Edexcel International AS/A Level

IG/IAL Chemistry: Bridging the Gap

Event code:YCH11-20IO1

First teaching in 2018, first assessment 2019

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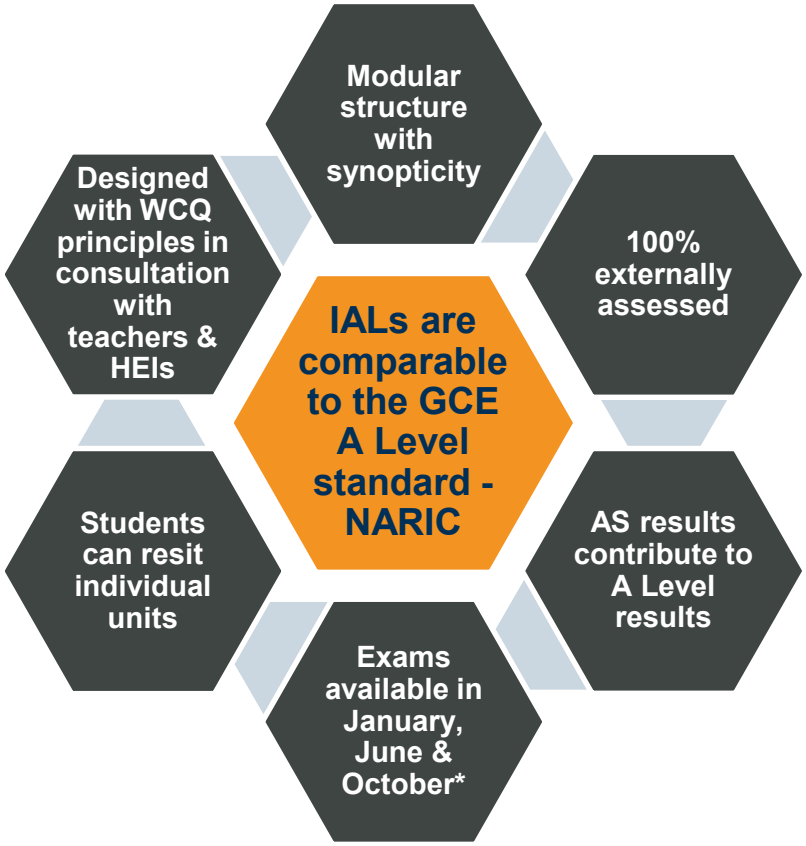
IAL Features

- International A Levels and AS Levels are created for International Students.
- Globally recognised.



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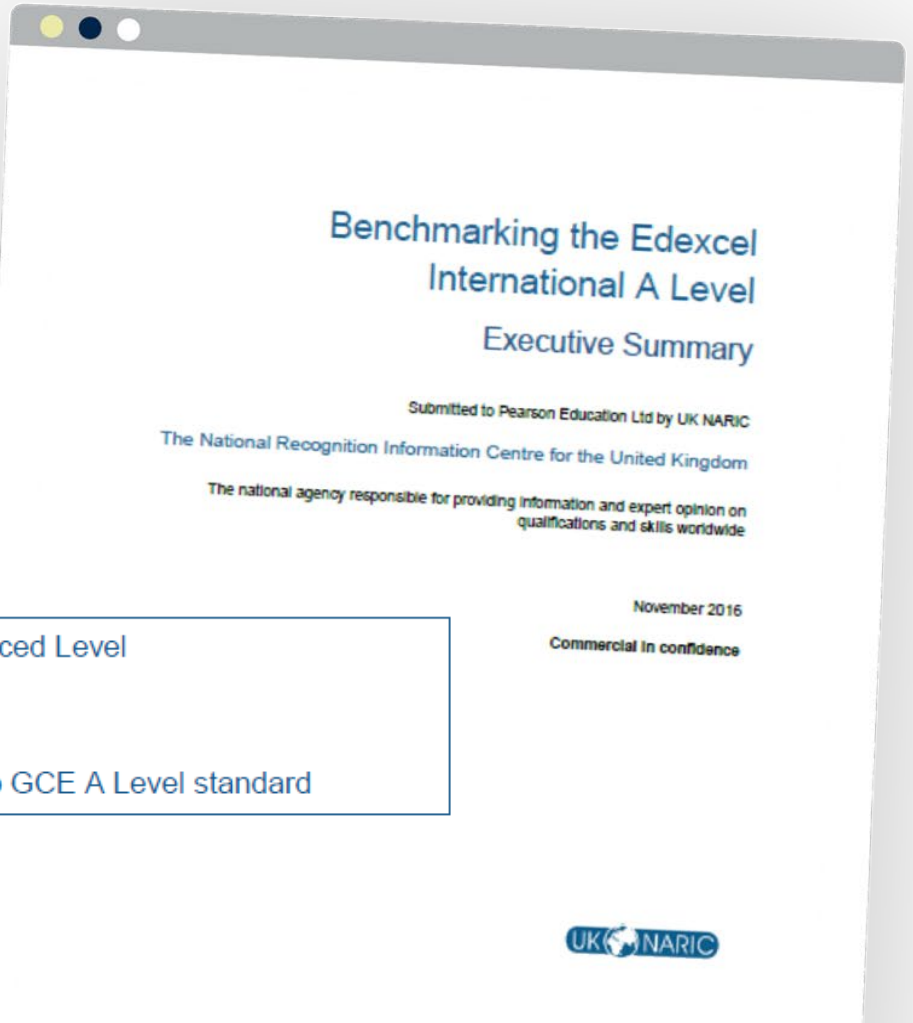
Updated NARIC report for Edexcel IAL

