# How Chemistry assessment works at AS and A level

With AS being a stand-alone qualification from September 2015, it no longer forms part of students' A level grades. As such, students can choose to take AS and A level exams to receive grades for both qualifications, or just A level papers at the end of Year 13 to gain an A level grade. The qualification structure is the same for all AS and A level Sciences, regardless of exam board.

## To achieve an AS qualification, students need to take:

**AS Paper 1** + **AS Paper 2** = **AS grade**

Note: AS exam papers will include questions on some of the **core practicals** in the AS specification.

## To achieve an A level qualification, students need to take:

**A level Paper 1** + **A level Paper 2** + **A level Paper 3** = **A level grade**

Note: A level exam papers will include questions on some of the **core practicals** in the specification. All content in the AS specification is included in the A level specification.

## The Practical Endorsement (at A level only)

**Teacher assessment of students' practical competency** = **Practical Endorsement (reported on A level certificate)**

Note: See page 9 for more details.



# AS assessment at a glance

First assessment: summer 2016.

- Exam questions will test students' knowledge and understanding of the relevant specification topics.
- Each paper will also assess students' knowledge and understanding of experimental methods, based on the core practicals in the specification.
- Question types: multiple choice, short and long answer questions (up to 6 marks), and calculations.
- Questions assessing students' use of mathematical skills will make up 20% of the exam papers.

### AS Paper 1 – Core Inorganic and Physical Chemistry

✓ 80 marks | ⚖ 50% weighting | 🕓 1 hour 30 minutes

- Topic 1: Atomic Structure and the Periodic Table
- Topic 2: Bonding and Structure
- Topic 3: Redox I
- Topic 4: Inorganic Chemistry and the Periodic Table
- Topic 5: Formulae, Equations and Amounts of Substance

### AS Paper 2 – Core Organic and Physical Chemistry

✓ 80 marks | ⚖ 50% weighting | 🕓 1 hour 30 minutes

- Topic 2: Bonding and Structure
- Topic 5: Formulae, Equations and Amounts of Substance
- Topic 6: Organic Chemistry I
- Topic 7: Modern Analytical Techniques I
- Topic 8: Energetics I
- Topic 9: Kinetics I
- Topic 10: Equilibrium I

Note: All AS exams must be taken in the same examination series. Results from AS examinations will count towards the AS grade but wil not form part of the A level grade.

# A level assessment at a glance

First assessment: summer 2017

- Exam questions will test students' knowledge and understanding of the relevant specification topics and experimental methods based on the core practicals in the specification.
- Paper 3 will also assess students' knowledge and understanding of experimental methods, based on the core practicals in the specification.
- Question types: multiple choice, short and long answer questions (up to 6 marks), and calculations.
- Questions assessing students' use of mathematical skills will make up 20% of the exam papers.

### A level Paper 1 – Advanced Inorganic and Physical Chemistry

✓ 90 marks | ⚖ 30% weighting | 🕒 1 hour 45 minutes

- Topic 1: Atomic Structure and the Periodic Table
- Topic 2: Bonding and Structure
- Topic 3: Redox I
- Topic 4: Inorganic Chemistry and the Periodic Table
- Topic 5: Formulae, Equations and Amounts of Substance
- Topic 8: Energetics I
- Topic 10: Equilibrium I
- Topic 11: Equilibrium II
- Topic 12: Acid-base Equilibria
- Topic 13: Energetics II
- Topic 14: Redox II
- Topic 15: Transition Metals

### A level Paper 2 – Advanced Organic and Physical Chemistry

✓ 90 marks | ⚖ 30% weighting | 🕒 1 hour 45 minutes

- Topic 2: Bonding and Structure
- Topic 3: Redox I
- Topic 5: Formulae, Equations and Amounts of Substance
- Topic 6: Organic Chemistry I
- Topic 7: Modern Analytical Techniques I
- Topic 9: Kinetics I
- Topic 16: Kinetics II
- Topic 17: Organic Chemistry II
- Topic 18: Organic Chemistry III
- Topic 19: Modern Analytical Techniques II

### A level Paper 3 – General and Practical Principles in Chemistry

✓ 120 marks | ⚖ 40% weighting | 🕒 2 hours 30 minutes

- All topics across the full A level specification.
- Half of the paper will focus on testing students' knowledge and understanding of practical skills and techniques.

## Practical Endorsement

As you'll see from the assessment models, exam papers will feature questions allowing students to demonstrate investigative skills in the context of the core practicals.

Students' skills and technical competency when completing practical work will be **assessed by teachers**. This will form the basis for the award of a Practical Endorsement at A level. This is separate to the A level grade and, if awarded, will be reported as a 'Pass' on A level certificates for students who achieve it.

# Sample Assessment Materials

This question comes from **A level Paper 1 – Advanced Inorganic and Physical Chemistry**.

Even though this question is towards the end of the A level paper, the first question part is designed to be **accessible** to the majority of students.

**8** Acids can be classified as weak or strong acids.

(a) A mixture of concentrated sulfuric and nitric acids is used in the nitration of benzene.

The following equilibrium is set up:

$$H_2SO_4 + HNO_3 \rightleftharpoons H_2NO_3^+ + HSO_4^-$$

Which statement about this equilibrium is correct?

