AQA qualification support

AS/A-level Chemistry: Preparing to Teach

General information

BOOKLET 1

Published date: Spring 2015 version1

Contents

Page

Contacts/Administration

Contact points for A-level /Chemistry

Please contact the subject department for further help and advice about the above specification and any information about standardisation.

Customer support team

A-level Science Department
AQA, Guildford, GU2 7XJ

Telephone: 01483 477 456 (Option 2)

email: alevelscience@aqa.org.uk

For help with Support Meeting Information, please contact:

Teacher Support Manager

Eilish Gorse

AQA, Guildford, GU2 7XJ

Telephone: 0161 957 3646

email: teachercpd@aqa.org.uk

Websites

AQA: aqa.org.uk

JCQ: jcq.org.uk

Administration

Entries:

Direct Line: 0161 455 5482

Fax: 0161 455 5408

email: entries@aqa.org.uk

Web: http://web.aqa.org.uk/exams-office/entries.php

Pre Exam Services – Access Arrangements/Special Consideration/ Modified Question Papers

Direct Line: 01483 477884
Fax: 01483 556417

email: specialneeds@aqa.org.uk

Post Results Services

Direct Line: 0844 209 6619 – EOS (Exam Office Support)
Fax: 01483 556 344

email: resultsenquiries-s@aqa.org.uk (Guildford office)
resultsenquiries-n@aqa.org.uk (Manchester office)

Web: http://web.aqa.org.uk/exams-office/about-results/re-marks.php

For general queries about additional AQA support; follow these web links:

e-aqa: http://web.aqa.org.uk/help/eaqa.php

Secure Key Materials (SKM) can be accessed through the above e-AQA link. You will find copies of some of the materials that we have used in this meeting on this site, as well as selected items that have been used at previous Teacher Support Meetings.

Online Booking Service: https://coursesandevents.aqa.org.uk

In-school CPD: http://web.aqa.org.uk/qual/cpd/cpd_inschool_guidelines.php

For subject coursework and controlled assessment standardisation meetings; please contact either the Internal Assessment Standardisation team or relevant subject departments.

For further guidance on standardisation please refer to:
http://web.aqa.org.uk/support/teacher-online-standardisation
http://store.aqa.org.uk/support/pdf/AQA-TOLS-GUIDE.PDF

Additional information

Visit our website to find the latest resources and information

A-level homepage for planning, teaching and assessment resources which includes the Specifications and Practical handbook:
http://www.aqa.org.uk/subjects/science/as-and-a-level/chemistry-7404-7405

Specifications launch webcast: Part 1 - Science main changes and rules
http://aqa.adobeconnect.com/p3w2qz5jdya/

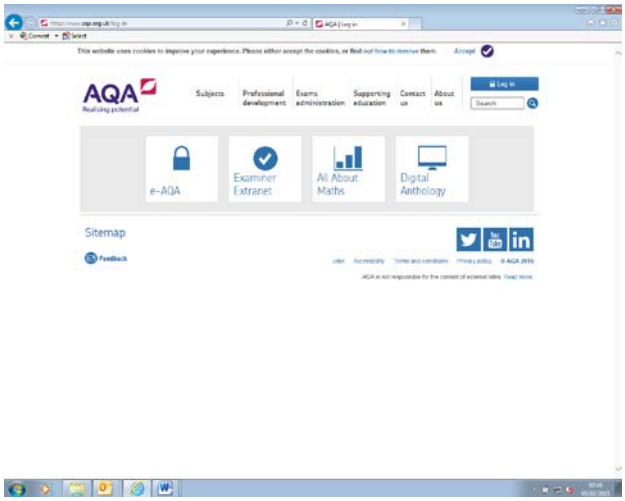
Specifications launch webcast: Part 2 - Chemistry content
http://aqa.adobeconnect.com/p4a99zqbat5/

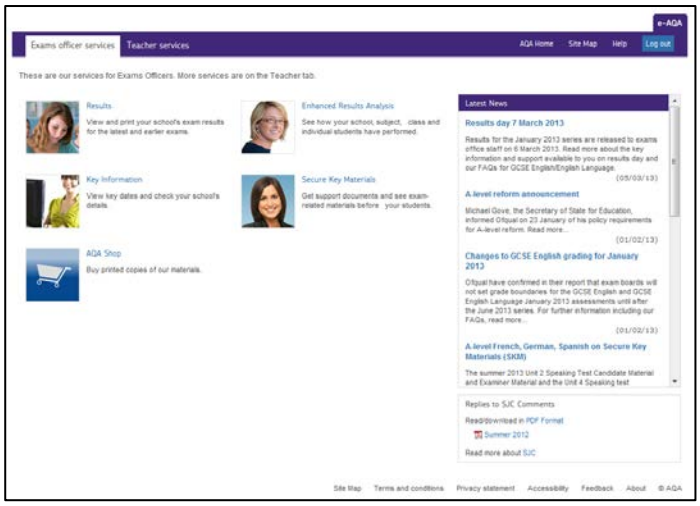
Programme for the day

10.00 - 10.15am	**Arrival tea/coffee**
	The A-level Specification
	External assessment
	Question types
11.15-11:30	**Tea/coffee break**
	Practical requirements and questions
12:30-13:15	**Lunch**
	Practical endorsement
	Activity
	Practical work
	Schemes of work
	Support and resources available
	Evaluation form
15:45	**Close**

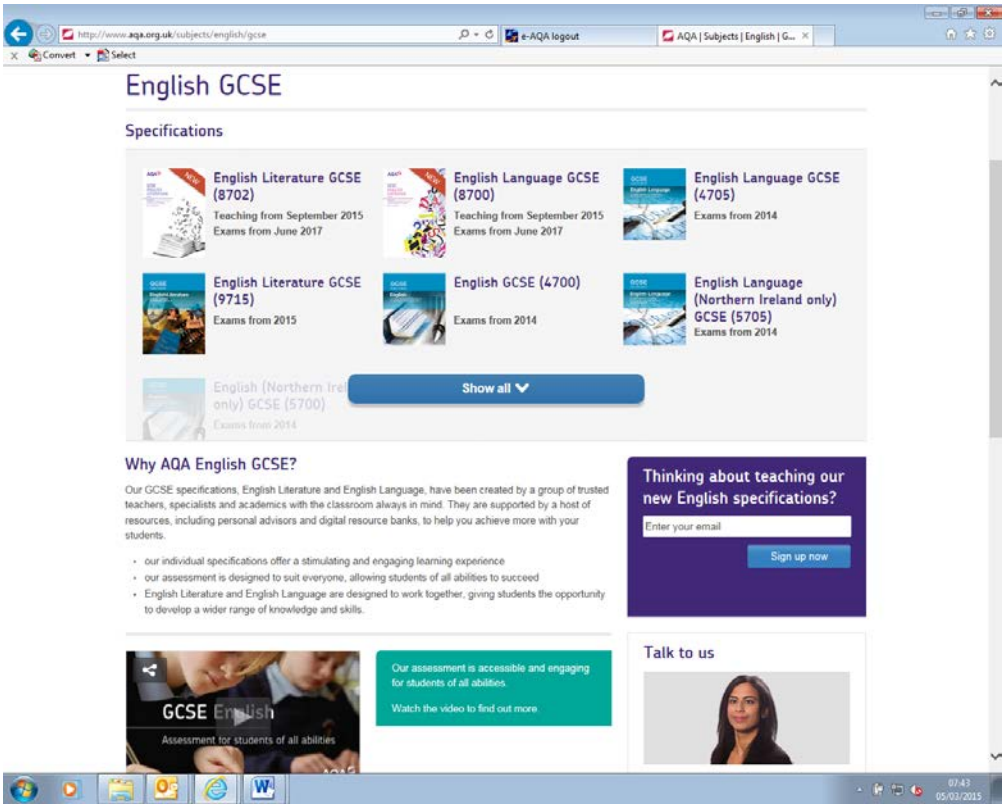
Guide to using e-AQA and ERA

To access e-AQA you will need a password from your Examinations Officer. Listed below are the materials available on e-AQA:





The regular AQA website (www.aqa.org.uk) contains materials and guidance by subject:



Unleash the potential...

Getting started

Enhanced Results Analysis (ERA) is a free online tool, offering instant exam results analysis by school, subject, classes/groups and individual students. ERA is used by thousands of teachers to identify their students' strengths and weaknesses, and improve performance. **More than 43,000 teachers are already using ERA so what are you waiting for?** Unleash its potential today!

> "ERA is really easy to use. Any service that **informs departments** and can be used in an empowering way to **enhance teaching and learning** – and is free – has to be a fantastic educational tool. It would be foolish to overlook its value."
>
> **Melanie, Head of English**

Top tip

"Play around with ERA and take the time to become familiar with it, as it saves a lot of time doing independent analysis."
Katie, Head of English

ERA will help you:

1. see how students performed in specific topics and identify those who need extra support
2. tailor your lesson plans and focus your teaching where it's needed most to maximise every student's progress
3. inspire your students: teachers who use ERA say their students are keen to see their marks for themselves so they know exactly where they need to improve to get the grade they aspire to
4. spot year-on-year trends and measure achievement against other schools and colleges for a broader perspective
5. create management reports for senior leadership teams.

Register for ERA in five easy steps

1. Complete the online form at: **aqa.org.uk/era-register**
2. Your form is sent to your school or college's centre administrator for verification. This may take a few days, but it's important to make sure that access to results is only given to teachers at AQA centres.
3. As soon as your request is approved, we will send you a confirmation email.
4. Click the link in this email to log onto e-aqa at **aqa.org.uk/era-login**
5. You're ready to unleash ERA's potential!

Who's using ERA?

22.6% Heads of department
16.7% Subject heads
50.1% Teachers
8.2% Exam officers
2.4% Other

and when?

