Qualification Accredited

OCR
Oxford Cambridge and RSA

AS and A LEVEL
Mapping Guide

CHEMISTRY A

H032/H432
For first teaching in 2015

Mapping the new specification to the legacy specification

Version 1

www.ocr.org.uk/chemistry

INTRODUCTION

This document compares the content of the A Level Chemistry A for first assessment in 2017 (H432) with the content of the legacy specification. We hope that this can assist with your planning of schemes of work, and allow you to easily recognise the areas of your current schemes of work that can be carried forward.

This document can also be used to plan for the new AS Level Chemistry A for first assessment in 2016 (H032). The content of the new AS Level is a subset of the new A Level content, as indicated below.

The legacy and new specifications at a glance

The following table provides an overview of the structures of the legacy and new specifications.

In the table for the new specification, the AS content is highlighted.

UNITS IN LEGACY SPECIFICATION			MODULES IN NEW SPECIFICATION		
AS Unit F321: Atoms, Bonds and Groups			**Module 1: Development of practical skills**		
Module 1: Atoms and Reactions	1.1.1	Atoms	1.1 Practical skills assessment in a written examination	1.1.1	Planning
	1.1.2	Moles and equations		1.1.2	Implementing
	1.1.3	Acids		1.1.3	Analysis
	1.1.4	Redox		1.1.4	Evaluation
Module 2: Electrons, Bonding and Structure	1.2.1	Electron structure	1.2 Practical skills assessed in the practical endorsement	1.2.1	Practical skills
	1.2.2	Bonding and structure		1.2.2	Use of apparatus and techniques
Module 3: The Periodic Table	1.3.1	Periodicity	**Module 2: Foundations in chemistry**		
	1.3.2	Group 2	2.1 Atoms and reactions	2.1.1	Atomic structure and isotopes
	1.3.3	Group 7		2.1.2	Compounds, formulae and equations
AS Unit F322: Chains, Energy and Resources				2.1.3	Amount of substance
Module 1: Basic Concepts and Hydrocarbons	2.1.1	Basic concepts		2.1.4	Acids
	2.1.2	Alkanes		2.1.5	Redox
	2.1.3	Alkenes	2.2 Electrons, bonding and structure	2.2.1	Electron structure
Module 2: Alcohols, Halogenoalkanes and Analysis	2.2.1	Alcohols		2.2.2	Bonding and structure
	2.2.2	Halogenoalkanes	**Module 3: Periodic table and energy**		
	2.2.3	Modern analytical techniques	3.1 The periodic table	3.1.1	Periodicity
Module 3: Energy	2.3.1	Enthalpy changes		3.1.2	Group 2
	2.3.2	Rates and equilibrium		3.1.3	The halogens
Module 4: Resources	2.4.1	Chemistry of the air		3.1.4	Qualitative analysis
	2.4.2	Green chemistry	3.2 Physical chemistry	3.2.1	Enthalpy changes
AS Unit F323 Practical Skills in Chemistry 1				3.2.2	Reaction rates
Qualitative				3.2.3	Chemical equilibrium
Quantitative			**Module 4: Core organic chemistry**		