The executive summary confirms that Edexcel IALs are considered comparable to the GCE A Level standard following reforms to the UK regulated qualifications.



Qualification:	Edexcel International Advanced Level
Awarding Institution:	Pearson Education Ltd
Comparability:	Is considered comparable to GCE A Level standard

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Introductions – Getting to know you

Complete the poll on your screen now

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Bridging the gap

Delegates will:

- discuss the differences between International GCSE and Advanced Level study, including level of difficulty, accessibility, learning styles and methods of assessment
- be introduced to a range of activities to enthuse and enable students who have just completed International GCSE assessments, to make and sustain the necessary step up to the level of understanding and methods of working – including independent learning – required to succeed at International A Level
- discuss and look at ways to address some of the common pitfalls experienced by students taking this challenging step.

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Learning objectives

Delegates will:

- learn effective ways to get students to ‘hit the ground running’ when they transfer to Advanced Level
- learn how to strike the necessary balance between students gaining a realistic understanding of the significantly higher level of work and commitment required at A Level, and students being encouraged and motivated to believe that this is the course for them and that they are capable of achieving success
- learn how to implement teaching and learning strategies that develop and enhance independent learning in students
- gain an appreciation of the key differences in assessment at Advanced Level compared to GCSE and the implications for assessment and feedback for teaching and learning.

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Session agenda

- Key differences between study at International GCSE and iAL.
- Strategies to use early in the course.
- Teaching and learning strategies to help with common misconceptions.
- Building independent learners.
- Formative and summative assessment and feedback.

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Key differences between studying chemistry at International GCSE & IAL

- Need for a secure foundation – chemist's toolkit.
- Greater range and depth of study.
- Far more emphasis on understanding and application.
- Expectation that students develop greater independence.
- Increased complexity and frequency of experimental work.

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Chemist's Toolkit from GCSE

Key ideas and skills include;

- understanding of patterns linked to Periodic Table, e.g. charges on ions, reactivity
- recall of 'chemical common sense' – e.g. solubility rules, colours of solutions containing common ions, common reactions e.g. acid-base, precipitation, redox
- ability to visualise at a particulate level e.g. collision theory, simple structures, giant structures
- translate between different representations e.g. molecular formulae and displayed formulae, diagrams and actual apparatus
- numeracy and problem solving – rearranging and using mathematical relationships.

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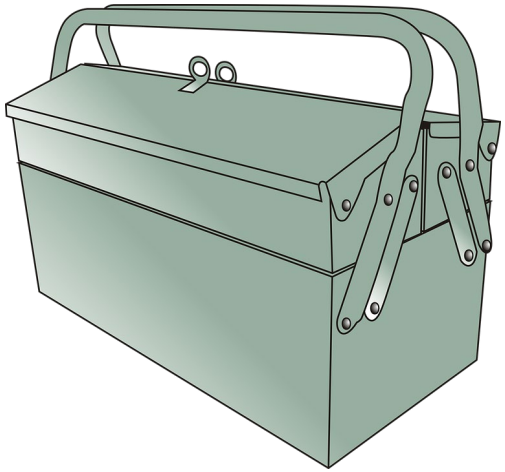
Possible strategies to ensure toolkit is embedded

- Prior knowledge summary (organiser).
- Do now tasks.
- Regular low stakes testing – use it or lose it.
- Spot the Mistake / True or False.
- Baseline assessments – could be anonymous.
- Focus on process as well as outcomes in calculations.



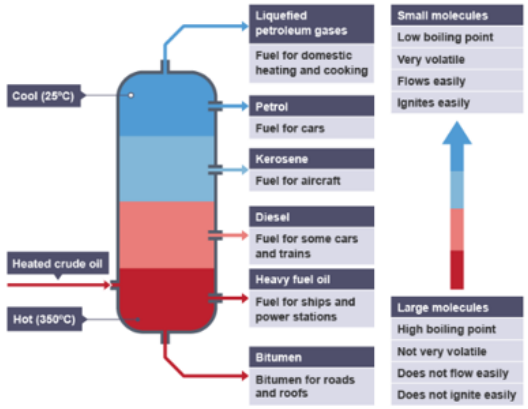
Prior knowledge organiser

Knowledge Organiser: Separate Science

C7 Organic Chemistry

Crude Oil

- is formed from the **remains of dead animals**, such as plankton (biomass)
- is a **finite resource**, which mean it's being used up faster than it forms
- is a mixture of **hydrocarbons**
- is separated into simpler mixtures of hydrocarbons using **fractional distillation**
- the hydrocarbons in oil belong to a chemical family called **alkanes**
- the simpler mixtures produced are called **fractions**
- examples of fractions include **petrol, diesel oil, kerosene, heavy fuel oil and LPG**
- we use the fractions as fuels or to make other materials such as **polymers, lubricants, solvents and detergents**



Combustion (burning) of Alkanes.