36% Summer results period
14% March results period
50% Outside main results periods

Don't forget to download our other ERA guides

Subject performance | School performance | Student performance | Group performance

Unleash the potential...

Review your school's performance

ERA allows you to take a snapshot of your school or college's performance. You can also view results according to qualification (for example A-level or GCSE), an individual examination, different classes and so much more.

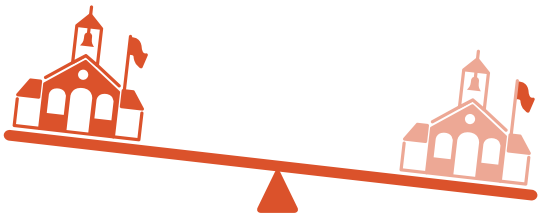
> "This feature is really useful, because the first thing I want to see on results day is the overall performance for my subject, in terms of the number of students receiving A*-C, A*-B, etc and the performance of specific groups."
>
> **Katie, Head of English**

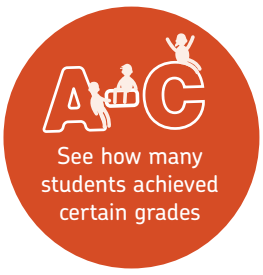
Dig a little deeper

Find out the percentage of students who have achieved an A*-C overall, compared to previous years, similar centres or the AQA national average.

Or...

See how many students in your school/college got an A*-C in your subject.





Grades overview – two easy steps!

1. Access 'Grades overview' from the left-hand panel on the ERA start page.
2. For more detailed analysis, select:
   - 'Entry code' for the specific assessment taken
   - 'Groups' to show any specific groups you have created (see our 'Group performance' guide for more on creating groups).

Did you know...?

ERA's not just for results time:

50% of ERA usage occurs outside of the main results periods to help teachers plan, set targets, provide feedback to students and create reports.

"ERA is a powerful tool that allows us to compare. As a department head, I use ERA to see how well our students have achieved in relation to other centres and the AQA national average. It's also invaluable for the analysis report that we produce for the senior leadership team and governers."

Melanie, Head of English

Don't forget to download our other ERA guides

Getting started | Subject performance | Student performance | Group performance

Unleash the potential...

Review subject performance

ERA allows you to see how your students have performed in your subject. You can create general performance summaries and comparisons with previous years, analyse results for each exam component – right down to individual questions – and highlight areas that need extra attention.

> "On results day, the first thing I want to know is **how well my students have done** overall, compared to our expectations. I then want to see how near or far they were from the next grade. The **subject breakdown** allows us to see if one particular area has let a student down."
>
> **Simon, Head of Chemistry**

Quick win

You can click the 'Download results' tab to build customised performance records and create reports throughout the year to track improvements and trends.

Top tips

Get started: click on the 'Marks analysis' tab in the left-hand panel on the ERA start page.

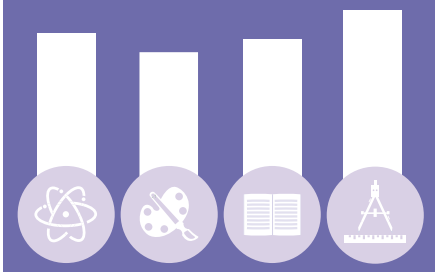
Compare your results: on the 'Marks analysis' page, use the tabs in the top toolbar to make comparisons with other centres, previous years and between groups (eg males and females). See our 'Group performance' reference guide for more on creating groups.

Analyse different subject components (eg for French these will be reading, writing, listening and speaking) by clicking the 'View components' tab.

See a question-by-question breakdown within each component, by clicking on 'View questions'.

View performance by question paper and mark scheme and see examiners' reports via the 'View questions' tab.

View the user guide in the ERA section on our website to view these steps in more detail.



Five reasons to review performance by subject

1. Find out instantly if your performance is better than last year.
2. View your students' marks for each question on a given paper.
3. Pinpoint exactly where individual students have lost marks.
4. Highlight topics/subject areas for improvement, or that need additional focus.
5. Identify the students who need extra help and in what areas.

Did you know...?

34% of the total ERA usage is in the autumn term, following the summer results period. Teachers use ERA to identify areas for improvements and to tailor their teaching plans for the year ahead.

Don't forget to download our other ERA guides

Getting started | School performance | Student performance | Group performance

Unleash the potential...
Review individual student performance

With ERA, you can see your students' performance in every subject and highlight near misses, so you can focus your teaching where it's needed most. You can also give this detailed feedback to your students to help them prioritise their studies.

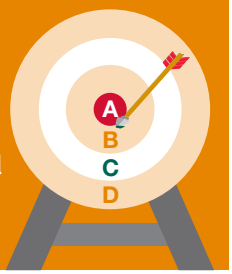
"ERA's really helped us **build a much clearer picture** of what our skills priorities are for our students. It has enabled us to **pinpoint individual students, skills and topics** that we now know we need to focus on."
Bradley, Key Stage 4 Coordinator, English

Identify areas for improvement by:

- highlighting which topics your students answered well and those where improvements could be made
- understanding how students fared against the key skills and assessment objectives for each specification
- downloading students' results for selected subjects to analyse them in applications – such as Microsoft Excel – create your own reports and feed back to your students.

Zoom in on your students' results

1. Click on 'Marks analysis'.
2. Choose your qualification and subject.
3. View components.
4. Select 'View skills and topics analysis'.
5. Choose the assessment area or specific question you are interested in.



"ERA is useful as a diagnostic tool, allowing us to look closely at the questions on which our students have performed less well. This enables the department to focus on that particular area in our planning and teaching. But it is important to exercise caution to ensure that other questions and topics are not then ignored."

Melanie, Head of English

Don't forget to download our other ERA guides

Getting started | School performance | Subject performance | Group performance

Unleash the potential...
Review group performance

Our 'Maintain groups' feature lets you create and customise different areas for comparison. You can create as many groups as you like – using your own data and a little imagination!

> "I have to report on gender performance at school and I can create groups of male and female students to compare their results."
>
> **Shaun, English teacher**

VS

Before you get started

- Make sure you have all the data you need to create the group – for example, if you are comparing performance of those who are learning a language against those who don't, you will need to have this information for every student.
- Ask your colleagues to add their class lists so you can use them to compare the performances of different classes.
- Decide on the level of security for your group(s). 'Private' means only you can see and edit the group; 'Read' allows others to see and report using the group, but they can't edit it; 'Read/write' allows all teachers in your centre to see and edit the group.
- You can only set up groups once candidates' entries have been submitted.

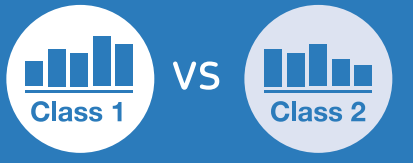
Step by step – creating your own groups

1. Select 'Maintain groups'.
2. Click 'Create new'.
3. Name your group: eg 'French A'.
4. Decide if the group is private.
5. Add students by ticking the box next to their name.
6. Save your group – you're done!

Viewing the results for your groups

7. Select 'Maintain groups'.
8. Choose which groups you want to compare.
9. Click the 'Marks analysis' icon.
10. Pick a subject and tick the 'Include groups' box then click 'Search' to view the results.

Make meaningful comparisons



Don't forget to download our other ERA guides

Getting started | School performance | Subject performance | Student performance

AS and A-level Chemistry
Preparing to teach

Chris Davies / Jon Downe / Ashley Law

Spring 2015

Follow us on Twitter @AQACPD.

Programme of the day

10.00 - 10.15am - **Arrival tea/coffee**
The A-level Specification
External assessment
Question types

11.15-11:30 - Tea/coffee break
Practical requirements and questions

12:30-13:15 - Lunch
Practical endorsement
Activity
Practical work
Schemes of work
Support and resources available
Evaluation form

15:45 - Close

Follow us on Twitter @AQACPD.

Some notations

- Specification
- Assessment model
- Assessment objectives
- Common to all boards All
- AQA specific AQA

Changes to the Ofqual rules

Timeline

All

	Sept 2014	June 2015	Sept 2015	June 2016	Sept 2016	June 2017	Sept 2017	June 2018
Legacy A-level Biology, Chemistry, Physics	Last two years teaching	AS exams		Last A2 exams				
New A-level Biology, Chemistry, Physics			First teaching	First AS exams		First A-level exams		
Legacy GCSE Sciences			Last two years teaching			Last linear GCSE		
New GCSE Sciences		Draft specs in schools			First teaching			First linear GCSE

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Rules for all Science A-level from 2015

All

- Minor changes to the subject content
- AS will be a stand-alone qualification
- Both AS and A-level are linear courses
- AS exams at the current standard of the current AS
- A-level exams at the standard of the full A-level currently
- Minimum assessment time

	AS	A-level
Assessment time	3 hours	6 hours
Maximum number of timetable slots	2	3
Coursework/controlled assessment?	No	No
Practical endorsement	No	Yes
Practical based marks	-	15%
Maths (Higher tier GCSE) marks	10%(B), 20%(C), 40%(P)	

AQA

AQA's response to the new rules

A-level

- Specification content has only minor changes
- Assessment is in three papers, each of two hours
- Practical skills assessment is mainly in Paper 3

AS

- Assessment is in two papers, each of 1.5 hours
- Course designed to be co-taught in the first year of the A-level course

Assessment objectives

		A-level	AS
AO1	Demonstrate knowledge and understanding of scientific ideas, processes, techniques and procedures	30-35% (Bi/Ch/Ph)	35-40% (Bi/Ch/Ph)
AO2	Apply knowledge and understanding of scientific ideas, processes, techniques and procedures: • in a theoretical context • in a practical context • when handling qualitative data • when handling quantitative data	40-45% (Bi/Ch/Ph)	40-45% (Bi/Ch/Ph)
AO3	Analyse, interpret and evaluate scientific information, ideas and evidence, including in relation to issues, to: • make judgements and reach conclusions • develop and refine practical design and procedures	25-30% (Bi/Ch/Ph)	20-25% (Bi/Ch/Ph)

Weighting of AOs for A-level Chemistry

Weighting of assessment objectives for A-level Chemistry

Assessment objectives (AOs)	Component weightings (approx %)			Overall weighting (approx %)
	Paper 1	Paper 2	Paper 3	
AO1	30	30	32	30
AO2	48	48	34	45
AO3	22	22	34	25
Overall weighting of components	35	35	30	100

20% of the overall assessment of A-level Chemistry will contain mathematical skills equivalent to Level 2 or above.

