

# Edexcel International AS/A Level

## IAL Chemistry

Event: YCH11-19IO1

## Getting Ready to Teach

Event Code:

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First teaching in 2018, first assessment 2019

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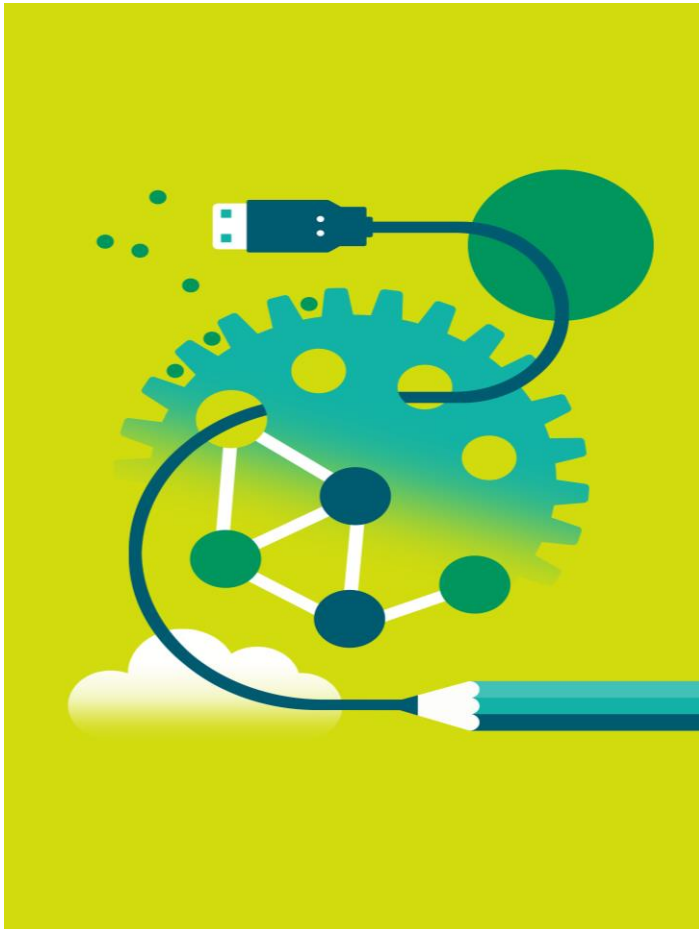


# IAL Chemistry

**What are your main reasons for attending this course?**

**Type your answers in the chat box.**

# Your Online Environment



- ❖ Technical Difficulties & Support
- ❖ Recording
- ❖ Communication in an online environment
- ❖ Asking Questions
- ❖ Using Polls
- ❖ Downloading Documents

# Aims and Objectives

During the session you will:

- ❖ Get an overview of the main changes in the 2018 specification
- ❖ Explore possible teaching and learning strategies that may be employed
- ❖ Look at planning and organisation
- ❖ Look at Sample Assessments and Mark Schemes
- ❖ Explore the teaching and learning support available to guide you
- ❖ This event can count as 2 hours of CPD.