Evaluative			4.1 Basic concepts and hydrocarbons	4.1.1	Basic concepts of organic chemistry
				4.1.2	Alkanes
				4.1.3	Alkenes
			4.2 Alcohols, haloalkanes and analysis	4.2.1	Alcohols
				4.2.2	Haloalkanes
				4.2.3	Organic synthesis
				4.2.4	Analytical techniques
A2 Unit F324: Rings, Polymers and Analysis			**Module 5: Physical chemistry and transition elements**		
Module 1: Rings, Acids and Amines	4.1.1	Arenes	5.1 Rates, equilibrium and pH	5.1.1	How fast?
	4.1.2	Carbonyl compounds		5.1.2	How far?
	4.1.3	Carboxylic acids and esters		5.1.3	Acids, bases and buffers
	4.1.4	Amines	5.2 Energy	5.2.1	Lattice enthalpy
Module 2: Polymers and Synthesis	4.2.1	Amino acids and proteins		5.2.2	Enthalpy and entropy
	4.2.2	Polyesters and polyamides		5.2.3	Redox and electrode potentials
	4.2.3	Synthesis	5.3 Transition elements	5.3.1	Transition elements
Analysis	4.3.1	Chromatography		5.3.2	Qualitative analysis
	4.3.2	Spectroscopy			
A2 F325: Equilibria, Energetics and Elements			**Module 6: Organic Chemistry and Analysis**		
Module 1: Rates, Equilibrium and pH	5.1.1	How fast?	6.1 Aromatic compounds, carbonyls and acids	6.1.1	Aromatic compounds
	5.1.2	How far?		6.1.2	Carbonyl compounds
	5.1.3	Acids, bases and buffers		6.1.3	Carboxylic acids and esters
Module 2: Energy	5.2.1	Lattice enthalpy	6.2 Nitrogen compounds, polymers and synthesis	6.2.1	Amines
	5.2.2	Enthalpy and entropy		6.2.2	Amino acids, amides and chirality
	5.2.3	Electrode potentials and fuel cells		6.2.3	Polyesters and polyamides
Module 3: Transition Elements	5.3.1	Transition elements		6.2.4	Carbon–carbon bond formation
A2 F326 Practical Skills in Chemistry 2				6.2.5	Organic synthesis
Qualitative			6.3 Analysis	6.3.1	Chromatography and qualitative analysis
Evaluative				6.3.2	Spectroscopy

SUMMARY OF CHANGES

Content changes have occurred due to:

1. DfE core content criteria
2. centre feedback
3. mathematical requirements
4. overlap with other specifications.

Current content which is not in the new specification:

- chemistry of the air and green chemistry (strongly reduced in response to centre feedback)
- fuels (strongly reduced due to overlap with GCSE)
- fats and lipids; amino acids and protein (reduced due to overlap with A Level Biology)
- azo dyes
- chiral synthesis
- chromatography (slimmed due to overlap with GCSE)

Content added to the new specification:

- ideal gas equation (driven by mathematical requirements); 2.1.3(f)
- use of Cahn-Ingold-Prelog rules (to better cover *E/Z*), 4.1.3 (c)
- Markownikoff, 4.1.3(i)
- Arrhenius (driven by mathematical requirements) 5.1.1(k)
- K_p, 5.1.2(d)
- introduction to directing effects, 6.1.1(k)
- acyl chlorides, 6.1.3(e),(f)
- HCN, C–C bond formation, 6.1.4(a–d)
- Friedel–Crafts 6.2.4(d)

Changes to terminology and symbols

The following changes have been made to bring the specification content in line with IUPAC guidance:

- periodic table layout: atomic number appears at the top of the cell, atomic mass at the bottom
- periodic table group numbering: Groups 1–18 (i.e. halogens Group 17)
- intermolecular forces terminology:
  - induced dipole–dipole interactions (may also be referred to as London forces)
  - permanent dipole–dipole interactions
  - the term 'Van der Waals' forces' may refer to any attractive or repulsive forces between molecular entities (does not include interactions involving ions); as such the term includes both induced dipole–dipole and permanent dipole–dipole interactions, and should not be used to refer specifically to induced dipole–dipole interactions
- enthalpy change symbols: now written as $\Delta_r H$, $\Delta_c H$, etc.

NEW SPECIFICATION MAPPED AGAINST LEGACY SPECIFICATION

In the table below, the right-hand columns show the legacy specification references which are associated with each section of the new specification.

Module 1 - Practical Skills

This module is new to the specification but covers many of the skills which would have been assessed during the controlled assessment tasks. Section 1.1 is part of both the AS and A Level specifications. Section 1.2 is included only in the A Level specification.