At least 15% of the overall assessment of A-level Chemistry will assess knowledge, skills and understanding in relation to practical work.

The new A-level specification

Changes to the specifications at AS and A-level

- One specification for AS and A-level
- A-level specification includes all of AS
- Specification content re-ordered into Physical, Inorganic and Organic chemistry
- First column shows specification 'Content'
- Second column shows 'Opportunities for skills development'
- Required practicals integrated into content

Specification layout

3.1.4.2 Calorimetry

Content	Opportunities for skills development
The heat change, q, in a reaction is given by the equation $q = mc\Delta T$ where m is the mass of the substance that has a temperature change ΔT and a specific heat capacity c. **Students should be able to:** • use this equation to calculate the molar enthalpy change for a reaction • use this equation in related calculations. Students will not be expected to recall the value of the specific heat capacity, c, of a substance.	**MS 0.0 and 1.1** Students understand that the correct units need to be used in $q = mc\Delta T$ Students report calculations to an appropriate number of significant figures, given raw data quoted to varying numbers of significant figures. Students understand that calculated results can only be reported to curate
Required practical 2 Measurement of an enthalpy change.	d 4.1 d to find ΔH for y. Examples of ium chloride n carbonate ith HCl n between ols.

Left hand side: Content.

Everything on this side can be assessed in question papers.

Clear. Includes enough detail to show what is required.

Required practicals here also.

Specification layout

3.1.4.2 Calorimetry

Content	Opportunities for skills development
The heat change, q, in a reaction is given by the equation $q = mc\Delta T$ where m is the mass of the substance that has a temperature change ΔT and a specific heat capacity c. **Students should be able to:** • use this equation to calculate the molar enthalpy change the	**MS 0.0 and 1.1** Students understand that the correct units need to be used in $q = mc\Delta T$ Students report calculations to an appropriate number of significant figures, given raw data quoted to varying numbers of significant figures. Students understand that calculated results can only be reported to the limits of the least accurate measurement.
	AT a and k **PS 2.4, 3.1, 3.2, 3.3 and 4.1** Students could be asked to find ΔH for a reaction by calorimetry. Examples of reactions could include: • dissolution of potassium chloride • dissolution of sodium carbonate • neutralising NaOH with HCl • displacement reaction between $CuSO_4$ + Zn • combustion of alcohols.

Right hand side: Opportunities for skills development.

Shows where teachers could introduce:
AT – apparatus and techniques
MS – mathematical skills
PS – practical skills

The numbers reference appendices at the back of the specification.

Changes to the specification content: Physical chemistry

New	Gone
Time of Flight mass spectrometer	Magnetic mass spectrometer, 2+ ions
K_c (moved from A to AS)	
K_p	
Equation showing how rate constant depends on temperature: $k = Ae^{-Ea/RT}$ and $\ln k = -E_a/RT + \ln A$	

Changes to the specification content: Inorganic chemistry

New	Gone
	Extraction of Metals
The agreed colours of transition metal ions in aqueous solution will be published in the support material	Chromium chemistry
Oxidation states of vanadium	Oxidation of Co(II) to Co(III) and test-tube reactions of cobalt compounds

AQA

Changes to the specification content: Organic chemistry

New	Gone
Skeletal formulae	
CIP priority rules for naming E-Z isomers	
Introduction to Biochemistry: Proteins as enzymes Structure of DNA Action of anti-cancer drug cis-platin	Fragmentation of molecular ions in a mass spectrometer
More about Chromatography TLC, GLC, Column	

To overcome a perception of too much recall, the structures of the components of DNA and some amino acids will be provided on the AQA data sheet.

AQA

Your questions

The new AS and A-level assessment

AS assessment at a glance

Two written papers		
Paper 1 Inorganic chemistry + some Physical chemistry	50%	1 hour 30 mins 80 marks
Paper 2 Organic chemistry + some Physical chemistry	50%	1 hour 30 mins 80 marks

- Equal length of papers
- Practical questions on both papers
- 15 multiple choice questions on the end of each paper

AS assessment in more detail

Paper 1: Inorganic and Physical chemistry
Content • Inorganic chemistry • Relevant practical skills • Relevant physical chemistry topics eg: – Atomic structure – Amount of substance – Bonding – Energetics – Equilibira – Redox
Question type and marks • 65 marks, with a mixture of short and long answer questions • 15 marks of multiple choice questions
Exam • 1 hour 30 mins written exam • 80 marks • 50% of AS

Paper 2: Organic and Physical chemistry
Content • Organic chemistry • Relevant practical skills • Relevant physical chemistry topics eg: – Amount of substance – Bonding – Energetics – Equilibria – Kinetics
Question type and marks • 65 marks, with a mixture of short and long answer questions • 15 marks of multiple choice questions
Exam • 1 hour 30 mins written exam • 80 marks • 50% of AS

A-level assessment at a glance

Three written papers		
Paper 1 Inorganic chemistry + some Physical chemistry	35%	2 hours 105 marks
Paper 2 Organic chemistry + some Physical chemistry	35%	2 hours 105 marks
Paper 3 Practical skills, data handling and synopsis	30%	2 hours 90 marks

A-level assessment in more detail

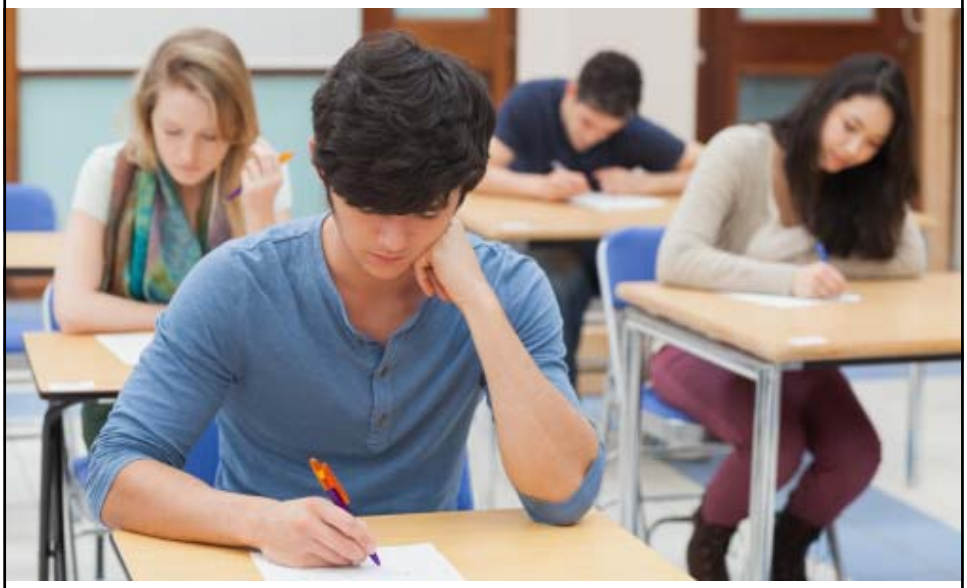
Paper 1: Inorganic and Physical chemistry	Paper 2: Organic and Physical chemistry	Paper 3: Practical skills, data handling and synopsis
Content • Inorganic chemistry • Relevant practical skills • Relevant physical chemistry topics eg: – Atomic structure – Amount of substance – Bonding – Energetics – Equilibria – Acids and bases – Redox	**Content** • Organic chemistry • Relevant practical skills • Relevant physical chemistry topics eg: – Amount of substance – Bonding – Energetics – Equilibria – Kinetics	**Content** • All content • All practical skills
Question type and marks • 105 marks, with a mixture of short and long answer questions	**Question type and marks** • 105 marks, with a mixture of short and long answer questions	**Question type and marks** • 40 marks of questions on practical techniques and data analysis • 20 marks of questions testing across the specification • 30 marks of multiple choice questions

Exam entry

- Students can be entered for AS exam at end of year 12 or for A-level at the end of year 13.
- Exam entry depends upon decision of centre.

Your questions

AS and A-level exam questions



Question types: extended response

- One extended response question per paper
- Marks shown for logically reasoned answer
- Can be shown in prose, through a series of reasoned steps
  or
  with a logical sequence of practical steps
  or
  through a series of steps in a calculation

Question types: extended response

1 Could be shown in prose, through a series of reasoned steps:
- explaining the compromise conditions needed for a reaction
- the shape of a molecule using VESPR rules
- how racemic mixtures can be made from N.A mechanism
- comparing acidities of different acids using the inductive effect.

2 Or with a logical sequence of practical steps:
- explaining how chloride, bromide , iodide ions could be distinguished
- explaining how a titration can be used to find a relative formula mass.

3 Or through a series of steps in a calculation:
- calculating a value for Kc from titration result
- calculating a value for Kp from data
- calculating oxidation number from titration data.

AQA

Question types: extended response

AS Paper 2, question 6.5

Reaction **2** is exothermic. A typical compromise temperature of 200 °C is used industrially for this reaction.

- Explain the effect of a change of temperature on both the position of equilibrium and the rate of reaction, and justify why a compromise temperature is used industrially.

