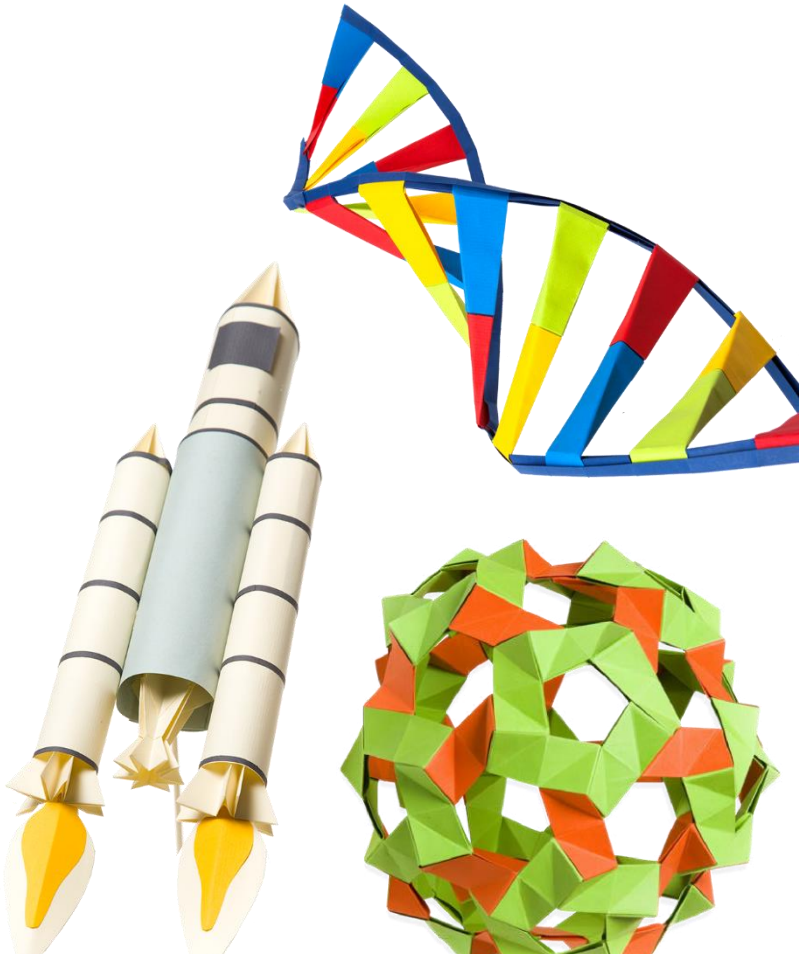
GCSE Combined Science

Chemistry Exam Insights

May/June 2024



Welcome

Trainer: Frankie Annets

This training is for teachers of the Pearson Edexcel GCSE Combined Science Chemistry specification and will provide feedback and insights on the May/June 2024 exam series.

The session will focus on the performance of some of the key questions in the series and provide analysis to support.

The session will point out key statistical performance data that may help with your planning for the year ahead.

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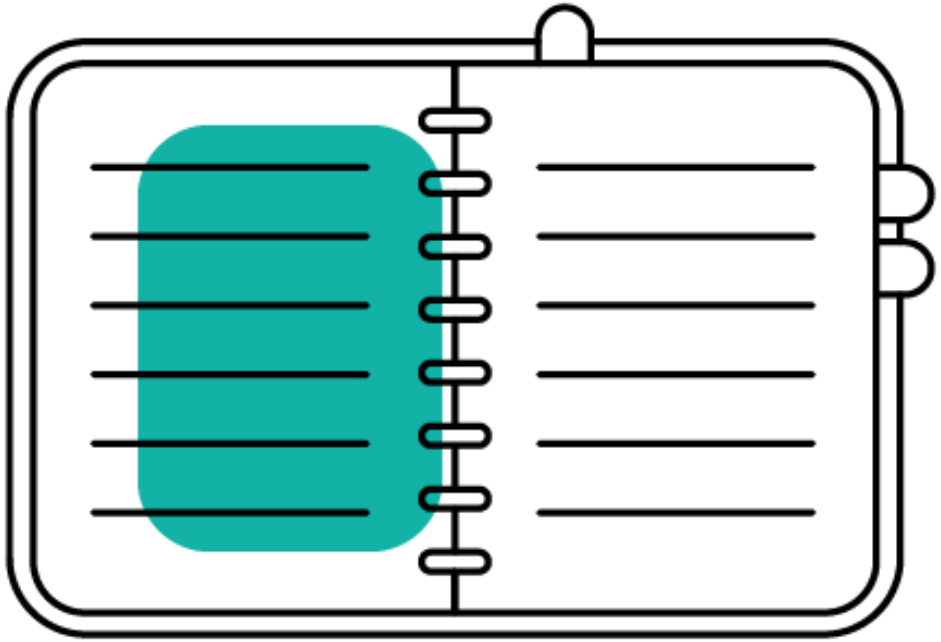
Agenda