When burnt in enough oxygen alkanes are **oxidised,** producing **carbon dioxide** and **water**

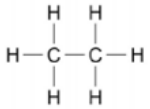
$$C_8H_{18}(l) + 11½O_2(g) \rightarrow 8CO_2(g) + 9H_2O(g)$$

Fractional Distillation

- crude oil is heated until most of it **evaporates**
- the vapour travels up a large tube called a **fractionating column**
- as the vapour gets further up the fractionating column it cools down
- different fractions **condense at different boiling points,** depending on their size
- the **smaller the molecules** in the fraction, the **lower the temperature** at which the fraction condenses (boiling point)
- Smaller molecules also evaporate and catch more readily, and flow more easily
- each fraction contains molecules with a similar number of carbon atoms

Alkanes all have single carbon-carbon bonds. The can be shown using a molecular formula, C_2H_6 or a displayed formula, which shows all the bonds. The number of hydrogen atoms in an alkane is always twice the number of carbon atoms plus two. So they have the **general formula C_nH_{2n+2}**

Displayed formula for C_2H_6 →



Names and formulae of common alkanes

Name	Molecular Formula
methane	CH_4
ethane	C_2H_6
propane	C_3H_8
butane	C_4H_{10}

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Do now task - example

Starters for 10 – Transition skills

0.1.2 Constructing ionic formulae

1. For each of the following ionic salts, determine the cation and anion present and use these to construct the formula of the salt. (5 marks)

a. Magnesium oxide

b. Sodium sulfate

c. Calcium hydroxide

d. Aluminium oxide

e. Copper(I) oxide

2. When an acid is added to water it dissociates to form H^+ ions (which make it acidic) and an anion. These acidic hydrogen atoms can be used to determine the charge on the anion. Deduce the charge on the anions in the following acids. The acidic H atoms, H^+, have been underlined for you. (5 marks)

a. $\underline{H}_2SO_3$

b. $\underline{H}NO_3$

c. $\underline{H}_3PO_4$

d. $HCOO\underline{H}$

e. $\underline{H}_2CO_3$

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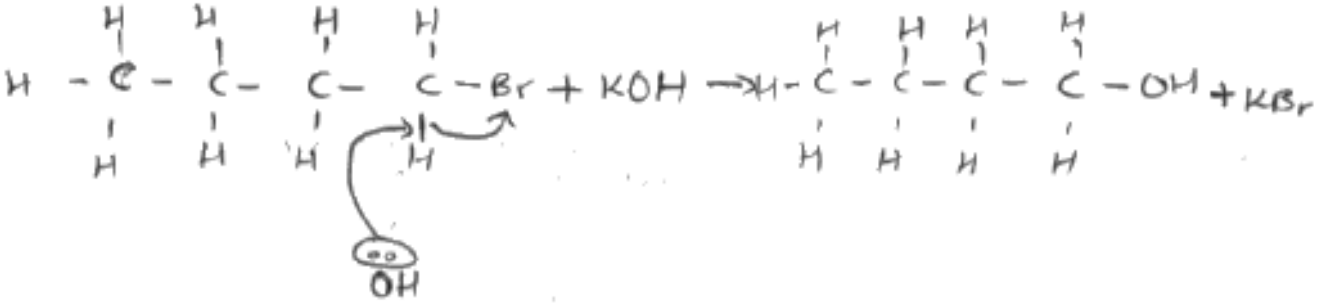
Spot the mistakes - example

This is an example from June 2019 – students were asked to show the mechanism for the reaction between 1-bromobutane and potassium hydroxide.



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Low stakes testing

- Think of the students you teach and write 2 or 3 questions on a topic of your choice that will reinforce key ideas.
- Share them in the chat when complete so other delegates can view / use them.

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Coping with content

There is lots to cover…

- Set curriculum goals.
- Help students to organise non-contact time to free up class time.
- Balance class time to check / reinforce understanding versus imparting facts.