AQA

Question types: extended response mark scheme

This question is marked using levels of response. Refer to the Mark Scheme Instructions for Examiners for guidance on how to mark this question.		6	1 AO1a 5 AO2a	**Indicative chemistry content**
Level 3 5–6 marks	All stages are covered and the explanation of each stage is generally correct and virtually complete. Answer communicates the whole process coherently and shows a logical progression from stage 1 and stage 2 (in either order) to stage 3.			**Stage 1:** consider effect of higher temperature on yield (Or vice versa for lower temperature) • Le Chatelier's principle predicts that equilibrium shifts to oppose any increase in temperature • Exothermic reaction, so equilibrium shifts in endothermic direction / to the left • So a Higher T will reduce yield **Stage 2:** consider effect of higher temperature on rate (Or vice versa for lower temperature) • At higher Temperature, more high energy molecules • more collisions have E>Ea • So rate of reaction increases/time to reach equilibrium decreases **Stage 3:** conclusion Industrial conditions chosen to achieve (cost-effective) balance of suitable yield at reasonable rate
Level 2 3–4 marks	All stages are covered but the explanation of each stage may be incomplete or may contain inaccuracies OR two stages are covered and the explanations are generally correct and virtually complete. Answer is mainly coherent and shows progression. Some steps in each stage may be out of order and incomplete.			
Level 1 1–2 marks	Two stages are covered but the explanation of each stage may be incomplete or may contain inaccuracies, OR only one stage is covered but the explanation is generally correct and virtually complete. Answer includes isolated statements but these are not presented in a logical order or show confused reasoning.			
Level 0 0 marks	Insufficient correct chemistry to gain a mark.			

AQA

Question types: extended response

A-level Paper 3, question 2.1

Ethanol and ethanoic acid react reversibly to form ethyl ethanoate and water according to the equation:

$$CH_3COOH + CH_3CH_2OH \rightleftharpoons CH_3COOCH_2CH_3 + H_2O$$

A mixture of 8.00×10^{-2} mol of ethanoic acid and 1.20×10^{-1} mol of ethanol is allowed to reach equilibrium at 20 °C.

The equilibrium mixture is placed in a graduated flask and the volume made up to 250 cm^3 with distilled water. A 10.0 cm^3 sample of this equilibrium mixture is titrated with sodium hydroxide added from a burette. The ethanoic acid in this sample reacts with 3.20 cm^3 of 2.00×10^{-1} mol dm^{-3} sodium hydroxide solution.

Calculate the value for K_c for the reaction of ethanoic acid and ethanol at 20 °C. Give your answer to the appropriate number of significant figures.

[6 marks]

AQA

Question types: extended response

Stage 1: Moles of acid at equilibrium			
Moles of sodium hydroxide in each titration = $(3.20 \times 2.00 \times 10^{-1}) / 1000 = 6.40 \times 10^{-4}$	1	AO2h	
Sample = 10 cm^3 so moles of acid in 250 cm^3 of equilibrium mixture			
$= 25 \times 6.40 \times 10^{-4} = 1.60 \times 10^{-2}$	1	AO2h	M2 can only be scored if = answer to M1 × 25
Stage 2: Moles of ester and water formed			
Moles of acid reacted = $8.00 \times 10^{-2} - 1.60 \times 10^{-2} = 6.40 \times 10^{-2}$			
= moles ester and water formed	1	AO2h	M3 is 8.00×10^{-2} – M2
Stage 3: Moles of ethanol at equilibrium			
Moles of ethanol remaining = $1.20 \times 10^{-1} - 6.40 \times 10^{-2} = 5.60 \times 10^{-2}$	1	AO2h	M4 is 1.20×10^{-1} – M3
Stage 4: Calculation of equilibrium constant			
$K_c = [CH_3COOCH_2CH_3][H_2O] / [CH_3COOH][CH_3CH_2OH]$	1	AO1b	
$= (6.40 \times 10^{-2})^2 / (1.60 \times 10^{-2})(5.60 \times 10^{-2})$			
= 4.5714 = 4.57	1	AO2h	M6 is $M3^2$ / M2 × M4 Answer must be given to 3 significant figures

Question types: multiple choice response

- Multiple choice questions at the end of the paper, to allow students to plan their time more effectively
- Synoptic questions so specification can be covered in less examining time
- One answer only, no mixed answer (eg statement 1 and 2 are correct)

Question types: multiple choice response

AS Paper 2, question 8

Which of these samples of gas contains the largest number of molecules?
The gas constant $R = 8.31\ \text{J K}^{-1}\ \text{mol}^{-1}$.

[1 mark]

A $5.0 \times 10^{-4}\ \text{m}^3$ at 1.0×10^{6} Pa and 300 K ⬭

B $4.0 \times 10^{-3}\ \text{m}^3$ at 2.0×10^{5} Pa and 400 K ⬭

C $3.0 \times 10^{1}\ \text{dm}^3$ at 3.0×10^{4} Pa and 500 K ⬭

D $2.0 \times 10^{2}\ \text{dm}^3$ at 4.0×10^{3} Pa and 600 K ⬭

AQA

Question types: multiple choice response

A-level Paper 3, question 7

A sample of 2.18 g of oxygen gas has a volume of 1870 cm^3 at a pressure of 101 kPa.

What is the temperature of the gas?
The gas constant is $R = 8.31\ \text{J K}^{-1}\ \text{mol}^{-1}$.

[1 mark]

A 167 K ⬭

B 334 K ⬭

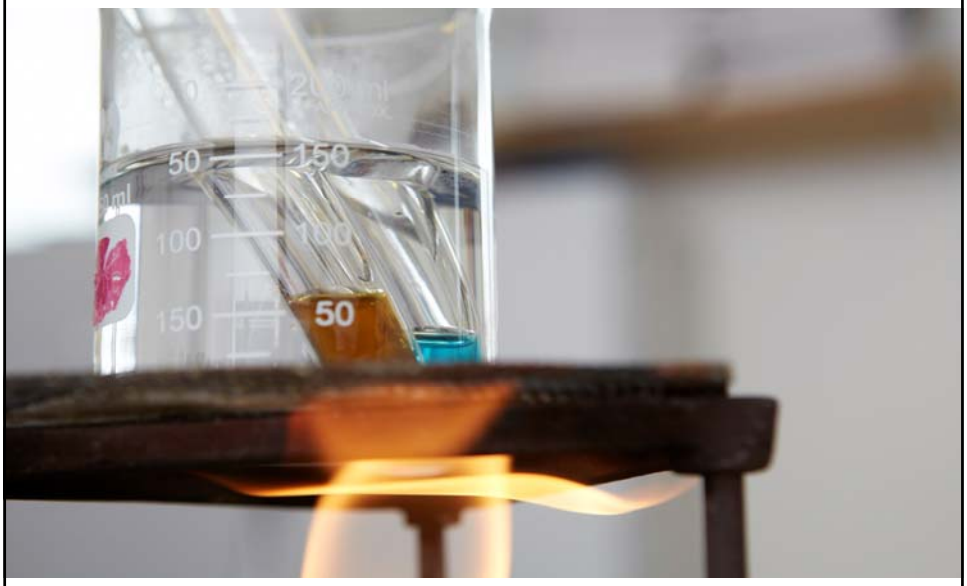
C 668 K ⬭

D 334 000 K ⬭

AQA

Your questions

Practical requirements at AS and A-level

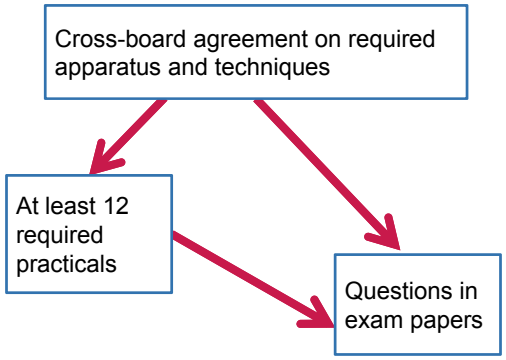


What is practical work and why is it so important?

- It supports and consolidates scientific **knowledge and understanding**
- It develops **investigative skills.**
- It builds confidence and mastery of **practical skills**

Assessment for A-level

- Questions will be asked in the papers based on practical work.
- It will be assumed that all students have done all 12 and understand the underlying skills, apparatus and techniques.



AQA

Our required practicals

- 12 required – but many more opportunities given
- The first 6 required practicals are in the AS
- Not constrained – flexible
- No need to tell us what you're doing
- No full investigation (students must demonstrate investigative approaches)
- Cover the required apparatus and techniques.

AQA

Required practical skills: use of apparatus and techniques

	Apparatus and techniques
AT a	Use appropriate apparatus to record a range of measurements (to include mass, time, volume of liquids and gases, temperature)
AT b	Use water bath or electric heater or sand bath for heating
AT c	Measure pH using pH charts, or pH meter, or pH probe on a data logger
AT d	Use laboratory apparatus for a variety of experimental techniques including: • titration, using burette and pipette • distillation and heating under reflux, including setting up glassware using retort stand and clamps • qualitative tests for ions and organic functional groups • filtration, including use of fluted filter paper, or filtration under reduced pressure
AT e	Use volumetric flask, including accurate technique for making up a standard solution
AT f	Use acid–base indicators in titrations of weak/strong acids with weak/strong alkalis
AT g	Purify: • a solid product by recrystallisation • a liquid product, including use of separating funnel
AT h	Use melting point apparatus

AQA

Required practical skills continued: use of apparatus and techniques

	Apparatus and techniques
AT i	Use thin-layer or paper chromatography
AT j	Set up electrochemical cells and measuring voltages
AT k	Safely and carefully handle solids and liquids, including corrosive, irritant, flammable and toxic substances
AT l	Measure rates of reaction by at least two different methods, for example: • an initial rate method such as a clock reaction • a continuous monitoring method

AQA

At least 12 required practicals

7.2 Required practical activities

The following practicals must be carried out by all students taking this course. Written papers will assess knowledge and understanding of these, and the skills exemplified within each practical.