In this session we are going to look at:

- an overview of the exam
- detailed analysis of questions
- common mistakes and how to avoid them
- conclusion
- Q&A session
- support



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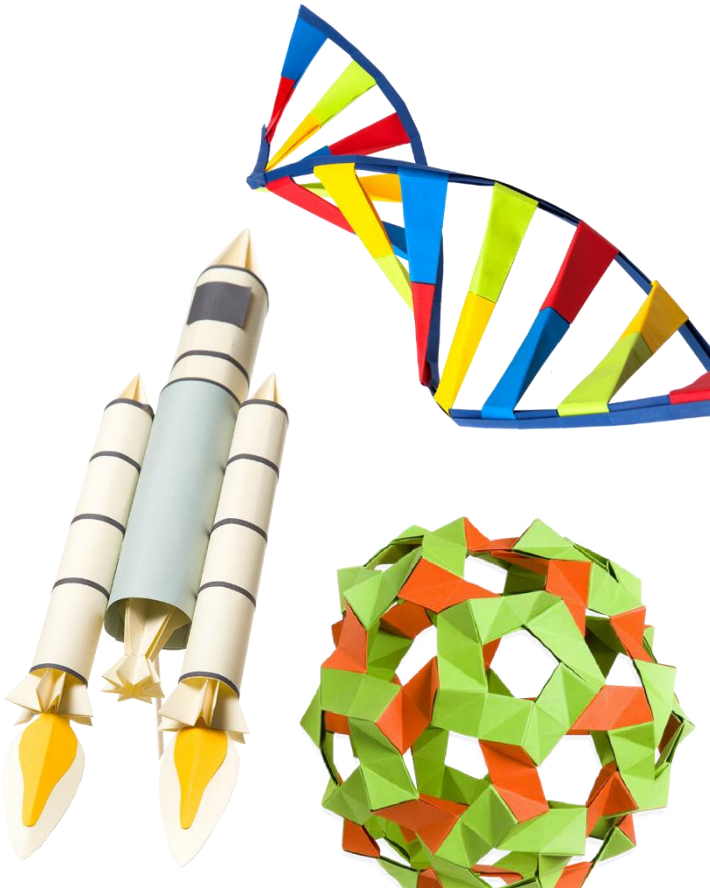
Overview of assessment



GCSE Combined Science Overview

Qualification assessment includes:

Foundation – targeted up to grade 5

- 2 papers biology
- 2 papers chemistry
- 2 papers physics

Higher – targeted grade 4–9

- 2 papers biology
- 2 papers chemistry
- 2 papers physics

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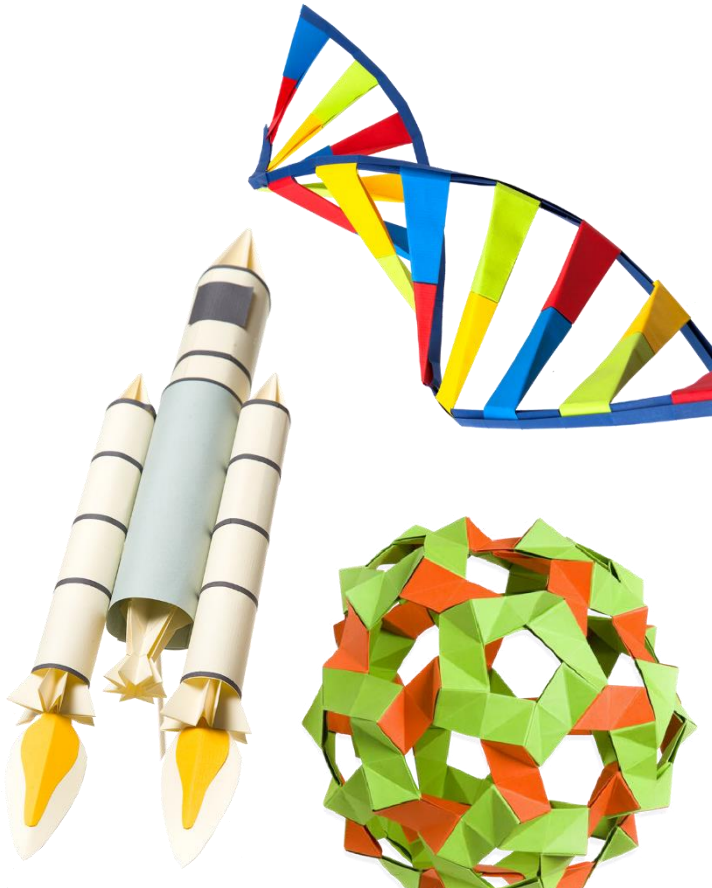
Overview of exam: 1SCO/1CF