NEW SPECIFICATION				LEGACY SPECIFICATION
1.1 Practical skills assessed in a written examination				These are practical skills which were previously assessed in the controlled assessment tasks. You would find many of these skills covered in F323 and F326
1.1.1 Planning		1.1.1	(a)–(c)	
1.1.2 Implementing		1.1.2	(a)–(c)	
1.1.3 Analysis		1.1.3	(a)–(d)	
1.1.4 Evaluation		1.1.4	(a)–(e)	
1.2 Practical skills assessed in the practical endorsement				
1.2.1 Practical skills	Independent thinking	1.2.1	(a)	
	Use and application of scientific methods and practices	1.2.1	(b)–(g)	
	Research and referencing	1.2.1	(h)–(i)	
	Instruments and equipment	1.2.1	(j)	
1.2.2 Use of apparatus and techniques		1.2.2	(a)–(l)	

For more information you should consult the Practical Skills Handbook available at

http://www.ocr.org.uk/qualifications/as-a-level-gce-chemistry-a-h032-h432-from-2015/

Module 2: Foundations in chemistry

This module is included in both the AS and A Level specifications.

This module covers mainly the following areas of the legacy specification, with the addition of the ideal gas equation.

- 1.1.1 Atoms
- 1.1.2 Moles and equations
- 2.1.1 Basic concepts (percentage yield and atom economy)
- 1.1.3 Acids
- 1.1.4 Redox
- 1.2.1 Electron structure
- 1.2.2 Bonding and structure

NEW SPECIFICATION				LEGACY SPECIFICATION	
2.1 Atoms and reactions					
2.1.1 Atomic structure and isotopes	Atomic structure and isotopes	2.1.1	(a)–(b)	1.1.1	(a)–(b)
	Relative mass	2.1.1	(c)–(e)	1.1.1	(c)–(e)
2.1.2 Compounds, formulae and equations	Formulae and equations	2.1.2	(a)–(b)	1.1.1	(f)–(i)
2.1.3 Amount of substance	The mole	2.1.3	(a)	1.1.2	(a)
	Determination of formulae	2.1.3	(b)–(d)	1.1.2	(b)–(e)
				1.1.3	(i)–(j)
	Calculation of reacting masses, gas volumes and mole concentrations	2.1.3	(e)	1.1.2	(f)
		2.1.3	(f)	**NEW**	
	Percentage yields and atom economy	2.1.3	(g)–(i)	2.1.1	(k)–(p)
2.1.4 Acids	Acids, bases, alkalis and neutralisation	2.1.4	(a)–(c)	1.1.3	(a)–(h)
	Acid–base titrations	2.1.4	(d)–(e)	1.1.3	(i)–(k)
2.1.5 Redox	Oxidation number	2.1.5	(a)–(c)	1.1.4	(a)–(c)
	Redox reactions	2.1.5	(d)–(f)	1.1.4	(d)–(g)

2.2 Electrons, bonding and structure					
2.2.1 Electron structure	Energy levels, shells, subshells, atomic orbitals, electron configuration	2.2.1	(a)–(d)	1.2.1	(a)–(i)
2.2.2 Bonding and structure	Ionic bonding	2.2.2	(a)–(c)	1.2.2	(a)–(d)
					(q)–(s)
	Covalent bonding	2.2.2	(d)–(f)	1.2.2	(e)–(f)
	The shapes of simple molecules and ions	2.2.2	(g)–(h)	1.2.2	(g)–(j)
	Electronegativity and bond polarity	2.2.2	(i)–(j)	1.2.2	(k)–(l)
	Intermolecular forces	2.2.2	(k)–(o)	1.2.2	(m)–(p)

Module 3: Periodic table and energy

This module is included in both the AS and A Level specifications.

This module covers mainly the following areas of the legacy specification; K_c (including calculations involving equilibrium concentrations only) has moved from current A2 to AS.

- 1.3.1 Periodicity
- 1.3.2 Group 2
- 1.3.3 Group 7
- 2.3.1 Enthalpy changes
- 2.3.2 Rates and equilibrium
- 5.1.2 How far?