Required activity	apparatus and technique reference
1 Make up a volumetric solution and carry out a simple acid-base titration	a, d, e, k
2 Measurement of an enthalpy change	a, d, k
3 Investigation of how the rate of a reaction changes with temperature	a, b, k
4 Carry out simple test-tube reactions to identify cations and anions in aqueous solution	b, d, k
5 Distillation of a product from a reaction	b, d, k
6 Tests for alcohol, aldehyde, alkene and carboxylic acid	b, c, d, k
7 Measuring the rate of a reaction: • by an initial rate method • by a continuous monitoring method	 a, k, l a, k, l
8 Measuring the EMF of an electrochemical cell	j, k
9 Investigate how pH changes when a weak acid reacts with a strong base and when a strong acid reacts with a weak base	a, c, d, f, k

At least 12 required practicals continued

Required activity	apparatus and technique reference
10 Preparation of: • a pure organic solid and test its purity • a pure organic liquid	a, b, d, g, h, k b, d, g, k
11 Carry out simple test-tube reactions to identify transition metal ions in aqueous solution	b, c, d, k
12 Separation of species by thin-layer chromatography	i, k

Teachers are encouraged to vary their approach to these practical activities. Some are more suitable for highly structured approaches that develop key techniques. Others allow opportunities for students to develop investigative approaches.

This list is not designed to limit the practical activities carried out by students. A rich practical experience for students will include more than the 12 required practical activities. The explicit teaching of practical skills will build students' competence. Many teachers will also use practical approaches to the introduction of content knowledge in the course of their normal teaching. Students' work in these activities can also contribute towards the endorsement of practical skills.

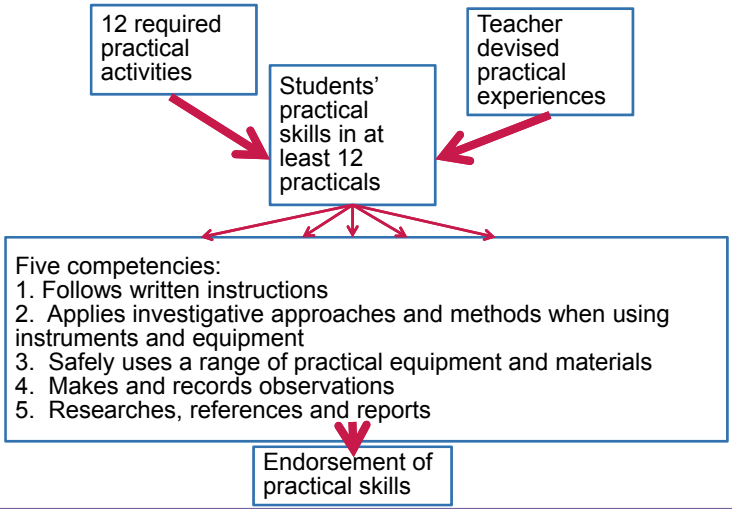
What can't be tested in exams?

- Exam papers cannot test students' abilities to:
  - follow instructions
  - work safely
  - use equipment
  - make measurements.
- These will be assessed via endorsement.

AQA

Assessment for endorsement

- Teacher assesses students' abilities in practical work through a set of competencies. Holistic judgement made at the end of a two year course.



AQA

Practical skills questions in chemistry papers

- Questions set in a practical context, where the question centres on the science, not the practical work.
- Questions that require specific aspects of a practical procedure to be understood in order to answer a question about the underlying science.
- Questions set directly on the required practical procedures.
- Questions applying the skills learned from the required practical procedures and and list of techniques.

AQA

Activity

Find practical questions in the Specimen Assessment Materials (SAMS) and decide which of the four types they fall into:

- questions set in a practical context, where the question centres on the science, not the practical work
- questions that require specific aspects of a practical procedure to be understood in order to answer a question about the underlying science
- questions directly on the required practical procedures
- questions applying the skills from the required practical procedures and the apparatus and techniques list.

AQA

Practical questions AS

AS Paper 1, question 5.2

0 5 . 2 A colourless solution contains a mixture of sodium chloride and sodium bromide.

Using aqueous silver nitrate and any other reagents of your choice, develop a procedure to prepare a pure sample of silver bromide from this mixture.
Explain each step in the procedure and illustrate your explanations with equations, where appropriate.

[6 marks]

AQA

Practical questions AS

AS Paper 1, question 10

1 0 Which of these pieces of apparatus has the lowest percentage error in the measurement shown?

[1 mark]

A Volume of 25 cm^3 measured with a burette with an error of ±0.1 cm^3. ⬭

B Volume of 25 cm^3 measured with a measuring cylinder with an error of ±0.5 cm^3. ⬭

C Mass of 0.150 g measured with a balance with an error of ±0.001 g. ⬭

D Temperature change of 23.2 °C measured with a thermometer with an error of ±0.1 °C. ⬭

AQA

Practical questions AS

AS Paper 1, question 6.1

0 6 . 1 A pure solid is thought to be calcium hydroxide. The solid can be identified from its relative formula mass.

The relative formula mass can be determined experimentally by reacting a measured mass of the pure solid with an excess of hydrochloric acid. The equation for this reaction is

$$Ca(OH)_2 + 2HCl \longrightarrow CaCl_2 + 2H_2O$$

The unreacted acid can then be determined by titration with a standard sodium hydroxide solution.

You are provided with 50.0 cm^3 of 0.200 mol dm^{-3} hydrochloric acid.
Outline, giving brief practical details, how you would conduct an accurate experiment to calculate the relative formula mass of the solid using this method.

[8 marks]

Practical questions AS

Stage 1: appreciation that the acid must be in excess and calculation of amount of solid that permits this			Maximum of 7 marks for answers which do not show a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.
Statement that there must be an excess of acid	1	AO2d	
Moles of acid = 50.0 × 0.200/1000 = 1.00 × 10^{-2} mol	1	AO3 2a	
2 mol of acid react with 1 mol of calcium hydroxide therefore moles of solid weighed out must be less than half the moles of acid = 0.5 × 1.00 × 10^{-2} = 5.00 × 10^{-3} mol	1	AO3 2b	
Mass of solid must be < 5.00 × 10^{-3} × 74.1 = < 0.371 g	1	AO3 2a	
Stage 2: Experimental method			
Measure out 50 cm^3 of acid using a pipette and add the weighed amount of solid in a conical flask	1	AO3 2b	
Titrate against 0.100 (or 0.200) mol dm^{-3} NaOH added from a burette and record the volume (v) when an added indicator changes colour	1	AO3 2b	
Stage 3: How to calculate M_r from the experimental data			
Moles of hydroxide = 5.00 × 10^{-3} – (v × conc NaOH)/1000 = z mol	1	AO3 2a	
M_r = mass of solid / z	1	AO3 2a	

Practical questions A-level

A-level Paper 1, questions 3.1 and 6.1

0 3 . 1 A salt bridge was used in a cell to measure electrode potential.

Explain the function of the salt bridge.

[2 marks]

0 6 . 1 Suggest a suitable piece of apparatus that could be used to measure out the sodium hydroxide solution.
Explain why this apparatus is more suitable than a pipette for this purpose.

[2 marks]

Practical questions A-level

A-level Paper 2, question 9.2

0 9 . 2 The product of step **1** was purified by recrystallisation as follows.

The crude product was dissolved in **the minimum quantity of hot water** and the hot solution was filtered through a hot filter funnel into a conical flask. This filtration removed any insoluble impurities. The flask was **left to cool to room temperature.**
The crystals formed were filtered off using a Buchner funnel and a clean cork was used **to compress the crystals in the funnel**. **A little cold water was then poured through the crystals.**
After a few minutes, the crystals were removed from the funnel and weighed.
A small sample was then used to find the melting point.

Give reasons for each of the following practical steps.

[4 marks]

The minimum quantity of hot water was used

The flask was cooled to room temperature before the crystals were filtered off

The crystals were compressed in the funnel

A little cold water was poured through the crystals

Practical questions A-level

A-level Paper 2, question 10

10 **Table 5** shows observations of changes from some test-tube reactions of aqueous solutions of compounds **Q**, **R** and **S** with five different aqueous reagents. The initial colours of the solutions are not given.

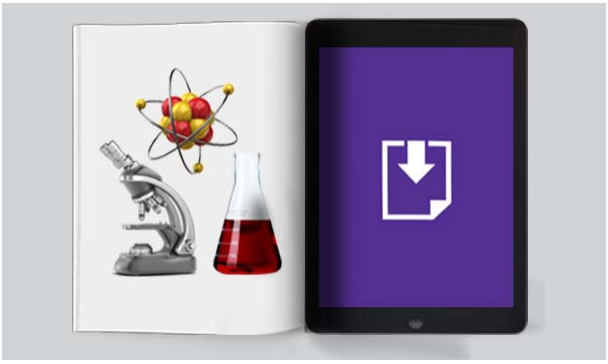
Table 5

	$BaCl_2$ + HCl	$AgNO_3$ + HNO_3	NaOH	Na_2CO_3	HCl (conc)
Q	no change observed	pale cream precipitate	white precipitate	white precipitate	no change observed
R	no change observed	white precipitate	white precipitate, dissolves in excess of NaOH	white precipitate, bubbles of a gas	no change observed
S	white precipitate	no change observed	brown precipitate	brown precipitate, bubbles of a gas	yellow solution

1 0 . 1 Identify each of compounds **Q**, **R** and **S**.
You are **not** required to explain your answers.