1SCO/1CF: Student performance

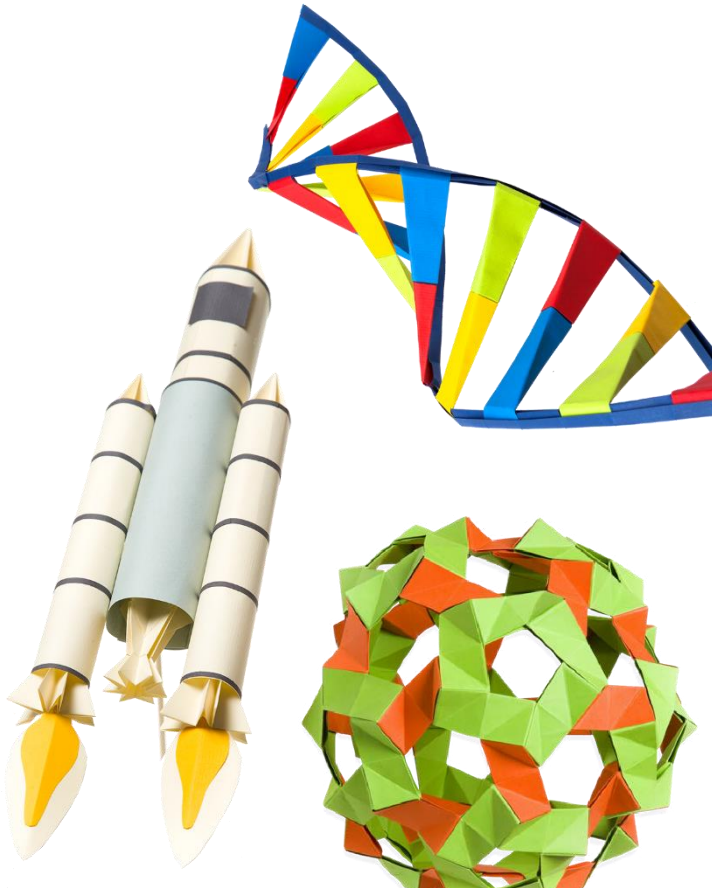
Positive comments

- Candidates understand structure of an atom
- Candidates can correctly suggest laboratory equipment
- Candidates can correctly identify hazard symbols
- Candidates can name changes of state

Areas for improvements

- Use of command words
- Scientific terminology
- Show working for calculations
- Practice calculation skills
- Practical experience

1SCO/1CF:
Question analysis



Question 2bi

(b) Some tap water contains chloride ions.

(i) Explain, in terms of electrons, how a chlorine atom, Cl, forms a chloride ion, Cl^-.

(2)

Common misconceptions

- Negatively charged ions have lost electrons
- Confusing ions and isotopes
- Electrons are shared when forming ion

Question 2bi - examples

Example 1

(b) Some tap water contains chloride ions.

(i) Explain, in terms of electrons, how a chlorine atom, Cl, forms a chloride ion, Cl^-.

(2)

The Chloride ~~is a~~ atom Cl has gained an atom turning it into a negative ion, Cl^-.

Example 2

An electron is shared in the outer shell of Chloride in order to complete the atoms outer shell

Question 2ci

(c) A student was asked to distil a sample of tap water.
Figure 4 shows the apparatus the student used.