# Session Agenda

16:00 Introduction

16:10 Overview of the 2018 IAL Chemistry specification

16:30 Unit 1

16:45 Unit 2

17:00 Unit 3 and practical work

17:10 Unit 4

17:25 Unit 5

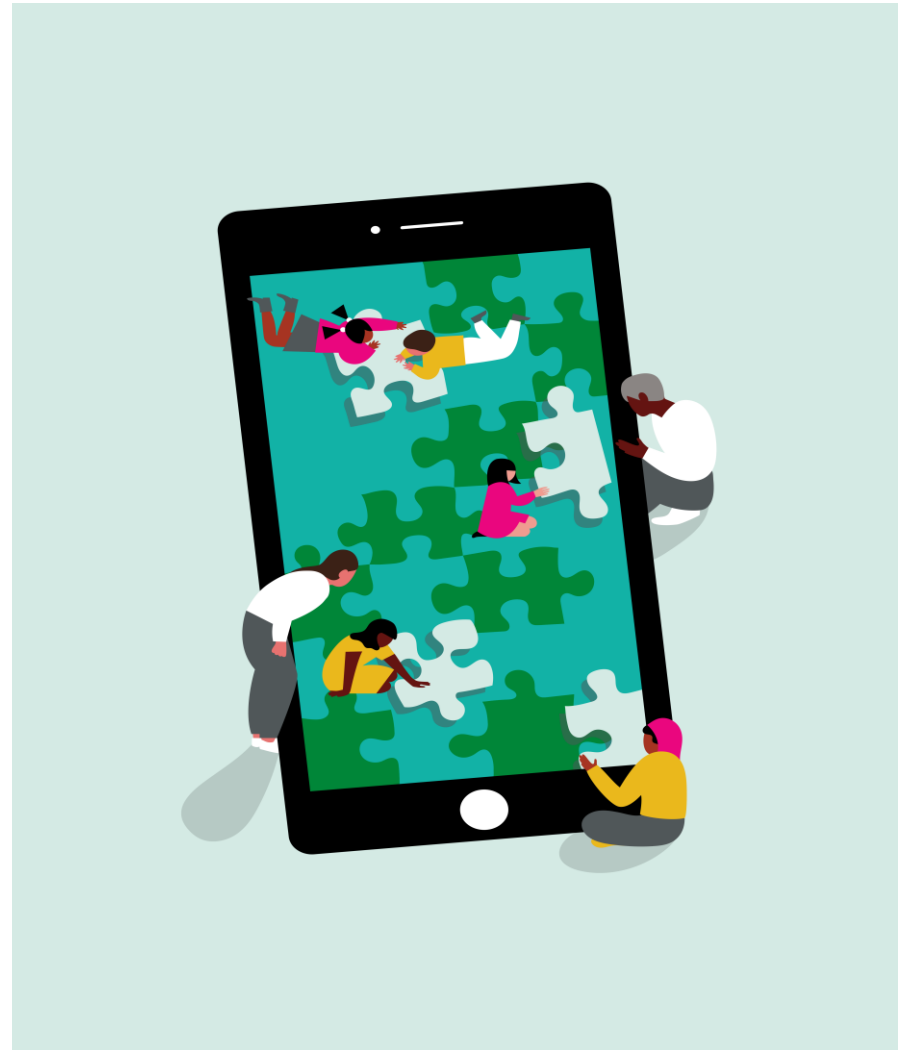
17:40 Unit 6

17:45 Extended writing questions

17.50 Support and questions

18:00 Finish

# Polls



# Introduction to the 2018 specification

# Key qualification features

Key features of the IAL remain the same including:

- ❖ modular assessment, offered at different times of year to suit your delivery model
- ❖ practical skills assessed through an examination unit both at AS (Unit 3) and at A Level (Unit 6)
- ❖ comparable content with the UK GCE A Level – giving comparability between specifications
- ❖ a range of types of questions in exams – testing breadth, as well depth of knowledge and understanding



# In IAL Chemistry, students will...

- ❖ ..develop knowledge and understanding of chemistry
- ❖ ...apply concepts in this specification to a range of different problems
- ❖ ...apply mathematical skills to the problems.
- ❖ ...develop practical skills through 16 core practical activities
- ❖ ...widen their learning through key transferable skills

# Progression

- ❖ IAL Chemistry enables successful progression to further education courses in chemical sciences.
- ❖ During development, we consulted with a number of universities in the UK, as well as internationally, to validate the appropriateness of these qualifications, including content, skills and assessment structure.
- ❖ The International Advanced Level in Chemistry sits within a wider subject offer for sciences.
- ❖ We also offer International Advanced Levels in Biology, Physics and Psychology, as well as in Mathematics and Further Mathematics.

# Structure of the 2018 specification

# Structure

- ❖ Both the International AS and the International A Level in Chemistry are modular qualifications
- ❖ Three externally assessed written papers at IAS
- ❖ Three further externally assessed written papers at IA2
- ❖ Students can claim the IAS for completing Units 1-3; and a full International Advanced Level for completing all six units (IAS and IA2 units)

# Content

- ❖ designed for students who have passed GCSE and who want to study the subject at a higher level
- ❖ the 2018 specification was updated from the legacy IAL Chemistry specification
- ❖ It is comparable with the Pearson Edexcel GCE A level Chemistry (9CH0)
- ❖ It covers the major topics in chemistry, including core principles and their application, experimental skills, rates, equilibria and organic chemistry, transition metals and organic nitrogen chemistry.