[6 marks]

Practical handbook



Glossary of terms

Specifications that use this resource:

- AS and A-level Physics 7407; 7408
- AS and A-level Biology 7401; 7402
- AS and A-level Chemistry 7404; 7405

Subject specific vocabulary

The language of measurement

The following subject specific vocabulary provides definitions of key terms used in AQA's AS and A-level Science specifications

Accuracy

A measurement result is considered accurate if it is judged to be close to the true value.

Calibration

Marking a scale on a measuring instrument.

This involves establishing the relationship between indications of a measuring instrument and standard or reference quantity values, which must be applied.

For example, placing a thermometer in melting ice to see whether it reads 0°C, in order to check if it has been calibrated correctly.

Data

Information, either qualitative or quantitative, that has been collected.

Errors

See also uncertainties.

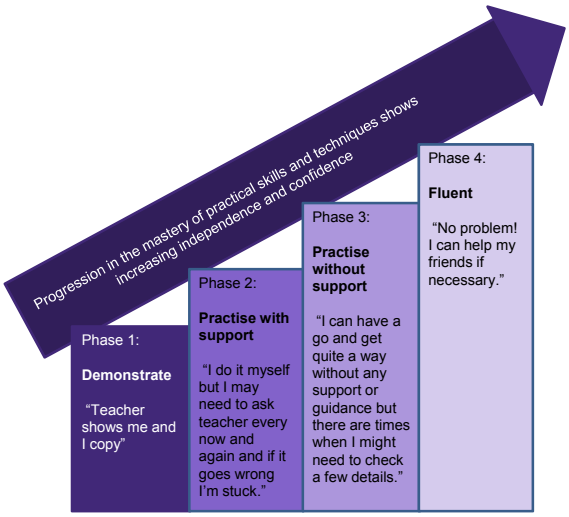
measurement error

The difference between a measured value and the true value.

anomalies

These are values in a set of results which are judged not to be part of the variation caused by random uncertainty.

Developing practical skills



Practical handbook – exemplar experiments

The Practical Handbook contains details of 12 required practicals including:

- apparatus and techniques covered
- indicative apparatus for each practical
- amount of choice for teacher in how to conduct the experiment by giving increasing independence
- opportunities for observation and assessment of the five competencies:
    - follows written instructions
    - applies investigative approaches and methods when using instruments and equipment
    - safely uses a range of practical equipment and materials
    - makes and records observations
    - researches, references and reports
- student work sheet.

AQA

Five competencies

1. Follows written instructions
2. Applies investigative approaches and methods when using instruments and equipment
3. Safely uses a range of practical equipment and materials
4. Makes and records observations
5. Researches, references and reports

AQA

Practical – increasing independence

Required practical	Make up a volumetric solution and carry out a simple acid-base titration			
Apparatus and techniques covered **(Relevant apparatus only, not full statements)**	a Use appropriate apparatus to record a range of measurements d Use laboratory apparatus for a variety of experimental techniques e Use volumetric flask, including accurate technique for making up a standard solution k Safely and carefully handle solids and liquids, including corrosive, irritant, flammable and toxic substances			
Indicative apparatus	Basic laboratory glassware, volumetric flask, burette, volumetric pipette and filler, and protective equipment such as goggles.			
	Amount of choice Increasing independence			
	Least choice	Some choice	Many choices	Full investigation
	Teacher gives students a full method with clear instructions for how to produce a standard solution. Teacher gives students a full method for how to carry out a simple titration.	Teacher gives students an outline for the procedure but allows choices at different steps. Teacher gives students an outline for the procedure to carry out a simple titration, but with some choices in technique, equipment or indicators.	Teacher specifies the compound and concentration of solution. Students research the method to carry out for the preparation of the standard solution. Students research methods to carry out a simple titration using the equipment provided.	Students research methods for making a standard solution and choose the chemical and concentration to be made. Students research methods for carrying out a simple titration and choose the method, chemicals and equipment to use.

AQA

Opportunities for assessment and observation - 1

	Increasing independence →			
Follow written procedures	✓✓✓ Students follow written method.	✓✓✓ Students follow written method, making individual choices in technique or equipment.	✓✓✓ Students follow a method they have researched.	✓✓✓ Students follow a method they have researched.
Applies investigative approaches and methods when using instruments and equipment	✓ Students must correctly use the appropriate equipment. Procedure should be followed methodically and appropriate variables measured or controlled.	✓Students must correctly use the appropriate equipment. Procedure should be followed methodically and suitable variables identified, measured and controlled.	✓✓ Students must correctly select and use the appropriate equipment. Procedural steps should be well sequenced and adjusted where necessary. Suitable variables identified, measured and controlled.	✓✓✓ Student must choose an appropriate methodical approach, equipment and techniques. Procedural steps should be well sequenced and adjusted where necessary. Suitable variables should be identified for measurement and control. Where variables cannot be readily controlled, approaches should be planned to take account of this.

AQA

Opportunities for assessment and observation - 2

	Increasing independence →			
Safely uses a range of practical equipment and materials	✓ Students must safely use the equipment.	✓ Students must safely use the equipment.	✓✓ Students minimise risks with minimal prompting.	✓✓✓ Students must carry out a full risk assessment and minimise risks.
Makes and records observations	✓ Students record data in specified ways.	✓ Students record accurate data in specified ways.	✓✓ Students record precise and accurate data, methodically using appropriate units, in specified ways.	✓✓✓ Students must choose the most effective way of recording precise and accurate data methodically using appropriate units.
Researches, references and reports	✓ Data are reported and conclusions drawn.	✓ Data are reported and conclusions drawn. Students compare results and identify reasons for differences.	✓✓✓ Students must research methods available. They compare results and report on differences. Appropriate software is used to process data and report findings.	✓✓✓ Students must research alternatives in order to plan their work. Reporting covers the planning, carrying out and an analysis of their results. Appropriate software and/or tools are used to process data and report findings.

Practical – increasing independence

Required practical	**Make up a volumetric solution and carry out a simple acid-base titration**			
Apparatus and techniques covered **(Relevant apparatus only, not full statements)**	a Use appropriate apparatus to record a range of measurements d Use laboratory apparatus for a variety of experimental techniques e Use volumetric flask, including accurate technique for making up a standard solution k Safely and carefully handle solids and liquids, including corrosive, irritant, flammable and toxic substances			
Indicative apparatus	Basic laboratory glassware, volumetric flask, burette, volumetric pipette and filler, and protective equipment such as goggles.			
	Amount of choice Increasing independence →			
	Least choice	Some choice	Many choices	Full investigation
	Teacher gives students a full method with clear instructions for how to produce a standard solution. Teacher gives students a full method for how to carry out a simple titration.	Teacher gives students an outline for the procedure but allows choices at different steps. Teacher gives students an outline for the procedure to carry out a simple titration, but with some choices in technique, equipment or indicators.	Teacher specifies the compound and concentration of solution. Students research the method to carry out for the preparation of the standard solution. Students research methods to carry out a simple titration using the equipment provided.	Students research methods for making a standard solution and choose the chemical and concentration to be made. Students research methods for carrying out a simple titration and choose the method, chemicals and equipment to use.

Time for lunch

AQA

What is practical work and why is it so important?

How could teachers include investigative approaches and research in practicals?

Example: making aspirin

Research different methods / conditions

Justify the method being chosen

Choose equipment

Decide how to carry out the experiment

Research safety aspects of chosen method

Research or justify methods for testing purity

Evaluate the differences in purity between different students / groups of students

AQA

Endorsement all boards

- Competencies (Common Practical Assessment Criteria) – assessed by the teacher for endorsement - A pass will be recorded on the students certificate.
- Consistency – details of administration will be common to all boards.
- AQA is very aware that record keeping and moderation needs to be a workable process, that is not onerous on schools.
- Awarding bodies have made recommendations to Ofqual and boards will be running trials, which could include:
  - monitoring teaching plans/student logs
  - monitoring teacher assessment
  - student interviews.
- Final details due soon.

Evidence required for endorsement

- Documented plans to carry out sufficient practical activities which meet the requirements of the CPAC, incorporating skills and techniques detailed in appendix 5, over the course of the A-level.
- A record of each practical activity undertaken and the date when this was completed.
- A record of the criteria being assessed in that practical activity.
- A record of student attendance.
- A record of which student met the criteria and which did not.
- Student work showing evidence required for the particular task with date.
- Any associated materials provided for the practical activity eg written instructions.

Supporting students with practical work - 1

- Clarify the importance of keeping a lab book or other records of practical work
- Warn students against plagiarism and copying
- Explain the learning criteria for each skill
- Start with simple tasks initially
- Teach practical work in your preferred order

Supporting students with practical work - 2

- Use feedback
- Discuss practical work with your students:
  - what are they doing?
  - how are they doing it?
  - why are they doing it?
- It's ok to use group work and peer assessment
  - students help each other

Your questions

Slide 71

AQA

Schemes of work and teaching resources

Slide 72

AQA

Support materials and resources for A-level Chemistry

- Specimen question papers and mark schemes on website
- Change documents from old specifications
- One scheme of work showing resources and assessment
- Progression from GCSE
- Command words
- Subject specific vocabulary
- e-AQA for exam results to analyse performance

Support materials and resources in development

- Practical handbook for chemistry
- Suggested methods for the 12 practicals
- Practice question papers on e-AQA for mock exams
- Second scheme of work
- Standard definitions
- Exampro for help in preparing end of topic tests
- New textbooks
- Teacher support material on:
  - Biochemistry
  - Transition metal ‘official‘ colours
  - Chromatography
  - Time of Flight mass spectrometry