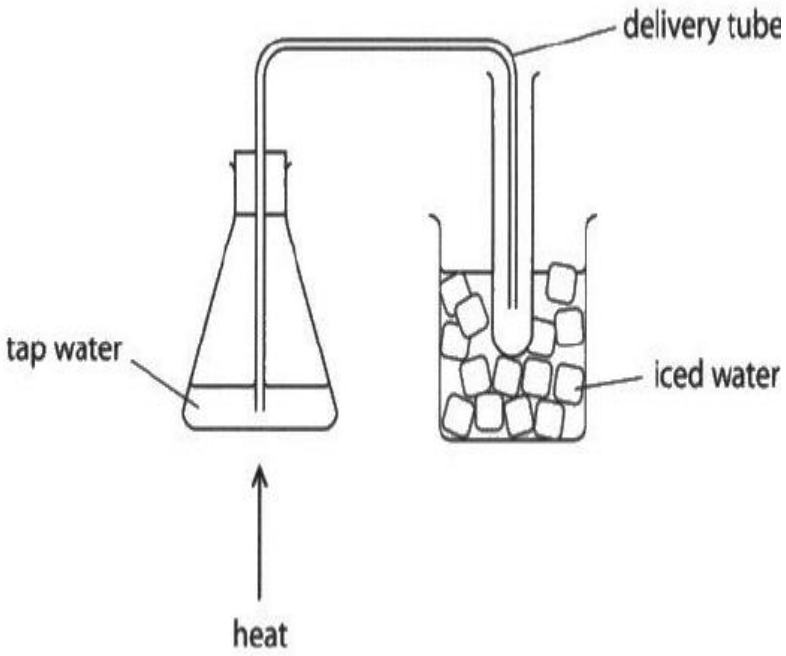


Figure 4

- Practical question
- Application of practical knowledge
- Evaluative skills

Common errors

- Apparatus was missing a condenser
- Cannot produce pure water from tap water
- Ice stops water being produced
- Test tube needs a bung/stopper to stop water being lost

Question 2ci: examples

Example 1

(i) The student made an error when setting up the apparatus in Figure 4.

This error meant that pure water could **not** be collected in the test tube.

Explain what the student needs to change so that pure water can be collected in the test tube.

(2)

Need to make the delivery ~~shorter end~~ tube shorter to collect the tap water is condensation instead of passing boiled water & into a new test tube.

Example 2

Figure 4 shows the apparatus the student used.

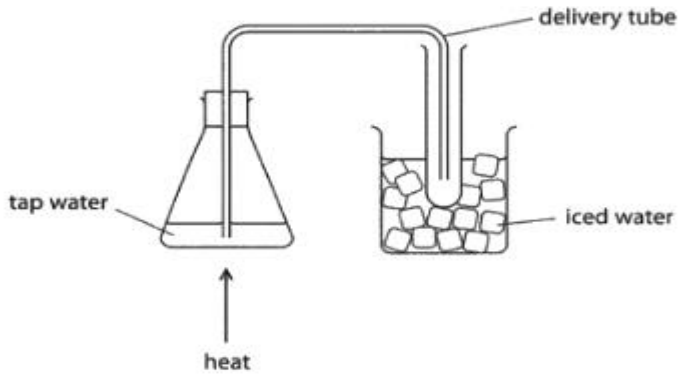


Figure 4

(i) The student made an error when setting up the apparatus in Figure 4.

This error meant that pure water could **not** be collected in the test tube.

Explain what the student needs to change so that pure water can be collected in the test tube.

(2)

~~The end tap water~~
The delivery tube is too low in and is in the tap water. I must be near the top of the beaker.

Question 4b

(b) Sodium hydroxide solution and copper sulfate solution were reacted together completely.

The result was a mixture of a precipitate of copper hydroxide in a solution of sodium sulfate.

Describe how to obtain

- a pure sample of solid copper hydroxide from the mixture
- a pure sample of solid sodium sulfate from the mixture.

(4)

Common incorrect methods suggested

- Fractional distillation
- Electrolysis
- Heat with a Bunsen burner

Question 4b

Example 1

Put the precipitate of Copper Hydroxide and the Sodium Sulfate Solution mixre in a beaker, Using filter paper, Collect the insoluble precipitate and let the Sodium Sulfate Solution filter through, leave the copper hydroxide to dry out to get a Sample of pure copper hydroxide. Distil the Sodium Sulfate to get a pure Sample of Sodium Sulfate.