# International AS Chemistry

- ❖ The qualification consists of 3 externally assessed units.
- ❖ This can be awarded as a separate IAS qualification or can contribute 50% towards the International Advanced Level qualification.
- ❖ Exam papers will include questions that target mathematics at Level 2 or above: a minimum of 20% of the marks across the papers will be awarded for the use of mathematics in Chemistry.

## UNIT 1

- Formulae, Equations and Amount of Substance
- Atomic Structure and the Periodic Table
- Bonding and Structure
- Introductory Organic Chemistry and Alkanes
- Alkenes

## UNIT 2

- Energetics
- Intermolecular Forces
- Redox Chemistry and Groups 1, 2 and 7
- Introduction to Kinetics and Equilibria
- Organic Chemistry: Alcohols, Halogenoalkanes, Spectra

## UNIT 3

- Students develop experimental skills by carrying out a range of practical experiments and investigations in Units 1 and 2.
- This unit will assess students' knowledge and understanding of experimental procedures and techniques that were developed in Units 1 and 2.

UNIT 1	UNIT 2	UNIT 3
<ul style="list-style-type: none"><li>• 1h 30 mins</li><li>• 80 marks</li><li>• 120 UMS</li><li>• Worth 40% of IAS (or 20% of the full IAL)</li><li>• Assessment in June, October and January</li></ul>	<ul style="list-style-type: none"><li>• 1h 30 mins</li><li>• 80 marks</li><li>• 120 UMS</li><li>• Worth 40% of IAS (or 20% of the full IAL)</li><li>• Assessment in June, October and January</li></ul>	<ul style="list-style-type: none"><li>• 1h 20 mins</li><li>• 50 marks</li><li>• 60 UMS</li><li>• Worth 20% of IAS (or 10% of the full IAL)</li><li>• Available June, October and January</li></ul>



# IAL Chemistry

- ❖ This qualification has 6 externally assessed units.
- ❖ It consists of the three IAS units (Units 1, 2 and 3) plus three IA2 units (Units 4, 5 and 6).
- ❖ Students wishing to achieve the International Advanced Level must, therefore, complete all six units.
- ❖ Exam papers will include questions that target mathematics at Level 2 or above: a minimum of 20% of the marks across the papers will be awarded for the use of mathematics in Chemistry.

## UNIT 4

- Kinetics
- Entropy and Energetics
- Chemical Equilibria
- Acid-base Equilibria
- Organic Chemistry: Carbonyls, Carboxylic Acids, Chirality

## UNIT 5

- Redox Equilibria
- Transition Metals and their Chemistry
- Organic Chemistry: Arenes
- Organic Nitrogen Compounds
- Organic Synthesis

## UNIT 6

- Students develop further their experimental skills by carrying out a range of practical experiments and investigations in Units 4 and 5.
- This unit will assess students' knowledge and understanding of the experimental procedures and techniques that were developed in Units 4 and 5

# IA2 Chemistry

UNIT 4	UNIT 5	UNIT 6
<ul style="list-style-type: none"> <li>• 1h 45 mins</li> <li>• 90 marks</li> <li>• 120 UMS</li> <li>• Worth 20% of the full IAL</li> <li>• Available June, October and January</li> </ul>	<ul style="list-style-type: none"> <li>• 1h 45 mins</li> <li>• 90 marks</li> <li>• 120 UMS</li> <li>• Worth 20% of the full IAL</li> <li>• Available June, October and January</li> </ul>	<ul style="list-style-type: none"> <li>• 1h 20 mins</li> <li>• 50 marks</li> <li>• 60 UMS</li> <li>• Worth 10% of the full IAL</li> <li>• Available June, October and January</li> </ul>

# Unit availability

Unit	January 2019	June 2019	October 2019	January 2020	June 2020
1	✓	✓	✓	✓	✓
2	x	✓	✓	✓	✓
3	x	✓	✓	✓	✓
4	x	x	x	✓	✓
5	x	x	x	x	✓
6	x	x	x	x	✓
IAS award	x	✓	✓	✓	✓
IAL award	x	x	x	x	✓

- IAS first Award – June 2019
- IAL first Award – June 2020

# Features of our question papers

- ❖ Our question papers are clear and accessible for students of all ability ranges, with straightforward mark schemes
- ❖ We use a series of well-defined command words
- ❖ Papers assess relevant mathematical skills – 20% of marks cover maths skills
- ❖ Question papers contain a mixture of question types, with an initial Multiple Choice Questions section

# Assessment objectives

## AO1

Demonstrate knowledge and understanding of science.