NEW SPECIFICATION				**LEGACY SPECIFICATION**	
3.1 The periodic table					
3.1.1 Periodicity	The structure of the periodic table	3.1.1	(a)	1.3.1	(a)
	Periodic trend in electron configuration and ionisation energy	3.1.1	(b)–(c)	1.3.1	(b)–(c)
	Periodic trend in structure and melting point	3.1.1	(d)–(g)	1.3.1	(d)–(f)
3.1.2 Group 2	Redox reactions and reactivity of Group 2 metals	3.1.2	(a)–(c)	1.3.2	(a)–(b)
	Reactions of Group 2 compounds	3.1.2	(d)–(e)	1.3.2	(c)–(f)
3.1.3 The halogens	Characteristic physical properties	3.1.3	(a)	1.3.3	(a)
	Redox reactions and reactivity of halogens and their compounds	3.1.3	(b)–(f)	1.3.3	(b)–(f)
	Characteristic reactions of halide ions	3.1.3	(g)	1.3.3	(g)–(h)
3.1.4 Qualitative analysis	Tests for ions	3.1.4	(a)	1.3.3	(g)–(h)
3.2 Physical chemistry					
3.2.1 Enthalpy changes	Enthalpy changes: ΔH of reaction, formation, combustion and neutralisation	3.2.1	(a)–(e)	2.3.1	(a)–(g)
	Bond enthalpies	3.2.1	(f)	2.3.1	(h)–(j)
	Hess' law and enthalpy cycles	3.2.1	(g)–(h)	2.3.1	(k)
3.2.2 Reaction rates	Simple collision theory	3.2.2	(a)–(b)	2.3.2	(a)–(b)
	Catalysts	3.2.2	(c)–(e)	2.3.2	(c)–(e)
	The Boltzmann distribution	3.2.2	(f)–(g)	2.3.2	(f)–(h)
3.2.3 Chemical equilibrium	Dynamic equilibrium and le Chatelier's principle	3.2.3	(a)–(e)	2.3.2	(i)–(l)
	The equilibrium constant, K_c	3.2.3	(f)–(g)	5.1.2	(b)–(e)

Module 4: Periodic table and energy

This module is included in both the AS and A Level specifications.

This module covers mainly the following areas of the legacy specification, with the addition of CIP priority rules and Markownikoff's rule.

- 2.1.1 Basic concepts
- 2.1.2 Alkanes
- 2.1.3 Alkenes
- 2.2.1 Alcohols
- 2.2.2 Halogenoalkanes
- 2.4.1 Chemistry of the air
- 2.4.2 Green chemistry
- 4.1.2 Carbonyl compounds (organic synthesis)
- 4.1.3 Carboxylic acids and esters (organic synthesis)
- 4.1.4 Amines (organic synthesis)
- 2.2.3 Modern analytical techniques

NEW SPECIFICATION				**LEGACY SPECIFICATION**	
4.1 Basic concepts and hydrocarbons					
4.1.1 Basic concepts of organic chemistry	Naming and representing the formulae of organic compounds	4.1.1	(a)–(b)	2.1.1	(a)–(b)
	Functional groups	4.1.1	(c)–(d)	2.1.1	(c)–(e)
	Isomerism	4.1.1	(e)	2.1.1	(f)–(g)
	Reaction mechanisms	4.1.1	(f)–(i)	2.1.1	(h)–(j)
4.1.2 Alkanes	Properties of alkanes	4.1.2	(a)–(c)	2.1.2	(a)–(e)
	Reactions of alkanes	4.1.2	(d)–(g)	2.1.2	(k)–(n)
4.1.3 Alkenes	Properties of alkenes	4.1.3	(a)–(b)	2.1.3	(a)–(c)
	Stereoisomerism in alkenes	4.1.3	(c)–(d) (c)(ii) **NEW**	2.1.1	(f)
	Addition reactions of alkenes	4.1.3	(e)–(h)	2.1.3	(d)–(f)
		4.1.3	(i)	**NEW**	
	Polymers from alkenes	4.1.3	(j)	2.1.3	(g)
	Waste polymers and alternatives	4.1.3	(k)–(l)	2.1.3	(h)–(j)
4.2 Alcohols, haloalkanes and analysis					
4.2.1 Alcohols	Properties of alcohols	4.2.1	(a)	2.2.1	(a)–(c)
	Reactions of alcohols	4.2.1	(b)–(f)	2.2.1	(d)–(h)
4.2.2 Haloalkanes	Substitution reactions of haloalkanes	4.2.2	(a)–(d)	2.2.2	(a)–(d)
	Environmental concerns from use of organohalogen compounds	4.2.2	(e)	2.4.1	(g)
4.2.3 Organic synthesis	Practical skills	4.2.3	(a)	4.1.2	(a)–(b)
	Synthetic routes	4.2.3	(b)–(c)	4.1.2	(c)
				4.1.3	(c)
				4.1.4	(c)
4.2.4 Analytical techniques	Infrared spectroscopy	4.2.4	(a)–(e)	2.2.3	(a)–(c)
				2.1.4	(a), (j)
	Mass spectrometry	4.2.4	(f)–(g)	2.2.3	(d)–(i)