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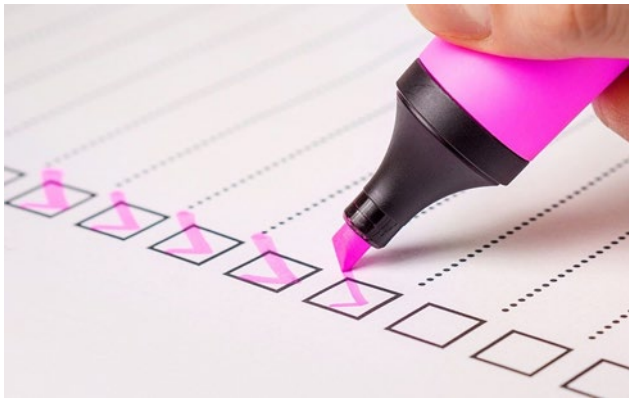
Coping with content - learning logs



Independent Learning Resources

Supplementing class notes

Source	Date completed	Evidence
Edexcel A level Chemistry Student Book 1 notes pages		
https://www.chemguide.co.uk/inorgmenu.html		
Allery Chemistry: https://www.youtube.com/watch?v=9S-BPnxa63Y		

Exam Practice Questions with answers - self assessment

Source	Date completed	Evidence
Edexcel A level Chemistry Student Book 1 review questions pages		
Edexcel A level Chemistry Student Book 1 Answer booklet - check answers		
Physics and Maths Tutor: https://www.physicsandmathstutor.com/chemistry-revision/a-level-edexcel/topic-4/		

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Coping with content - flip the learning

- Set guided reading / viewing / note taking outside of the classroom.
- You can use technology to check this is being done e.g. edpuzzle.
- Free up contact time to check understanding and provide feedback.
- Helps prevent build-up of unchecked misunderstanding.
- Balances coverage versus engagement issue.

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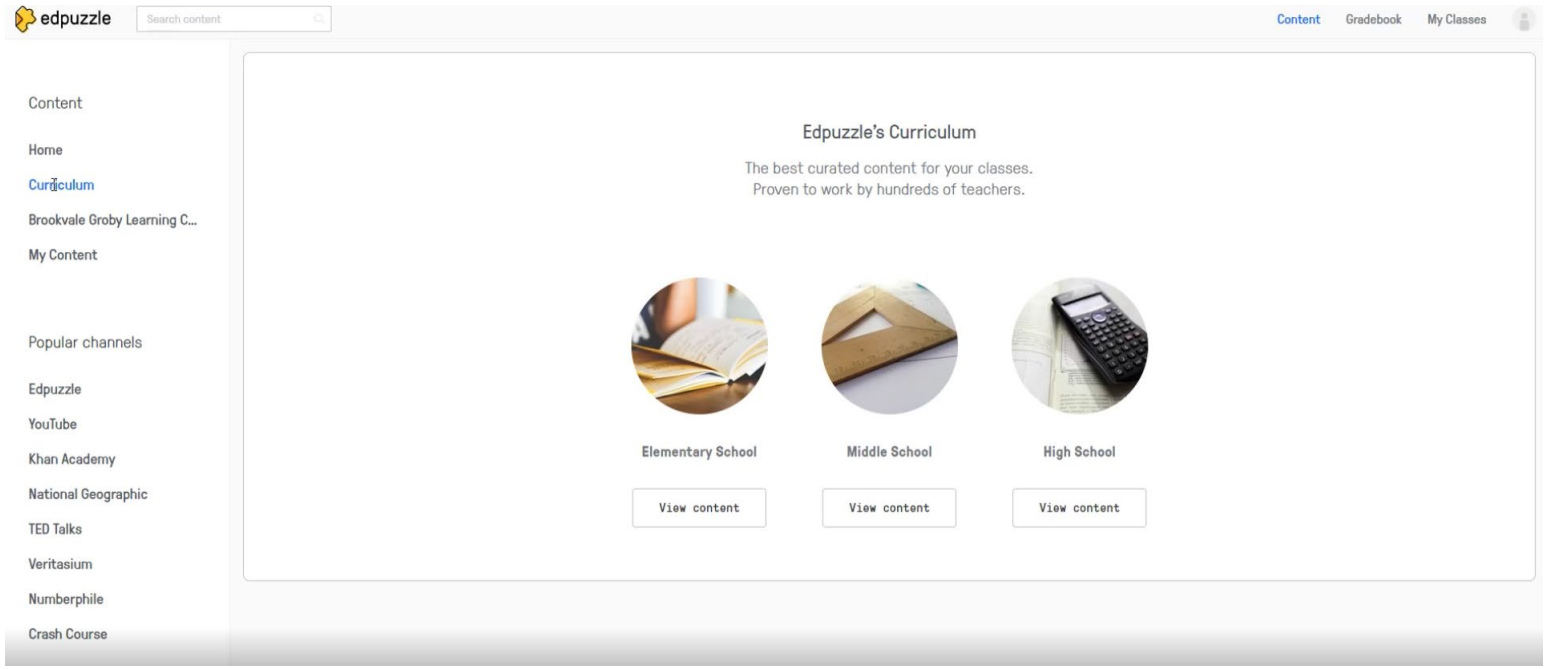
Coping with content - use of technology



https://edpuzzle.com/home

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Common misconceptions / problems

Discuss the ideas that you think are the most common misconceptions and problems you see early on in year 1 of the course. Feedback via the chatbox.

- Misuse of particle terminology.
- Always sticking to the octet rule in bonding.
- Recognising type of bonding and structure.
- Polarisation of bonds.
- Chemical amounts – the mole.
- Secure foundation of reactions / reaction type.
- Ionic Equations.
- Organic Mechanisms.