## AO2

(a) Application of knowledge and understanding of science in familiar and unfamiliar contexts.

(b) Analysis and evaluation of scientific information to make judgements and reach conclusions.

## AO3

Experimental skills in science, including analysis and evaluation of data and methods.

# Data booklet

- ❖ A revised Data Booklet has been produced for the new specification
- ❖ It provides values for key constants, as well as spectroscopic data, electronegativity values, electrode potentials and indicator ranges
- ❖ A Periodic Table is also provided

# Unit 1:

# The Core Principles of Chemistry



# Topic 1: Formulae, Equations and Amount of Substance

Additions:

- ❖ the use of  $pV = nRT$  in calculations involving gases and volatile liquids

Note:

- ❖ calculations more likely to be unstructured.

# Topic 2: Atomic Structure and the Periodic Table

Additions:

- ❖ understanding that ions in a mass spectrometer may have a +2 charge
- ❖ be able to predict the mass spectra, including relative peak heights, for diatomic molecules, including chlorine, given the isotopic abundances
- ❖ explaining the decrease in first ionisation energy down a group

❖

# Topic 3: Bonding and Structure

## 3A: Ionic bonding

Additions:

- ❖ understanding the effects of ionic radius and ionic charge on the strength of ionic bonding

Note:

- ❖ Born-Haber cycle and lattice energy move to Unit 4 but Unit 1 includes understanding of the term 'polarisation' as applied to ions, that the polarising power of a cation depends on its radius and charge, and the polarisability of an anion also depends on its radius and charge.

# Topic 3: Bonding and Structure

## 3B: Covalent bonding

- ❖ bonding and structures of diamond, graphite and graphene have been moved from Unit 2 to Unit 1
- ❖ intermediate bond and bond polarity have been moved from Unit 2 to Unit 1.

- ❖ **3C: Shapes of molecules**

- ❖ This has been moved from Unit 2 to Unit 1 and the content is almost the same with just the shape of  $\text{C}_2\text{H}_4$  added.

- ❖ **3D: Metallic bonding**

- ❖ This is the same as the legacy specification.

# Topic 4: Introductory Organic Chemistry and Alkanes

## 4A: Introduction

- ❖ classification of reactions as addition, substitution, oxidation, reduction or polymerisation has moved from Unit 2 to Unit 1
- ❖ understand that bond breaking can be homolytic, to produce free radicals, or heterolytic, to produce ions, has moved from Unit 2 to Unit 1
- ❖ definitions of the terms 'free radical' and 'electrophile' have moved from Unit 2 to Unit 1.

# Topic 4: Introductory Organic Chemistry and Alkanes

## 4B: Alkanes

Additions:

- ❖ more detail on pollutants produced during the combustion of alkane fuels
- ❖ the concept of carbon neutrality

# Topic 5: Alkenes

Additions:

- ❖ the addition of steam to alkenes

Note:

- ❖ in mechanisms, curly arrows must start from a bond or a lone pair of electrons.

# Sample question

A sample of bromine gas occupied  $200 \text{ cm}^3$  at a temperature of  $77^\circ\text{C}$  and a pressure of  $1.51 \times 10^5 \text{ Pa}$ .

**Calculate**, using the ideal gas equation, the amount in moles of bromine molecules in this sample.

$$[pV = nRT \text{ and } R = 8.31 \text{ J mol}^{-1}\text{K}^{-1}]$$

How would you award the 4 marks?



# Sample mark scheme

- conversion of volume to  $\text{m}^3$  ( $2.00 \times 10^{-4} \text{ m}^3$ )
- conversion of temperature to K (350 K)
- rearrangement of expression ( $n = \frac{1.51 \times 10^5 \times 2.00 \times 10^{-4}}{8.31 \times 350}$ )
- evaluation to give n ( $1.04 \times 10^{-2}$ )

## Note

Candidates can score full marks for the final answer without any working, however, we advise against this approach. If the final answer is incorrect and working has been shown, transferred error marks can be awarded.

For example, if the candidate does not convert the volume, a final answer of 10383 would score 3 marks if working is shown but 0 if there is no working.