Module 5: Physical chemistry and transition elements

This module is included in the A Level specification only.

This module covers mainly the following areas of the legacy specification, with the addition of the Arrhenius equation and K_p.

- 5.1.1 How fast?
- 5.1.2 How far?
- 5.1.3 Acids, bases and buffers
- 5.2.1 Lattice enthalpy
- 5.2.2 Enthalpy and entropy
- 5.2.3 Electrode potentials and fuel cells
- 5.3.1 Transition metals

NEW SPECIFICATION				LEGACY SPECIFICATION	
5.1 Rates, equilibrium and pH					
5.1.1 How fast?	Orders, rate equations and rate constants	5.1.1	(a)–(c)	5.1.1	(a)–(c)
	Rate graphs and orders	5.1.1	(d)–(h)	5.1.1	(d)–(h)
	Rate-determining step	5.1.1	(i)	5.1.1	(i)
	Effect of temperature on rate constants	5.1.1	(j)	5.1.1	(h)
		5.1.1	(k)	**NEW**	
5.1.2 How far?	Equilibrium	5.1.2	(a)–(h) + K_p	5.1.2	(a)–(e)
5.1.3 Acids, bases and buffers	Brønsted–Lowry acids and bases	5.1.3	(a)–(c)	5.1.3	(a)–(c)
	pH and $[H^+(aq)]$	5.1.3	(d)–(h)	5.1.3	(d)–(j)
	Buffers: action, uses and calculations	5.1.3	(i)–(m)	5.1.3	(k)–(o)
	Neutralisation	5.1.3	(n)–(o)	5.1.3	(p)–(q)
5.2 Energy					
5.2.1 Lattice enthalpy	Lattice enthalpy	5.2.1	(a)	5.2.1	(a)
	Born–Haber and related enthalpy cycles	5.2.1	(b)–(e)	5.2.1	(b)–(e)
5.2.2 Enthalpy and entropy	Entropy	5.2.2	(a)–(c)	5.2.2	(a)–(d)
	Free energy	5.2.2	(d)–(f)	5.2.2	(e)–(g)
5.2.3 Redox and electrode potentials	Redox	5.2.3	(a)–(c)	5.2.3	(a)–(c)
	Redox titrations	5.2.3	(d)–(e)	5.3.1	(p)–(r)
	Electrode potentials	5.2.3	(f)–(i)	5.2.3	(d)–(h)
	Storage and fuel cells	5.2.3	(j)–(k)	5.2.3	(i)–(j)
5.3 Transition elements					
5.3.1 Transition elements	Properties	5.3.1	(a)–(c)	5.3.1	(a)–(c)
	Ligands and complex ions	5.3.1	(d)–(g)	5.3.1	(e)–(j)
	Ligand substitution	5.3.1	(h)–(i)	5.3.1	(k)–(o)
	Precipitation reactions	5.3.1	(j)	5.3.1	(d)
	Redox reactions	5.3.1	(k)–(l)	5.2.3	(a)–(c)
5.3.2 Qualitative analysis	Tests for ions	5.3.2	(a)	1.3.3	(g)–(h)

Module 6: Organic chemistry and analysis

This module is included in the A Level specification only.

This module covers mainly the following areas of the legacy specification; there are some new areas to the specification here including introduction to directing effects, acyl chlorides, HCN, C–C bond formation and the Friedel–Crafts reaction.