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Chemical amounts – preliminary knowledge

Make sure our KS3 / lower secondary curriculum looks at 3 key concepts which students have unsecure understanding of:

- chemical reactions produce new substances
- matter is made from tiny particles invisible to the naked eye
- chemists need to be able to measure amounts of substances accurately in order to be able to control a reaction.

These concepts should be revisited at each relevant point of the curriculum – not just chemistry units… embed over time.

At GCSE / A Level – need to ensure mastery at each step before moving on to multi-step calculations – **minimise cognitive load.**

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Chemical amounts – before the calculations…

- Use pre-weighed samples of familiar elements, labelled with symbol, mass and atomic mass e.g.
  64 g of copper and 32 g of sulphur.
- Tell students each sample has the same number of atoms and ask them to imagine what the ratio of masses would be if we had 1 of each atom.
- Show that the ratio remains the same regardless of the numbers of atoms.
- Introduce the idea of Avogadro's number and re-emphasise the notion that atoms are tiny so the number has to be large.

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Chemical amounts – the calculations

- Ensure students are comfortable with mol = mass / molar mass.
- Start with empirical formulae calculations – understanding the difference between Cu_2O and CuO is easier to conceptualise than the ratios in complex chemical equations.
- Once students begin reacting mass calculations, ensure they lay them out with clear notation – if their solutions do not have clear notation give them back to be re-worked – they need to develop schema for future reference.
- Repeat the process with other mole relationships e.g. concentration x volume.

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Chemical amounts – example of layout

Calculate the mass of copper produced from the reduction of 2.86 g of copper(I) oxide using the equation below:

$Cu_2O + H_2 \rightarrow 2\ Cu + H_2O$

$M_r(Cu_2O) = 63.5 \times 2 + 16 = 143$

$\text{mol}(Cu_2O) = \frac{2.86}{143} = 0.02\ \text{mol}$

$\text{mol}(Cu) = 0.02 \times 2 = 0.04\ \text{mol}$

$\text{mass}(Cu) = 0.04 \times 63.5 = 2.54\ \text{g}$

It may be helpful to recognise that using molar mass in g mol^{-1} is useful here as the units can be a useful trigger to recall the equation.

Chemical amounts – use moles to balance equations

12.0 g of tridecane ($C_{13}H_{28}$) is cracked to form 2.87 g of propane (C_3H_8), 5.48 g of propene (C_3H_6) and 3.65 g of ethene (C_2H_4). Write a balanced equation for the reaction.

$$\text{Mol}(C_{13}H_{28}) = \frac{12.0}{184} = 0.0652 \text{ mol}$$

$$\text{Mol}(C_3H_8) = \frac{2.87}{44} = 0.0652 \text{ mol}$$

$$\text{Mol}(C_3H_6) = \frac{5.48}{42} = 0.130 \text{ mol}$$

$$\text{Mol}(C_2H_4) = \frac{3.65}{28} = 0.130 \text{ mol}$$

Therefore, 1 : 1 : 2 : 2

$$C_{13}H_{28} \rightarrow C_3H_8 + 2\,C_3H_6 + 2\,C_2H_4$$

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Chemical amounts – reinforce with experimental work

- Confirming equations via empirical measurements e.g. reaction of Fe with $CuSO_4$.
- Decomposition of $KHCO_3$.
- Investigation into the percentage by mass of magnesium hydroxide in milk of magnesia.

Slides 20-25 used ideas from https://edu.rsc.org/ideas/five-steps-to-help-students-master-mole-calculations/3010333.article and https://edu.rsc.org/ideas/reinventing-the-chemistry-practical/3009877.article

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Organic mechanisms – preliminary knowledge

- Translation between displayed, structural and skeletal formula.
- Understanding of bonding pairs, lone pairs and unpaired electrons from bonding topics.
- Understanding of bond polarity.

Organic mechanisms – before curly arrows

- Ensure structures of reactants are clearly shown.
- Focus on the key features of the reactants – functional groups, relevant dipoles and lone pairs.
- Encourage students to sketch / describe what they think might happen.

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Organic mechanisms – add curly arrows

- Whiteboards allow idea that mistakes during learning are acceptable as they can easily be corrected.
- Use dual coding.
- Use colours.

Organic mechanisms – reinforce links to evidence

- e.g. rate of hydrolysis of halogenoalkanes.

Organic mechanisms – practice for mastery

- Look, say, cover, draw, explain, check – become a ‘double threat’ – recall **and** clarity of understanding.