# Unit 2:

# Application of Core Principles of Chemistry

# Topic 6: Energetics

This has moved to Unit 2 from Unit 1.

- ❖ candidates will not be provided the expression for calculating an enthalpy change from a temperature change

# Topic 7: Intermolecular forces

There are no significant changes to the legacy specification.

The statements have just been rewritten to provide extra clarity.

# Topic 8: Redox Chemistry and Groups 1,2 and 7

## 8A: Redox chemistry

Notes:

- ❖ there is more clarification on determining and using oxidation numbers
- ❖ explaining redox reactions in terms of gain and loss of electrons has been added
- ❖ there is more emphasis on oxidising and reducing agents.

# Topic 8: Redox Chemistry and Groups 1,2 and 7

## 8B: The elements of Groups 1 and 2

Additions:

- ❖ patterns in properties and reactions of Group 1 elements has been added
- ❖ tests for carbonate, hydrogencarbonate, sulfate and ammonium ions have been added
- ❖ titrations appear in this Topic.

# Topic 8: Redox Chemistry and Groups 1,2 and 7

## 8C: Inorganic chemistry of Group 7

### Notes:

- ❖ there is more emphasis on understanding the reasons for the trends in physical properties and reactivity
- ❖ there is more emphasis on understanding the redox reactions of the elements with halide ions, metals and disproportionation reactions
- ❖ iodine/thiosulfate titrations have moved to Unit 5.

# Topic 9: Introduction to kinetics and equilibria

## 9A: Kinetics

Additions:

- ❖ calculating the rate of a reaction from:
  - ❖ i the time taken for a reaction, using  $\text{rate} = 1/\text{time}$
  - ❖ ii the gradient of suitable graph, by drawing a tangent, either for initial rate, or at a time,  $t$
- ❖ drawing the reaction profiles for uncatalysed and catalysed reactions, including the energy level of the intermediate formed with the catalyst



# Topic 9: Introduction to kinetics and equilibria

## 9B: Equilibria

Additions:

- ❖ evaluate data to explain the necessity, for many industrial processes, to reach a compromise between the yield and the rate of reaction

# Topic 10: Organic Chemistry: Alcohols, Halogenoalkanes and Spectra

## 10A: General Principles

This is taken from the legacy specification 2.11.

## 10B: Halogenoalkanes

Additions:

- ❖ reaction between halogenoalkanes and alcoholic KCN to produce nitriles (as an example of a reaction to increase the length of the carbon chain)
- ❖ the hydrolysis of primary haloalkanes using aqueous silver nitrate in ethanol

# Topic 10: Organic Chemistry: Alcohols, Halogenoalkanes and Spectra

## 10C: Alcohols

Additions:

- ❖ reactions to produce bromoalkanes and iodoalkanes
- ❖ tests for aldehydes and carboxylic acids
- ❖ specific techniques for the preparation and purification of an organic liquid

Note:

- ❖ the reaction with sodium is no longer required

# Topic 10: Organic Chemistry: Alcohols, Halogenoalkanes and Spectra

## 10D: Mass spectra and IR

Note:

- ❖ understanding which molecules absorb IR radiation has been removed.

Most of Topic 2.13 on Green Chemistry is no longer required.

Any statements that are required are listed in separate Topics, for example, carbon neutrality has been moved to Unit 1.

# Unit 3: Practical Skills in Chemistry 1

# Practicals in the specification

- ❖ The specification contains 16 Core Practicals (8 at AS and 8 at A2 – **see handout**).

It is strongly recommended that students complete these Core Practicals in order to develop skills

- ❖ Other suggested practicals appear in the specification
- ❖ The suggested practicals are optional
- ❖ You may add – or substitute – your own practicals too!

# Practical skills

- ❖ Students will be assessed on practical skills in Units 3 and 6.
- ❖ This will include testing the skills of students in familiar and unfamiliar applications
- ❖ Students may be asked about planning, including risk management and the selection of apparatus, with reasons
- ❖ Other questions may cover data handling, including the use of significant figures, processing data and plotting graphs.

# Support for practical skills

- ❖ The approach is similar for the GCE A level; many resources are adaptable.
- ❖ Practical Guide for Teachers and Students – introduces the practicals and has some questions
- ❖ Worksheets for students, teachers and technicians – to give further detail of the practical activities
- ❖ Lab Books – to save you having to photocopy worksheets!