Example 2

Sodium hydroxide solution and copper sulfate solution were reacted together completely.

The result was a mixture of a precipitate of copper hydroxide in a solution of sodium sulfate.

Describe how to obtain

- a pure sample of solid copper hydroxide from the mixture
- a pure sample of solid sodium sulfate from the mixture.

(4)

- get a filter
- filter it through
- heat it up
- let it cool down then have pure samples,

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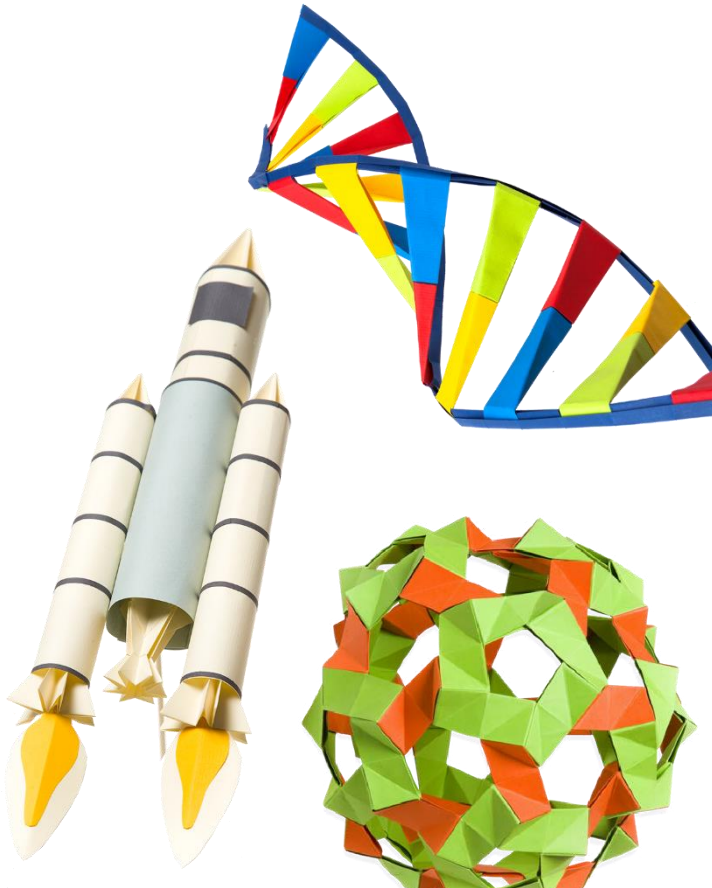
Overview of exam: 1SCO/2CF



Student performance

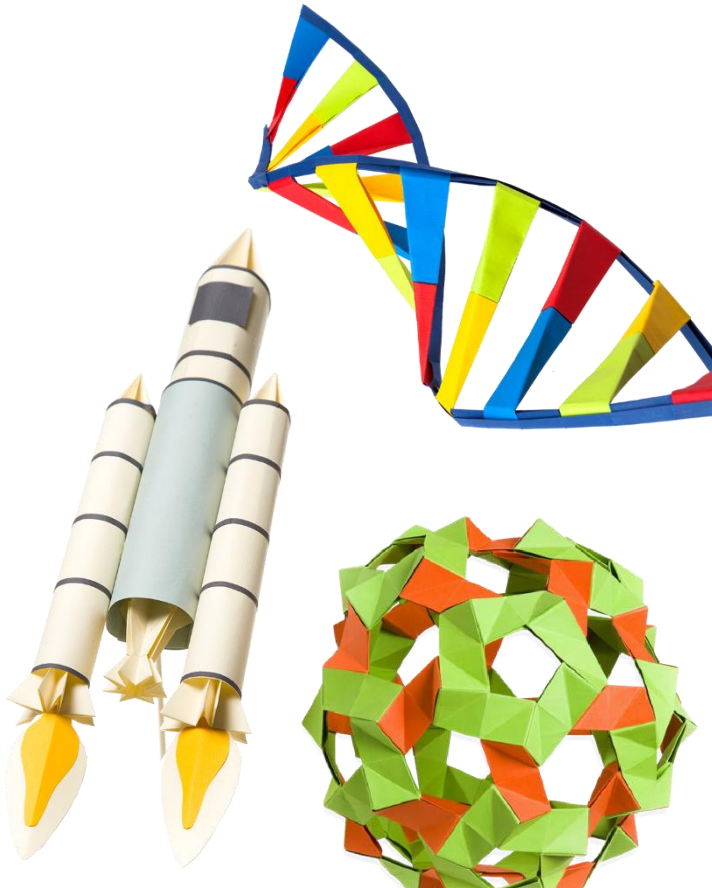
Positive comments

- Candidates could name equipment used to measure temperature
- Candidates could recognise elements from their chemical symbol
- Candidates understood factors that affect rate of reaction
- Candidates could write simple word equations