- 4.1.1 Arenes
- 4.1.2 Carbonyl compounds
- 4.1.3 Carboxylic acids and esters
- 4.1.4 Amines
- 4.2.1 Amino acids and proteins
- 4.2.2 Polyesters and polyamides
- 4.2.3 Synthesis
- 4.3.1 Chromatography
- 4.3.2 Spectroscopy

NEW SPECIFICATION				**LEGACY SPECIFICATION**	
6.1 Aromatic compounds, carbonyls and acids					
6.1.1 Aromatic compounds	Benzene and aromatic compounds	6.1.1	(a)–(c)	4.1.1	(a)–(b)
	Electrophilic substitution	6.1.1	(d)–(g)	4.1.1	(c)–(e)
	Phenols	6.1.1	(h)–(j)	4.1.1	(f)–(g)
		6.1.1	(k)–(l)	**NEW**	
6.1.2 Carbonyl compounds	Reactions of carbonyl compounds	6.1.2	(a)–(c)	4.1.2	(a)–(c)
	Characteristic tests for carbonyl compounds	6.1.2	(d)–(e)	4.1.2	(d)–(f)
6.1.3 Carboxylic acids and esters	Properties of carboxylic acids	6.1.3	(a)–(b)	4.1.3	(a)–(b)
	Esters	6.1.3	(c)–(d)	4.1.3	(c)–(d)
	Acyl chlorides	6.1.3	(e)–(f)	**NEW**	
6.2 Nitrogen compounds, polymers and synthesis					
6.2.1 Amines	Basicity and preparation of amines	6.2.1	(a)–(b)	4.1.4	(a)–(c)
6.2.2 Amino acids, amides and chirality	Reactions of amino acids	6.2.2	(a)	4.2.1	(a)
	Amides	6.2.2	(b)	**NEW**	
	Chirality	6.2.2	(c)–(d)	4.2.1	(g)–(i)
6.2.3 Polyesters and polyamides	Condensation polymers	6.2.3	(a)–(c)	4.2.2	(a)–(f)
6.2.4 Carbon–carbon bond formation	Extending carbon chain length	6.2.4	(a)–(d)	**NEW**	
6.2.5 Organic synthesis	Practical skills	6.2.5	(a)	4.2.3	(a)–(b)
	Synthetic routes	6.2.5	(b)–(c)		
6.3 Analysis					
6.3.1 Chromatography and qualitative analysis	Types of chromatography	6.3.1	(a)–(b)	4.3.1	(d)–(e)
	Tests for organic functional groups	6.3.1	(c)	2.1.3	(d)
				4.1.2	(e)
				Practical skills	
6.3.2 Spectroscopy	NMR spectroscopy	6.3.2	(a)–(d)	4.3.2	(a)–(g)
	Combined techniques	6.3.2	(e)	4.3.2	(i)

The small print

We'd like to know your view on the resources we produce. By clicking on the 'Like' or 'Dislike' button you can help us to ensure that our resources work for you. When the email template pops up please add additional comments if you wish and then just click 'Send'. Thank you.

If you do not currently offer this OCR qualification but would like to do so, please complete the Expression of Interest Form which can be found here: www.ocr.org.uk/expression-of-interest

OCR Resources: *the small print*
OCR's resources are provided to support the teaching of OCR specifications, but in no way constitute an endorsed teaching method that is required by the Board and the decision to use them lies with the individual teacher. Whilst every effort is made to ensure the accuracy of the content, OCR cannot be held responsible for any errors or omissions within these resources. We update our resources on a regular basis, so please check the OCR website to ensure you have the most up to date version.

OCR acknowledges the use of the following content:
Square down andSquare up: alexwhite/Shutterstock.com

Please get in touch if you want to discuss the accessibility of resources we offer to support delivery of our qualifications: resources.feedback@ocr.org.uk

We will inform centres about any changes to the specification. We will also publish changes on our website. The latest version of our specification will always be the one on our website (www.ocr.org.uk) and this may differ from printed versions.

ocr.org.uk/alevelreform
OCR customer contact centre

General qualifications
Telephone 01223 553998
Facsimile 01223 552627
Email general.qualifications@ocr.org.uk