# Assessing practical skills – Unit 3

- ❖ Unit 3 is a written practical examination, covering the skills and techniques developed during practical work in Units 1 and 2.
- ❖ The unit content contains eight core practical activities
- ❖ The examination may include questions where students apply their knowledge to new practical situations.
- ❖ Students should develop their practical skills by completing a range of different practicals that require a variety of different techniques.
- ❖ Suggested practicals are included at the end of each Topic.

# Questions may ask students to:

- ❖ recall and/or interpret observations relating to tests for ions and gases in Units 1 and 2
- ❖ recall and/or interpret observations relating to tests for organic functional groups in Units 1 and 2
- ❖ manipulate data and comment on experimental methods and techniques for a range of experiments involving measurements in Units 1 and 2, including molar mass calculations, titrations, thermochemical investigations and simple kinetics experiments
- ❖ comment on experimental methods and techniques in the preparation of inorganic or organic compounds in Units 1 and 2.

# Unit 4:

## General Principles of Chemistry I – Rates, Equilibria and Further Organic Chemistry

# Topic 11: Kinetics

- ❖ The topic assumes knowledge of Topic 9A: Kinetics

Notes:

- ❖ The content is almost the same as the legacy specification but has been re-ordered and clarified
- ❖ Heterogeneous catalysts have been moved from Unit 5 Transition metals

# Topic 12 Entropy and Energetics

## 12A: Entropy

No significant changes from the legacy specification – the statements have been rewritten to provide extra clarity.

## 12B: Lattice energy

Notes:

- ❖ This topic has been moved from Unit 1 in the legacy specification.
- ❖ The use of entropy and enthalpy changes of solution to predict the solubility of ionic compounds and discuss trends in solubility has been added.

# Topic 13: Chemical equilibria

- ❖ This topic assumes knowledge of Unit 2 Topic 9B: Chemical equilibria.
- ❖ The statements from the legacy specification Topics 4.5 and 4.6 have been rewritten to simplify and clarify this section of work.
- ❖ There is less emphasis on details of industrial processes, although questions could still be set on these processes using application of knowledge of the points in the new specification.

# Topic 14: Acid-base equilibria

- ❖ knowledge of early theories about acidity has been removed

# Topic 15: Organic Chemistry:

## Carbonyls, Carboxylic acids and Chirality

### Topics 15A: Chirality, 15B: Carbonyl compounds and 15C: Carboxylic acids

These are almost the same as the legacy specification, with just some rewriting to provide clarification.

### Topic 15D: Carboxylic acid derivatives

This is almost the same as the legacy specification but transesterification has been removed.



# Topic 15: Organic Chemistry:

## Carbonyls, Carboxylic acids and Chirality

### Topic 15E: Spectroscopy and Chromatography

Additions:

- ❖ use of mass spectra data to 4 decimal places
- ❖ use of  $^{13}\text{C}$  NMR spectroscopy
- ❖ predicting the chemical shifts and splitting patterns of the  $^1\text{H}$  atoms in a given molecule
- ❖ paper and thin layer chromatography

Notes:

- ❖ use of magnetic resonance imaging has been removed

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

# Topic 16: Redox Equilibria

Additions:

- ❖ writing cell diagrams using the conventional representation of half-cells

Notes:

- ❖ the breathalyser test has been removed

❖

# Topic 17: Transition Metals and their Chemistry

Additions:

- ❖ understanding that colour changes in transition metal ions may arise as a result of changes in oxidation number of the ion, ligand and coordination number of the complex
- ❖ knowing that haemoglobin is a complex of iron(II)
- ❖ understanding the interconversion of the oxidation states of vanadium in terms of  $E^\ominus$  values
- ❖ more detail on homogeneous and heterogeneous catalysts, including autocatalysis

Notes:

- ❖ photochromic sunglasses has been removed

# Topic 18: Organic Chemistry - Arenes

❖ Addition of hydrogen to benzene has been removed

# Topic 19: Organic Nitrogen Compounds: Amines, Amides, Amino Acids and Proteins

- ❖ the preparation of primary aliphatic amines from halogenoalkanes and by the reduction of nitriles has been added
- ❖ the reaction of amino acids with ninhydrin has been removed

# Topic 20: Organic Synthesis

## Additions:

- ❖ increasing the length of a carbon chain using Grignard reagents

## Notes:

- ❖ importance of synthesis in research for the production of useful products and explaining why sensitive methods of chemical analysis are important have been removed
- ❖ understanding of the importance of the mechanism in the synthesis of stereo-specific drugs and combinatorial chemistry in drug research have been removed

# Sample Question

\*Benzene can be represented by either a cyclic triene or with a delocalised ring of electrons.

