Techniques to measure rate of reaction	June	20	4.3b
2	Rate equations, rate constants and the order of a reaction			4.3a
3	Determining the order of a reaction and the rate equation from experimental data			4.3f(ii, iii)
4	Graphical representation of kinetic measurements			4.3d
5	Half-life in a chemical reaction			4.3a, f(i)
6	Investigating the rate of a reaction ***(internal assessment opportunity: activity A2C2)***			4.3c
7	Activation energy and types of catalysts			4.3a
8	Investigating the activation energy of a reaction ***(internal assessment opportunity: activity A2C4)***			4.3f(v), g
9	Relating a mechanism to the rate-determining step			4.3a, f(iv), h, j
10	The mechanism of the reaction of iodine with propanone			4.3e, i

4.4 How far? — entropy

Lesson number	Lesson title	Month	No. of Periods	Specification references
1	What is entropy?	June/July	20	4.4b, c, d
2	The natural direction of change			4.4e, f
3	Increases in entropy during chemical reactions			4.4a, g (i, ii, iii, iv)
4	Calculating entropy changes			4.4h, i, j

5	The feasibility of a reaction, thermodynamic stability and kinetic inertness			4.4k, l, m
6	Predicting solubility from the enthalpy and entropy of solution			4.4n, o, p

4.5 Equilibria

Lesson number	Lesson title	Month	No. of Periods	Specification references
1	The idea of an equilibrium constant	July	6	4.5a, b, c, e
2	Calculations involving K_c and K_p			4.5e
3	More calculations involving K_c and K_p			4.5g
4	Determination of an equilibrium constant			4.5d
5	Relating entropy to equilibrium constants			4.5f, h

4.6 Application of rates and equilibrium

Lesson number	Lesson title	Month	No. of Periods	Specification references
1	Explaining why temperature, pressure and catalysis affect an equilibrium constant (if at all) and the interplay with rate of reaction	July	4	4.6a
2	Choosing conditions for industrial processes			4.6b
3	Controlling reactions for safety, yield, cost and atom economy			4.6c, d

4.7 Acid/base equilibria

Lesson number	Lesson title	Month	No. of Periods	Specification references
1	What are acids and bases?	September	10	4.7a, b, c
2	A definition for pH and measuring pH for a variety of substances			4.7d, f (i, ii)
3	K_a, K_w and strong and weak acids and bases			4.7d, e
4	Calculating K_a for a weak acid			4.7h
5	Determination of K_a for a weak acid			4.7g
6	pH changes during acid/base titrations			4.7i
7	Choosing suitable indicators			4.7j
8	Finding K_a for a weak acid from a pH titration *(internal assessment opportunity:*			4.7l

	activity A2C1)			
9	An introduction to buffer solutions			4.7k, l
10	Buffers in biological systems			4.7m

4.8 Further organic chemistry

Lesson number	Lesson title	Month	No. of Periods	Specification references
1	Isomerism and chirality	Sep/Oct	20	4.8.1a, b
2	Optical activity of chiral molecules			4.8.1c
3	Evidence for reaction mechanisms from optical activity			4.8.1d
4	An introduction to aldehydes and ketones: examples and solubility			4.8.2a, b
5	Testing and identifying carbonyl compounds			4.8.2c(iv)
6	Reactions of carbonyl compounds			4.8.2c(i, ii, iii, v)
7	An introduction to carboxylic acids: examples, physical properties and preparation			4.8.3a, b, c
8	Reactions of carboxylic acids			4.8.3d(i, ii, iii)
9	Synthesis of esters ***(internal assessment opportunity: activity A2D3)***			4.8.3d(iv)
10	Reactions of esters			4.8.4a, c
11	Polyesters			4.8.4d
12	Reactions of acyl chlorides			4.8.4a, b

4.9 Spectroscopy and chromatography

Lesson number	Lesson title	Month	No. of Periods	Specification references
1	How does radiation affect molecules?	November	10	4.9a(i, ii, iii, iv), c
2	High resolution nmr			4.9b(i, ii, iii)
3	Using nmr to identify molecular structures and in magnetic resonance imaging			4.9b(iv)
4	A review of mass spectroscopy			4.9d
5	Gas chromatography and HPLC			4.9e
6	Observation exercise on three organic compounds ***(internal assessment opportunity: activity A2B4)***			