Possible teaching order

AS and A-level Chemistry
Teaching Order DRAFT

For teaching from September 2015

Year 1

Ref	Topic		Practical	No weeks
3.1.1	Atomic structure	P		1.0
3.1.2	Amount of substance	P	1 Make up a volumetric solution and carry out a simple acid-base titration	2.9
3.1.3	Bonding	P		3.6
3.2.1	Periodicity	I		0.6
3.2.2	Group 2, the alkaline earth metals	I		1
3.3.1	Introduction to organic chemistry	O		2
3.1.4	Energetics	P	2 Measurement of an enthalpy change	3.7
3.3.2	Alkanes	O		1.4
3.1..5	Kinetics	P	3 Investigation of how the rate of a reaction changes with temperature	1.2
3.3.3	Halogenoalkanes	O		2.4
3.1.7	Oxidation reduction and redox equations	P		1
3.2.3	Group 7(17), the halogens	I	4 Carry out simple test-tube reactions to identify cations and anions in aqueous solution	1.7
3.1.6	Chemical equilibria and Le Chatelier's principle	P	6 Tests for alcohol, aldehyde, alkene and carboxylic acid	1
3.3.4	Alkenes	O		1
3.3.5	Alcohols	O	5 Distillation of a product from a reaction	2.2
3.3.6	Organic analysis	O		1.5
				28.2

Year 2 (30 weeks)

Ref	Topic		Practical	No weeks
3.1.9	**Rate equations**	P	7 Measuring the rate of a reaction • by an initial rate method • by a continuous monitoring method	3
3.3.15	**Nuclear magnetic resonance spectroscopy**	O		1
3.3.8	**Aldehydes and ketones**	O		1
3.3.7	**Optical isomerism**	O		1
3.3.10	**Aromatic chemistry**	O		1
3.1.8	**Thermodynamics**	P		2.5
3.1.10	**Equilibrium constant K_c for homogeneous systems**	P		2
3.1.12	**Acids and Bases**	P	9 Investigate how pH changes when a weak acid reacts with a strong base 0and when a strong acid reacts with a weak base	2.5
3.3.9	**Carboxylic acids and derivatives**	O	10 Preparation of • a pure organic solid and test its purity • a pure organic liquid	2
3.3.11	**Amines**	O		1
3.3.12	**Polymers**	O		1
3.3.16	**Chromatography**	O	12 Separation of species by thin-layer chromatography	1
3.3.13	**Amino acids, proteins and DNA**	O		2
3.3.14	**Organic synthesis**	O		1
3.2.4	**Properties of Period 3 elements and their oxides**	I		1
3.1.11	**Electrode potentials and electrochemical cells**	P	8 Measuring the EMF of an electrochemical cell	2

AQA

Possible teaching order

For teaching from September 2015

Year 1

Ref	Topic		Practical	No weeks
3.1.1	Atomic structure	P		1.0
3.1.2	Amount of substance	**P**	1 Make up a volumetric solution and carry out a simple acid-base titration	2.9
3.1.3	Bonding	**P**		3.6
3.2.1	Periodicity	**I**		0.6
3.2.2	Group 2, the alkaline earth metals	**I**		1
3.3.1	Introduction to organic chemistry	**O**		2
3.1.4	Energetics	**P**	2 Measurement of an enthalpy change	3.7
3.3.2	Alkanes	**O**		1.4

AQA

Schemes of work

Scheme of work 1 includes :

- Prior knowledge from GCSE
- 12 practical experiments embedded
- Suggestions of rich questions
- Web links to resources
- Suggestions for assessment opportunities from past papers
- Opportunities for key skills and other practicals flagged up
- Links to assessment objectives
- Extension suggestions

Schemes of work

3.1.1.1 Fundamental particles

Learning objective	Time taken	Learning Outcome	Learning activity with opportunity to develop skills	Assessment opportunities	Resources
The structure of atoms	0.2 week	Students should be able to: • describe the structure of atoms in terms of protons, neutrons and electrons • recall the relative mass and relative charge of protons, neutrons and electrons.	Students research how the model of the atom changed over time (examples of key contributions could include the Ancient Greeks, Dalton, Thompson, Rutherford, Bohr, Chadwick) (AO1 - Knowledge and understanding of atomic structure; AO3 - Evaluate how and why atomic structure model developed over time). Rich question – How can we tell what is inside an atom if we can't see it?		RSC timeline: http://www.rsc.org/chemsoc/timeline RSC: Chemists in a social & historical context: http://www.rsc.org/learn-chemistry/resource/res00001332/the-atom-detectives?cmpid=CMP00002843 RI Christmas Lecture – section on atomic structure http://www.rsc.org/learn-chemistry/resource/res00001119/ri-christmas-lectures-2012-atomic-structure

Schemes of work

3.1.2.1 Relative atomic mass and relative molecular mass

Learning objective	Time taken	Learning Outcome	Learning activity with opportunity to develop skills	Assessment opportunities	Resources
Relative mass of atoms, elements and compounds	0.1 week	Students should be able to: • define relative atomic mass (A_r) • define relative molecular mass (M_r) • determine relative molecular mass (M_r) of a substance using relative atomic mass (A_r) values.	• The relative mass of different substances is calculated from the formula (AO2 - Apply knowledge and understanding) • The mass of everyday objects could be measured relative to a specific object of known mass. (AO2 - Apply knowledge and understanding) • Determine the relative formula mass (M_r) of substances using relative atomic mass values. (AO2 - Apply knowledge and understanding)	• Students can calculate M_r given the formula of compounds	Suitable resources can be found at http://www.docbrown.info/ and http://www.chemsheets.co.uk/ (subscription required)
Extension			• Students could research why ^{12}C was chosen as the standard (AO3 - Analyse, interpret and evaluate scientific information).		

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Schemes of work

3.1.3.4 Bonding and physical properties

Understand the structure of ionic, molecular, giant covalent and metallic substances. **Describe and sketch details of the structures of diamond, graphite, ice, iodine, magnesium and sodium chloride.** **Understand the structure of ionic, molecular, giant covalent and metallic substances.**	**1 week**	**Students should be able to:** • **describe and explain the properties of ionic, molecular, giant covalent and metallic substances, in terms of melting/boiling points and conductivity** • **describe in detail and draw the structures of diamond, graphite, ice, iodine, magnesium and sodium chloride.**	• **Practical opportunity: investigate the melting point, solubility and conductivity of substances with different structure types (AO2 - Apply knowledge and understanding; PS 1.1 - Solve problems set in practical contexts).** • **Students create a summary table to describe and explain the structure and properties of ionic, molecular, giant covalent and metallic substances. (AO2 - Apply knowledge and understanding).** • **Students sketch the structures of diamond, graphite, ice, iodine, magnesium and sodium chloride as solids and label the diagrams to explain their melting/boiling points and conductivity. (AO2 - Apply knowledge and understanding).** • **Students determine which type of structure a substance has from its properties using data and/or experimentally (e.g. to test solubility, conductivity and ease of melting. (AO2 - Apply knowledge and understanding).**	• **June 2013 Unit 1 Question 3 (QS13.1.03)** • **June 2011 Unit 1 Question 4 (QS11.1.04)** • **June 2010 Unit 1 Question 7 (QS10.1.07)** • **June 2006 Unit 1 Question 2 (QS06.1.02)** • **January 2006 Unit 1 Question 6 (QW06.1.06)** • **January 2005 Unit 1 Question 5A (QW05.1.05A)** • **January 2003 Unit 1 Question 1e(QW03.1.01)**	**Nuffield Science Data Book (free download): What is practical work and why is it so important? Chemistry Data Book (Starck, Wallace, McGlashan) ISBN: 9780719539510** **Chemistry Review article: Graphene (Volume 19, edition 2)** **Chemistry Review article: The disguises of carbon (Volume 18, edition 1)**

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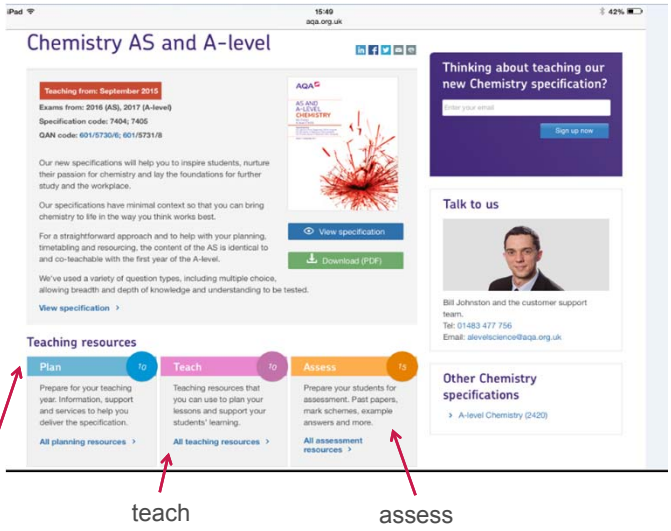
Your questions

Resources on the AQA website



Planning and teaching resources

Planning resources

Practical and detailed resources to build lesson plans and schemes of work and prepare topics and objectives.

- Companion: Guide (295.3 KB)
  - Guidance on co-teaching
- Launch meeting: Slides (6.0 MB)
- Options evening: Flyer (146.8 KB)
  - Part 1 - Science main changes and rules: Launch webcast
  - Summary of changes
  - Switching to AQA from Edexcel
  - Switching to AQA from OCR A
  - Switching to AQA from OCR B
- Why choose AQA: Guide (177.6 KB)

Teaching resources

Tailored and informative resource materials to help you deliver engaging and inspiring lessons.

- A-level Chemistry: Scheme of work (231.5 KB)
- AS Chemistry: Scheme of work (243.5 KB)
  - Command words
  - Cross-board practical trial (Autumn 2014)
  - GCSE to A-level progression
  - Practical handbook
  - Subject specific vocabulary
  - Textbooks (print and digital)
  - Trialling practicals
  - Using your existing textbook

Assessment resources

Prepare your students for assessment. Past papers, mark schemes, example answers and more.