**(1)**

- ☒ **A** $HNO_3$ and $H_2NO_3^+$ are a conjugate acid-base pair
- ☒ **B** the nitric acid acts as an acid
- ☒ **C** the nitric acid acts as an oxidising agent
- ☒ **D** the sulfuric acid acts as a dehydrating agent

Typically, about **10%** of questions on question papers (except A level Paper 3) will be **multiple-choice questions**, with this format.

(b) Sulfuric acid ionises in two stages.

Stage 1: $H_2SO_4(aq) \rightarrow H^+(aq) + HSO_4^-(aq)$

Stage 2: $HSO_4^-(aq) \rightleftharpoons H^+(aq) + SO_4^{2-}(aq)$

(i) Explain, with reference to the equations, why the $HSO_4^-$ ion is classified as a weak acid.

**(2)**

Our specification gives guidance on the **command words** used in our question papers.

For '**explain**', the question requires that, 'an explanation requires a justification or exemplification of a point. The answer must contain some element of reasoning or justification.





This question is a calculation which assesses **mathematical skills** at the required level. Students should remember to show all the relevant steps in any calculation.

(ii) A 0.100 mol $dm^{-3}$ solution of sulfuric acid has a pH of 0.97.

Calculate the concentration of hydrogen ions in this solution.

**(1)**

(c) Ethanoic acid, $CH_3COOH$, is a weak acid.

A student prepares 600 $cm^3$ of a buffer solution by mixing 400 $cm^3$ of 0.500 mol $dm^{-3}$ ethanoic acid solution with 200 $cm^3$ of 0.500 mol $dm^{-3}$ sodium ethanoate solution, $CH_3COONa$.

Calculate the pH of the buffer solution produced.

($K_a$ for ethanoic acid = $1.74 \times 10^{-5}$ mol $dm^{-3}$)

**(4)**

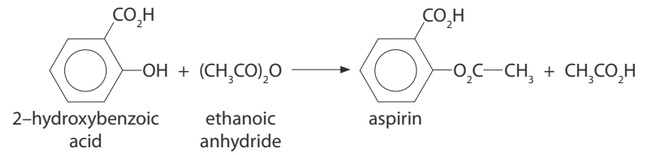
The question is **ramped** towards a more demanding final part. Ramping of the whole paper, as well as within each question, encourages students to complete papers whilst still stretching the most able.

**(Total for Question 8 = 8 marks)**

# Sample Assessment Materials

This question comes from **A level Paper 3 – General and Practical Principles in Chemistry**.

(b) The painkiller aspirin can be synthesised by the reaction between 2-hydroxybenzoic acid, which contains a hydroxyl group, and ethanoic anhydride, using concentrated phosphoric acid as a catalyst. The reagents are heated under reflux, then the excess ethanoic anhydride is removed by reacting it with water.




2–hydroxybenzoic acid — ethanoic anhydride — aspirin

(i) The percentage yield for this synthesis is 65%.

Calculate the mass of aspirin you would obtain using 2.0 g of 2-hydroxybenzoic acid.

**(3)**

Preparing aspirin is a **core practical** activity. As different methods may have been used, a method is outlined and an equation provided.

This calculation meets the requirements for assessing **mathematical skills** at the required level, as some rearrangement of the equation for percentage yield is needed.

A data booklet, with a Periodic Table, is provided for students to look up relative atomic masses.



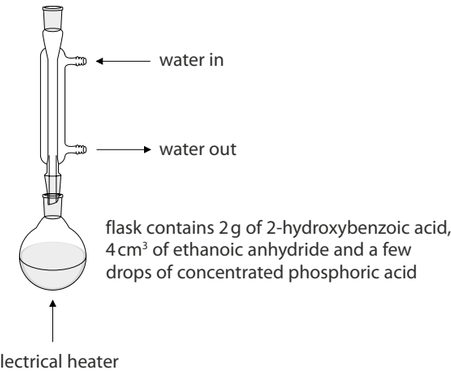
This question tests what students learned from the **core practical** activity. Note that the question does not ask for the recall of a method, which could have been learned from a book. Instead, it tests students' **practical experience** by asking them to identify areas where the setup is not ideal for the procedure.

(ii) The diagram shows a proposed set-up of apparatus used for the stage of the synthesis that requires heating under reflux.

Identify **three** improvements that should be made to this set-up. Give a reason for each improvement made.

You may assume suitable clamps are used.

**(6)**




**(Total for Question 6 = 15 marks)**

# Sample Assessment Materials

This question comes from **AS Paper 2 – Core Organic and Physical Chemistry**.

**3** Ammonia is used in the manufacture of nitric acid.

The equation for one step in this manufacturing process is:

$$4NH_3(g) + 5O_2(g) \rightleftharpoons 4NO(g) + 6H_2O(g) \quad \Delta_r H = -900 \text{ kJ mol}^{-1}$$

*(a) A manufacturer carries out this reaction at a temperature of 1200 K and a pressure of 10 atm. A scientist proposes that a temperature of 1000 K should be used at the same pressure.

Evaluate the effects of making this change on the rate and yield of this reaction.

**(6)**

The **asterisk** shows students that this question is an **'extended-writing question'**.

The front page of the question paper tells students that 'marks will be awarded for your ability to structure your answer logically showing the points that you make are related or follow on from each other where appropriate'.

For an **'evaluate'** question, students need to 'review information then bring it together to form a conclusion, drawing on relevant data or information'.



Pearson Edexcel Level 3 Advanced Subsidiary GCE in Chemistry
Sample Assessment Materials – Issue 1 – February 2015 © Pearson Education Limited 2015



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