Unit 5: General Principles of Chemistry II — Transition Metals and Organic Nitrogen Chemistry

5.3 Redox and the chemistry of the transition metals

Lesson number	Lesson title	Mon th	No.of Perio	Specification references
1	Linking oxidation number and reaction stoichiometry	Jan/ Feb	30	5.3.1a, b
2	Redox titrations with potassium manganate(VII) *(internal assessment opportunity: activity A2C3)*			5.3.1h(i)
3	Redox titrations with sodium thiosulfate			5.3.1h(ii)
4	Measuring standard electrode potentials			5.3.1c
5	Predicting the thermodynamic feasibility and the extent of reactions (vanadium)			5.3.1d, e, f
6	Hydrogen and alcohol fuel cells			5.3.1j
7	How breathalysers work			5.3.1k
8	An introduction to transition metals			5.3.2a, b, c
9	Characteristics of transition metals			5.3.2d(i, ii, iii, iv)
10	Using standard electrode potentials to predict the feasibility of forming different oxidation states of a transition metal			5.3.1g and 5.3.2d(i), f(i)
11	The chemistry of copper			5.3.2e, f, g(i)
12	The chemistry of chromium			5.3.2e, f, g(ii)
13	Explaining the chemistry of copper and chromium			5.3.2f(i, ii, iii, iv)
14	Preparing a sample of a complex ion *(internal assessment opportunity: activity A2D2)*			5.3.2g(iii)
15	Reactions of transition metal ions with aqueous sodium hydroxide			5.3.2j
16	Reactions of transition metal ions with aqueous ammonia			5.3.2j
17	Ionic equations for the reaction of transition metal ions with aqueous sodium hydroxide			5.3.2k
18	Observation exercises *(internal assessment opportunity: activities A2B1, A2B2, A2B3, A2B4)*			
19	Transition metals as catalysts			5.3.2h, i
20	Modern uses of transition metals			5.3.2l

5.4 Organic chemistry — arenes, nitrogen compounds and synthesis

Lesson numbe	Lesson title	Month	No.of Perio	Specification references
1	Evidence for the structure of the benzene ring	March	30	5.4.1a
2	Reactions of benzene: combustion, addition of hydrogen and bromine, and with fuming sulphuric acid			5.4.1b(i, ii, iv, vi)
3	Reactions of benzene: concentrated nitric and sulphuric acids			5.4.1b(iii),d
4	Reactions of benzene: halogenoalkanes and acyl chlorides			5.4.1b(v),d
5	Reactions of phenol			5.4.1e
6	An introduction to amines and the formation of aromatic amines			5.4.2a(i), b(i, ii, iii, iv),c
7	Making paracetamol: reactions of amines with ethanoyl chloride and halogenoalkanes			5.4.2b(v)
8	Making an azo dye			5.4.2d
9	Amides and polyamides			5.4.2e, f(i, ii), g
10	Properties of polyamides			5.4.2h
11	An introduction to amino acids			5.4.2a(ii), i(i)
12	Separation of amino acids			5.4.2i(ii, v)
13	Optical activity of amino acids			5.4.2i(iii)
14	Proteins			5.4.2i(iv)
15	The importance of synthetic organic chemistry			5.4.3a
16	Identifying organic molecules for synthesis			5.4.3b, c
17	Predicting reactions of organic compounds			5.4.3d(i)
18	Planning synthetic routes			5.4.3d(ii, iii)
19	Synthesis of stereo-specific drugs			5.4.3d(v)
20	Practical techniques in organic synthesis			5.4.3f (i–ix)
21	Practical techniques in organic synthesis			5.4.3f (i–ix)
22	Practical techniques in organic synthesis			5.4.3f (i–ix)
23	Control measures for hazards in organic synthesis			5.4.3d(iv)
24	Combinatorial chemistry			5.4.3e
25	The preparation or synthesis of aspirin in two stages *(internal assessment opportunity: activity A2D1)* *(internal assessment opportunity: activity A2M1)*			
26	Continuing the synthesis of aspirin in two stages *(internal assessment opportunity: activity A2M1)*			