- Exampro A-level science

AS

- Chemistry (AS): Specimen mark scheme instructions (24.6 KB)
- Chemistry (AS): Specimen data booklet (178.8 KB)
- Paper 1 (AS): Specimen mark scheme (201.6 KB)
- Paper 1 (AS): Specimen question paper (345.6 KB)
- Paper 2 (AS): Specimen mark scheme (266.0 KB)
- Paper 2 (AS): Specimen question paper (350.8 KB)

A-level

- Chemistry (A-level): Specimen mark scheme instructions (24.6 KB)
- Chemistry (A-level): Specimen data booklet (176.6 KB)
- Paper 1 (A-level): Specimen question paper (324.0 KB)
- Paper 1 (A-level): Specimen mark scheme (252.3 KB)
- Paper 2 (A-level): Specimen mark scheme (410.0 KB)
- Paper 2 (A-level): Specimen question paper (453.0 KB)
- Paper 3 (A-level): Specimen mark scheme (194.0 KB)
- Paper 3 (A-level): Specimen question paper (313.4 KB)

Support or background material for teachers on the new topics

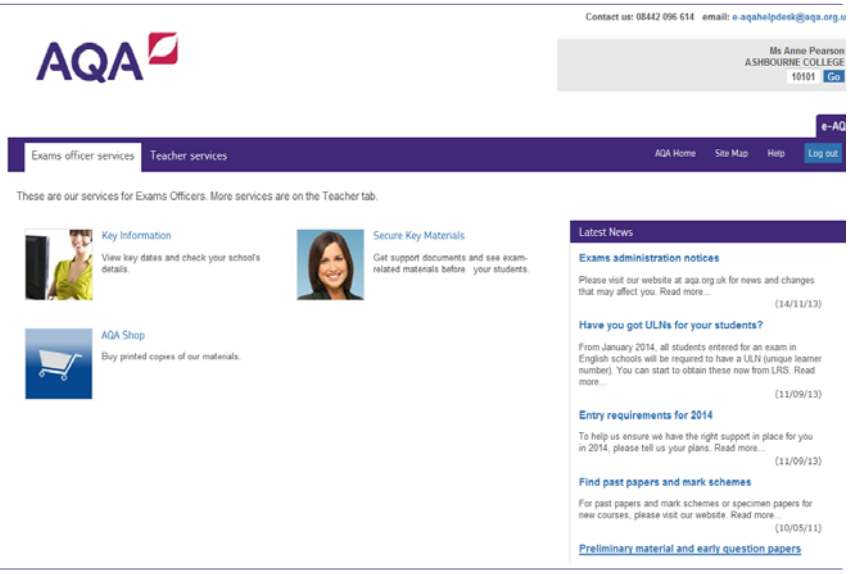
Support material for teachers on new topics

Short background accounts with information about:

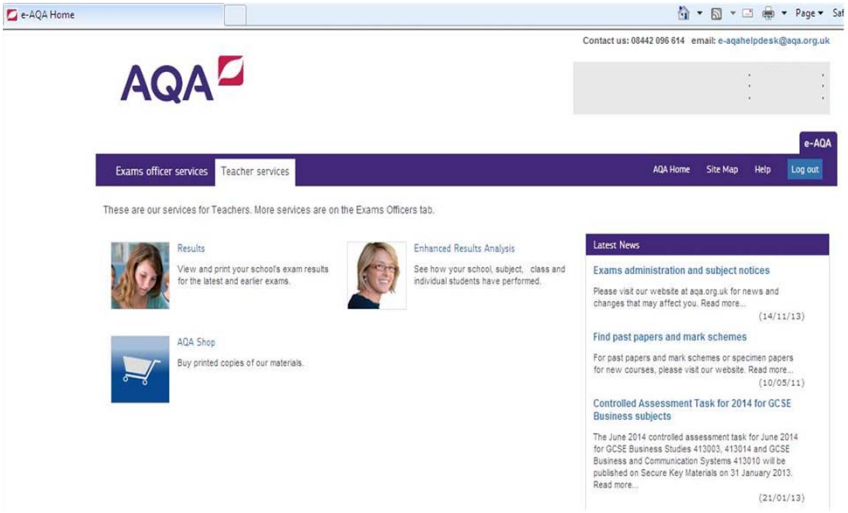
- Time of Flight mass spectrometry
- Biochemistry (proteins as enzymes, DNA)
- Chromatography
- Colours of Transition Metal complexes

You can download these documents from our website

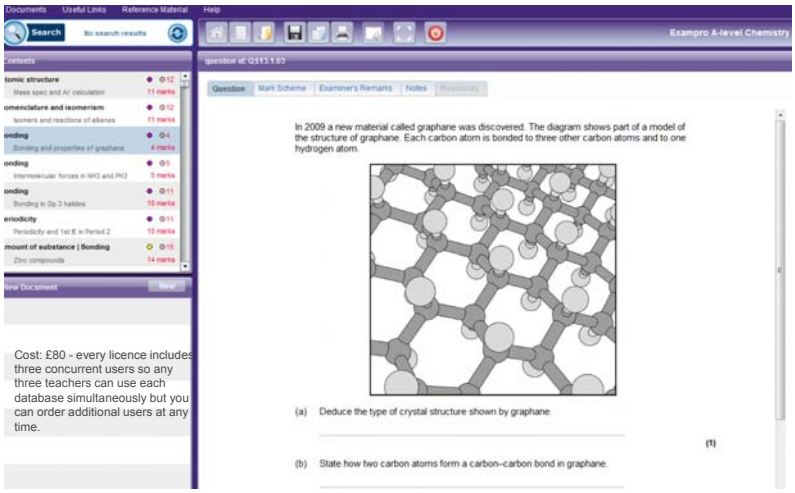
Secure key materials



Enhanced results analysis

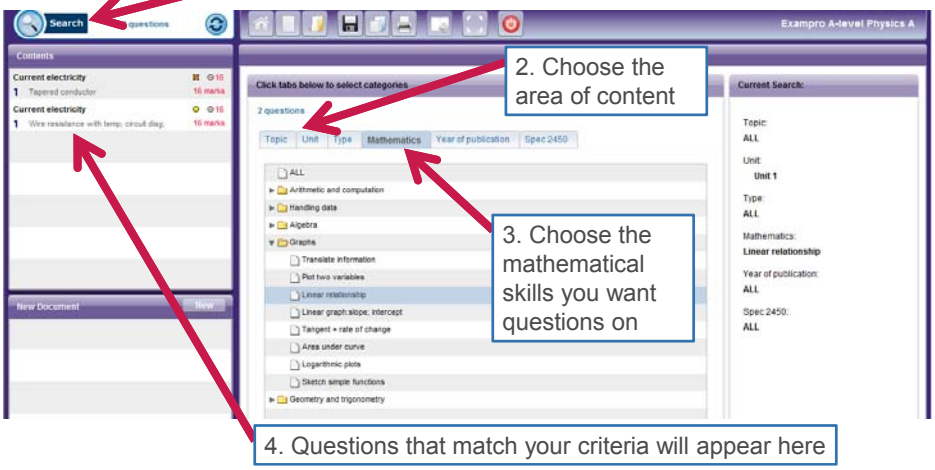


Exampro - assemble your own exams from past questions



How can you prepare for the new maths requirements?

- Include tagged questions from Exampro in your teaching



Command words 1

- Analyse, consider, discuss…
- Define…
- Describe…
- Deduce
- Draw
- Explain…
- Justify
- Outline…
- State / Give…
- Suggest…

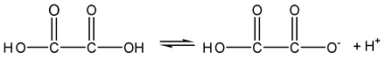
Command words 2

Analyse, consider, discuss	Require students to describe and evaluate by reference to different and perhaps contrasting factors
Define	requires students to state what is meant by a particular term
Describe	Requires students to present their knowledge and understanding of the issue in the question
Deduce	Requires students to work out an answer from given or recalled information
Draw	This is used when a student is required to show the structure of a molecule or sketch an apparatus
Explain	Requires students to use reasoning and/or reference to theory in presenting their knowledge and understanding
Justify	Requires students to explain why one course of action is preferred
Outline	Similar to 'describe' or 'explain', but implies brevity
State / Give	Require a concise answer with no supporting explanation
Suggest	Requires students to respond in a situation when there is no unique answer and/or apply their knowledge and understanding in a novel context

Examples of command words in questions

1. State the meaning of the term **structural isomers**.

2. Ethanedioic acid is a weak acid.
   Ethanedioic acid acts, initially, as a monoprotic acid.



   Use the concept of electronegativity to justify why the acid strengths of ethanedioic acid and ethanoic acid are different.

3. In a trial experiment, the student failed to fill the burette (containing bromine water) correctly so that the gap between the tap and the tip of the burette still contained air.

   Suggest what effect this would have on the measured volume of bromine water in this trial. Explain your answer.

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Your questions

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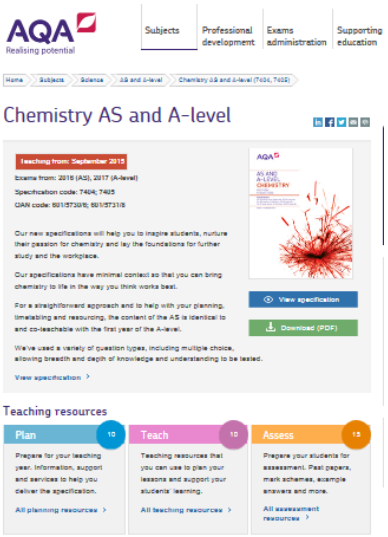
More information on support

aqa.org.uk/chemistry-a-resources

Includes:

- Companion guide (overview of the new specifications)
- switching documents (helping you to move from other boards to AQA)
- summary of changes (helping you move from current AQA to the new specification)
- launch event webcast and other resources.



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Thank you

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