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.

**AS assessment at a glance**

- 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

### First assessment: summer 2016.

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

**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.
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

<table>
<thead>
<tr>
<th>Topic</th>
<th>Marks</th>
<th>Percentage</th>
<th>Duration</th>
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<tbody>
<tr>
<td>1: Atomic Structure and the Periodic Table</td>
<td>90</td>
<td>30%</td>
<td>1 hour 45 minutes</td>
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<tr>
<td>2: Bonding and Structure</td>
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<tr>
<td>3: Redox I</td>
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<tr>
<td>4: Inorganic Chemistry and the Periodic Table</td>
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<tr>
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<tr>
<td>8: Energetics I</td>
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<tr>
<td>10: Equilibrium I</td>
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<tr>
<td>11: Equilibrium II</td>
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<td>12: Acid-base Equilibria</td>
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<td>13: Energetics II</td>
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<tr>
<td>14: Redox II</td>
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<td>15: Transition Metals</td>
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A level Paper 2 – Advanced Organic and Physical Chemistry

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<tr>
<th>Topic</th>
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<tbody>
<tr>
<td>2: Bonding and Structure</td>
<td>90</td>
<td>30%</td>
<td>1 hour 45 minutes</td>
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<tr>
<td>3: Redox I</td>
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<tr>
<td>6: Organic Chemistry I</td>
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<tr>
<td>7: Modern Analytical Techniques I</td>
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<tr>
<td>9: Kinetics I</td>
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<tr>
<td>10: Kinetics II</td>
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<tr>
<td>12: Organic Chemistry II</td>
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<tr>
<td>13: Organic Chemistry III</td>
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<tr>
<td>14: Modern Analytical Techniques II</td>
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A level Paper 3 – General and Practical Principles in Chemistry

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<thead>
<tr>
<th>Marks</th>
<th>Percentage</th>
<th>Duration</th>
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<tbody>
<tr>
<td>120</td>
<td>40%</td>
<td>2 hours 30 minutes</td>
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- 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.
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:
   \[ \text{H}_2\text{SO}_4 + \text{HNO}_3 \rightarrow \text{HSO}_4^- + \text{HNO}_3^- \]
   Which statement about this equilibrium is correct?
   - A. \( \text{HNO}_3 \) and \( \text{H}_2\text{NO}_3^- \) 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

   (b) Sulfuric acid ionises in two stages.
   Stage 1: \( \text{H}_2\text{SO}_4(aq) \rightarrow \text{H}^+(aq) + \text{HSO}_4^-(aq) \)
   Stage 2: \( \text{HSO}_4^-(aq) \rightarrow \text{H}^+(aq) + \text{SO}_4^{2-}(aq) \)

   (ii) Explain, with reference to the equations, why the \( \text{HSO}_4^- \) ion is classified as a weak acid.

   (iii) 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.

   (c) Ethanoic acid, \( \text{CH}_3\text{COOH} \), 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, \( \text{CH}_3\text{COONa} \).
   Calculate the pH of the buffer solution produced.
   \( K_a \) for ethanoic acid = \( 1.74 \times 10^{-5} \) mol dm\(^{-3}\)

   (Total for Question 8 = 8 marks)
Sample Assessment Materials

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

Principles in Chemistry
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.

\[
\text{2-hydroxybenzoic acid} + (\text{CH}_3\text{CO})_2\text{O} \rightarrow \text{aspirin}
\]

(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.

Preventing 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.

(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.

(Total for Question 6 = 15 marks)
Ammonia is used in the manufacture of nitric acid. The equation for one step in this manufacturing process is:

$$4\text{NH}_3(\text{g}) + 5\text{O}_2(\text{g}) \rightleftharpoons 4\text{NO}(\text{g}) + 6\text{H}_2\text{O}(\text{g}) \quad \Delta H = -900 \text{ kJ mol}^{-1}$$

(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. 

(b) When this reaction is used in industry, the catalyst is an alloy of platinum and rhodium.

The diagram shows the reaction profile for the uncatalysed reaction.

(i) On the diagram, draw the reaction profile for the catalysed reaction.

(ii) Label the diagram to show:

- the enthalpy change, $$\Delta_r H$$
- the activation energy, $$E_a$$

(c) Ammonia is used in the manufacture of nitric acid. The equation for one step in this manufacturing process is:

$$4\text{NH}_3(\text{g}) + 5\text{O}_2(\text{g}) \rightleftharpoons 4\text{NO}(\text{g}) + 6\text{H}_2\text{O}(\text{g}) \quad \Delta H = -900 \text{ kJ mol}^{-1}$$

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