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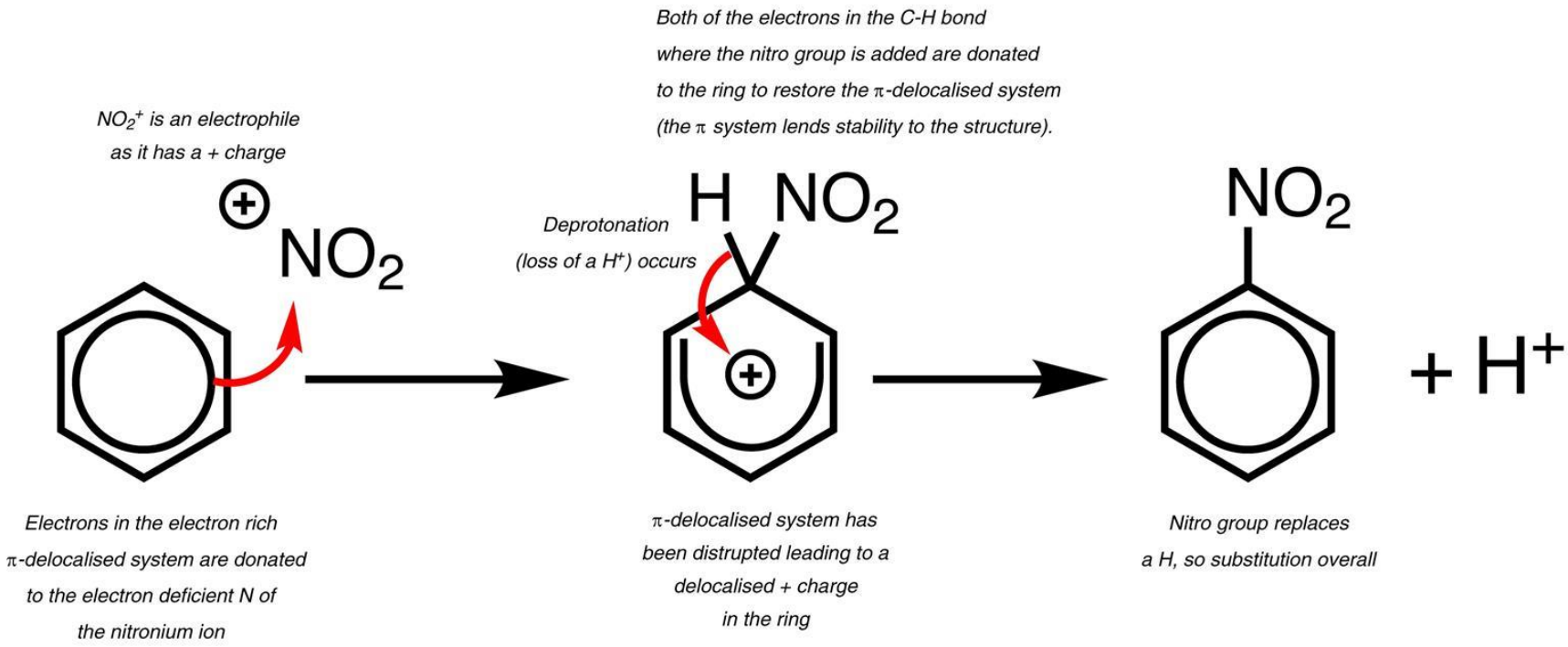
Example of dual coding



from https://edu.rsc.org/ideas/teaching-organic-mechanisms/3010691.article

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Revisit the process…

To review the learning transition for each topic the key features used are:

- revisit curriculum links from earlier years
- distil down topic to highlight key ideas – divide into chunks
- practise mastery of each of the key ideas
- make links to practical work / empirical evidence
- use skills in multi-layered problems.

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Your turn…

Choose a topic that proves challenging on transition for your students.
Use the model to review your approach to teaching that topic.

Does your current scheme meet the model? If so, explain how.
Is there anything you could change in your delivery to improve the transition to iAL?

Spend 10-15 minutes and then feedback comments via the chatbox.

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Building more independent learners

- Model good practice, encouraging students to use similar strategies, e.g. learning logs.
- Encourage students to take responsibility for prior knowledge.
- Use criteria to help students assess their own performance – self review / peer review.
- ‘Jigsaw’ tasks.
- Make time to allow lessons where you adopt more of a ‘coaching’ role, than a ‘director’ role.
- C3B4UCM.

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Building more independent learners

- ‘Snowball’ explanations – encourages peer to peer discussion / collaboration.
- Access to reference material – hard copy or online.
- Use open questioning.
- Have scaffolding ready.

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Building more independent learners – possible lesson strategies

- Envoys.
- Choices – differentiation by task.
- Interviewing.
- Exam question lucky dip.