**Discuss** evidence, including one example from each of spectroscopy, thermochemistry and the type of reaction normally undergone, that support the view that the better representation of benzene is with a delocalised ring of electrons.

(6)

This is an example of a 6 mark extended writing question.  
What would you expect the six indicative points to cover?



# Sample Answer

Spectroscopy: (IP1 and 2)

Either X-ray diffraction

- all C-C bond lengths in benzene are equal
- but if it was a cyclic triene then they would alternate in 'short' and 'long' lengths  
or

which is consistent with equivalent C-C bonds with a delocalised ring of electrons

Or infrared spectroscopy

- benzene has peaks at 1600, 1580, 1500, 1450 ( $\text{cm}^{-1}$ ) for an aromatic C=C
- alkene C=C has a peak at 1669 – 1645 ( $\text{cm}^{-1}$ ).

Thermochemistry: (IP3 and 4)

- enthalpy of hydrogenation is less exothermic than expected for a cyclic triene
- which is consistent with the delocalisation stability of the ring from the ring of electrons,

Type of reaction: (IP5 and 6)

- benzene undergoes substitution reactions
- alkenes undergo addition reactions/decolourise bromine water.

# Unit 6: Practical Skills in Chemistry II

# Practical skills

The points covered in Unit 3 also apply to Unit 6 except:

- ❖ students are expected to develop experimental skills and knowledge and understanding of the necessary techniques by carrying out a range of practicals while they study Units 4 and 5.

# Extended writing questions

# Extended writing questions

- ❖ The previous IAL specification also had questions worth around 6 marks
- ❖ In general, these were “points mark”, but sometimes included a mark for “QWC”
- ❖ The new IAL specification has a 6-mark question on Units 2, 4 and 5

# Marking extended writing questions

- ❖ Up to 4 marks are given for chemical knowledge
- ❖ The chemistry is found in the “indicative marking points”
- ❖ There are usually 6 indicative marking points
- ❖ The table in the mark scheme shows how many marks are scored by different numbers of indicative points

# Marking extended writing questions

- ❖ Up to 2 marks are given for reasoning and logical presentation of ideas
- ❖ Note that this isn't about spelling and grammar – instead it is about linking the points together in a clear sequence
- ❖ In general, answers with fewer indicative points are unlikely to score both marks of the 2 available

# Teaching and learning support



# Planning

- ❖ • [Getting Started Guide](#): gives you an overview of the Edexcel IAL in Chemistry to help you understand the changes to content and assessment
- ❖ • [Course planner](#) and [scheme of work](#): saves you time in planning and helps you put together teaching strategies for delivering the specification content.
- ❖ • [Mapping documents](#): highlight key differences between the new and legacy qualifications to help you understand the changes made to the new specifications.

# Teaching and learning

- ❖ [Practical Skills](#) and [Mathematical Skills Guides](#): helps you ensure that students are developing these skills, both of which form a key part of the assessment for the new IAL
- ❖ *Getting Ready to Teach* and other training events: available locally and online.
- ❖ [Printed textbooks and digital teaching resources](#) – promote ‘any time, any place’ learning to improve student motivation and encourage new ways of working.

# Digital support

## ResultsPlus

- ❖ ResultsPlus provides the most detailed analysis available of your students' examination performance. It can help you identify the topics and skills where further learning would benefit your students.

## examWizard

- ❖ A free online resource, containing a bank of past paper questions, designed to support students and teachers with examination preparation and assessment.

# Dedicated Science Subject Advisor

Your subject advisor is Irine Muhiuddin

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[Science community](#): A place to chat, share resources and ideas, ask questions and start your own discussions.



**Any questions?**

**Thank you for attending this  
event.**

*How did we do?*

*Please fill in the evaluation form that you'll receive via  
e-mail in a few minutes.*

ALWAYS LEARNING