Some content adapted from https://www.tes.com/sites/default/files/tes_strategies_to_develop_independent_learners.pdf

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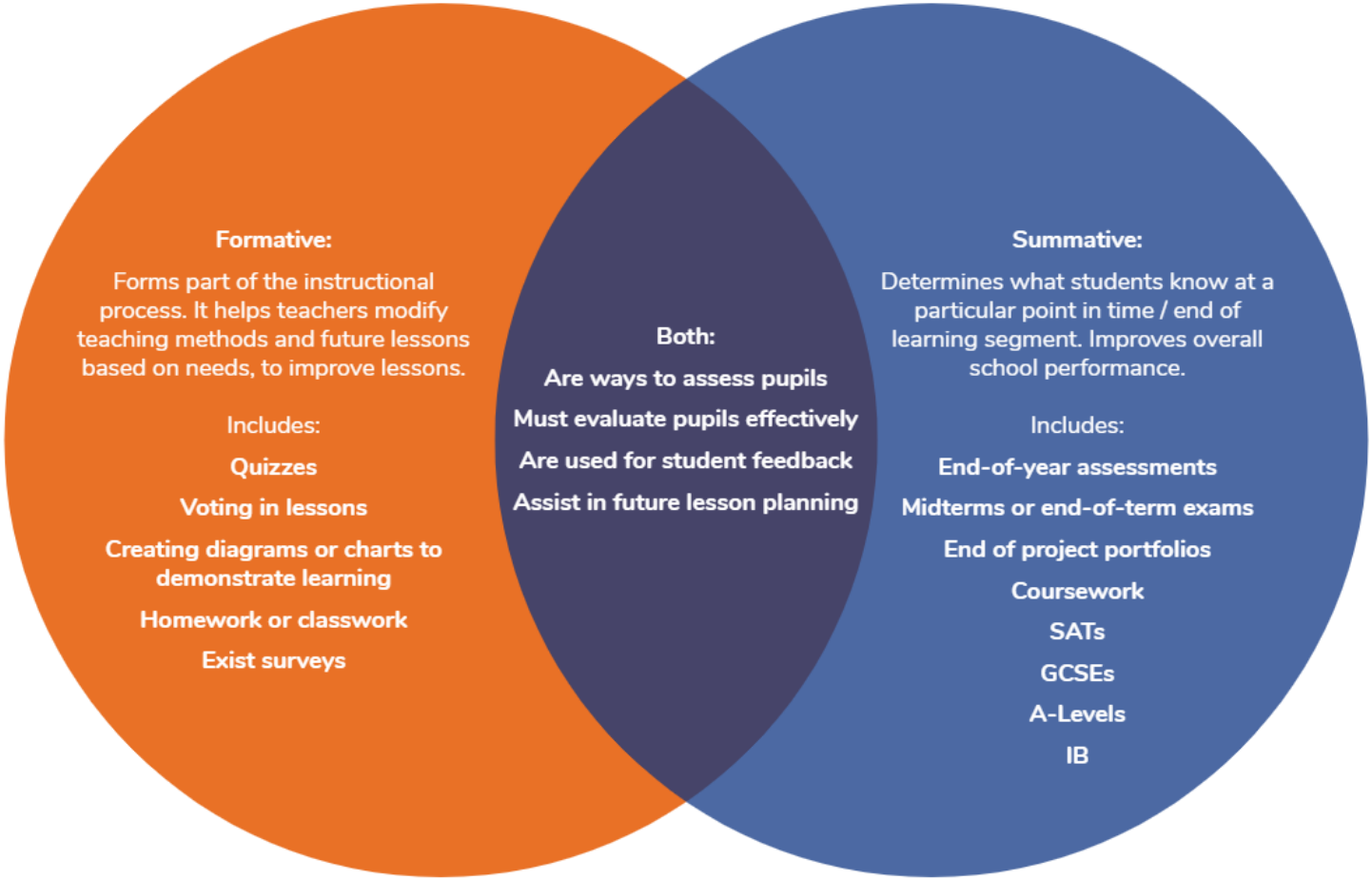
Formative and summative assessment



Source: *Rick Wormell, Fair Isn't Always Equal*

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Formative assessment

- Examples could include;

- strategic questioning
- 3-way summaries
- 3–2–1 countdown
- exit tickets
- one-minute papers.

- Allow time for feedback – use formative assessment for future planning.

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Design a formative assessment

Use the ideas discussed to design a formative assessment task for use with your students to help make sure you can gauge their understanding of a key idea early in the year 12 course.

Feedback your thoughts via the chatbox.

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Summative assessment

Models of summative assessment used in IAL and International GCSE have not changed significantly.
Changes to International GCSE assessment include:

- improving students' analytical skills by applying understanding of scientific concepts to a range of situations. Some examination questions are more problem-solving in style
- addressing the need for mathematical skills to complement students' science skills
- developing students' practical skills by including several practicals in the specification content. The skills developed will be assessed through questions in written examinations
- use of summative assessment outcomes via ResultsPlus can be used to inform curriculum planning in subsequent years.

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Feedback

- Probably the most useful to make sure the transition happens as effectively as possible.
- Doesn't have to involve lengthy written comments.
- Should be focused on helping the student improve their skills and understanding….the 'right' answer and improved grades will then follow.
- Need to allow time in lessons for students to engage with feedback.

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Feedback strategies – effective time savers

Grades are great for school managers but less useful for students because:

- they don't indicate what a student needs to do to improve and students tend to focus on comparing the grade to their peers
- they can de-motivate lower achievers and lead to complacency in high achievers
- however detailed written feedback for large classes is unsustainable for teachers, so what can we do?

Discuss via the chat window.

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Feedback strategies – effective time savers

- Standardised success criteria.
- Systematic whole class feedback.
- Supported self-review of summative assessments.

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Standardised success criteria

[ ] Graph is drawn with a sharp pencil and ruler.

[ ] A bar chart is drawn for categoric data or a line chart for continuous data.

[ ] Axes take up at least half a page.

[ ] Scales go up in sensible multiples of (1, 2 or 5) x 10^{n}.

[ ] Axes have labels with units.

[ ] Data covers two-thirds of the scale (unless origin is included).

[ ] The line of best fit is drawn to show the trend (and is labelled if appropriate).

Original from edu.rsc.org

Self-review of summative assessment

Chemistry paper 1H			
Q	**Topic(s)**	**RG page(s)**	**Tasks**
1	Halogens	25	Explain why the halogens get less reactive as you go down the group.
2	Transition metals and alkali metals	24	Compare the properties of transition metals with the alkali metals.
3	Ionic bonding and properties of ionic compounds Covalent bonding and simple molecular substances	28-30 31-32	1. Explain why ionic compounds conduct electricity when molten or aqueous but not when solid. 2. Explain why ionic compounds have high melting points. 3. Draw a dot cross diagram for N_2. 4. Explain why N_2 has a low boiling point.
4	Distillation	18	Explain how distillation works.
5	Making salts	54	Describe how a sample of pure, dry potassium nitrate crystals could be made. Watch the Making salts required practical video and use the pages in the revision guide for support.
6	Cells, batteries and hydrogen fuel cells	64-65	Complete questions 11-20 on page 66.

Original from edu.rsc.org

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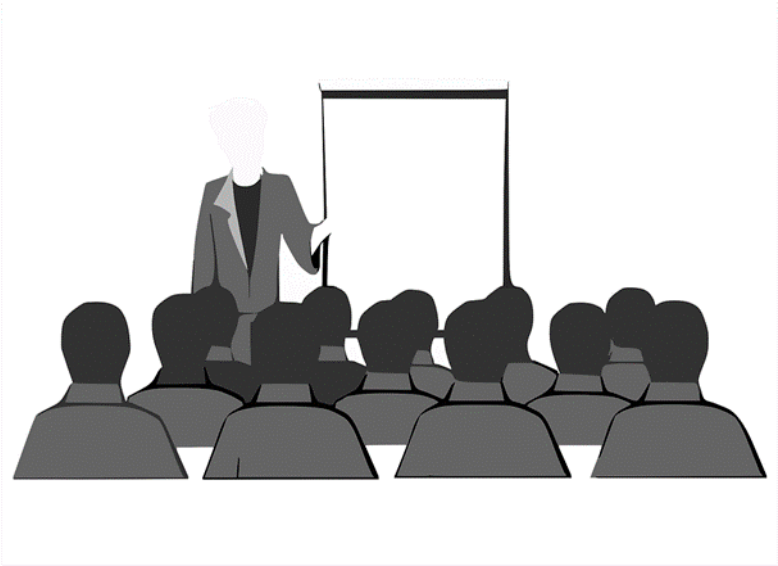
Whole class feedback

- Look at the four examples of Q23 from WCH12. On the basis of the work seen, what feedback would you prioritise for the group, if this work was from your students?

- Write your feedback in the chatbox.



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Summary

To maximise the chances of an effective transition from International GCSE to IAL we can use strategies in our classroom to:

- ensure prior knowledge is secure
- check key ideas little and often using low stakes assessment
- be creative to help students manage the content load
- review and amend our teaching schemes to help counter misconceptions / deal with new content
- don't assume all students are fully developed independent learners – help them develop those skills
- look to use effective and efficient feedback.

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IAS & IAL subjects

Biology	Chemistry	Physics	Mathematics	Further Mathematics
Pure Mathematics	Information Technology	Business	Economics	Accounting
English Language	English Literature	History	Geography	Psychology
Arabic	French	German	Greek	Spanish
		Law (IAL only)		

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IAS and IAL 2018

Biology, Chemistry and Physics

Reviewed and updated in light of GCE A Level changes

Better defined application of Mathematical Skills to each subject

Opportunities for Core Practical activities throughout each subject

Practical Skills assessed through dedicated units (Unit 3 and Unit 6)

Better consistencies between examinations and use of command words across subjects

Fully modular examinations three times a year
AS contributes to A Level

Dedicated textbooks are currently in production

Teachingscience@pearson.com

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Support overview

Free Support

- Getting Started Guide & Scheme of Work
- Getting Ready to Teach events
- Subject interpretation of transferable skills
- Subject Advisor
- ResultsPlus
- Regional Support Manager

Additional support for selected subjects

- Curriculum matched publishing
- Lesson plans
- Exemplar marked responses
- Topic booklets & subject guides
- Additional SAMs
- ExamWizard

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Evaluation

Please fill in an evaluation form!

Thank you for participating.

Find out more about us at:
http://qualifications.pearson.com

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ALWAYS LEARNING