Areas for improvement

- Read whole question carefully
- Formulae of ionic compounds
- Calculations
- Trends and properties of fractions obtained by fractional distillation
- Reaction types
- Gas tests

1SCO/2CF:
Question analysis



Question 2bv

(v) One of the salts dissolved is barium chloride, $BaCl_2$.

Barium chloride contains the chloride ion, Cl^-.

Give the **formula** of the barium ion in barium chloride.

(1)

.....

Common errors

- Repeating formula for barium chloride
- No charge on ion
- Incorrect charge on ion

Question 2bv examples

Example 1

(v) One of the salts dissolved is barium chloride, $BaCl_2$.

Barium chloride contains the chloride ion, Cl^-.

Give the **formula** of the barium ion in barium chloride.

(1)

Ba^{2}

Example 2

(v) One of the salts dissolved is barium chloride, $BaCl_2$.

Barium chloride contains the chloride ion, Cl^-.

Give the **formula** of the barium ion in barium chloride.

(1)

Ba^{+2}

Question 5a

5 A student investigates the reaction between marble chips and dilute hydrochloric acid.

The student measures the total volume of carbon dioxide gas produced each minute, for 10 minutes.

(a) Figure 8 shows part of the apparatus used in the experiment.

Complete Figure 8 by drawing and labelling apparatus that could be used to collect and measure the volume of the carbon dioxide gas.

(2)

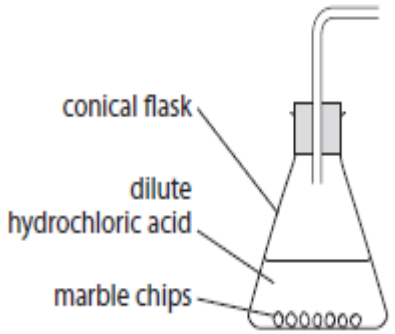


Figure 8

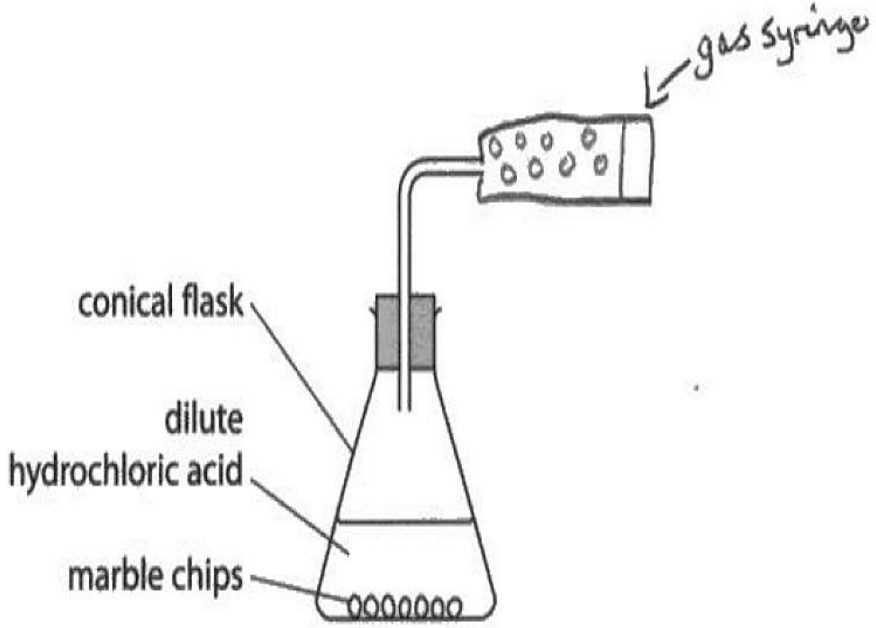
This is a core practical.

Common issues

- Sealed systems
- Many blank responses
- Missing labels

Question 5a examples

Example 1



Example 2

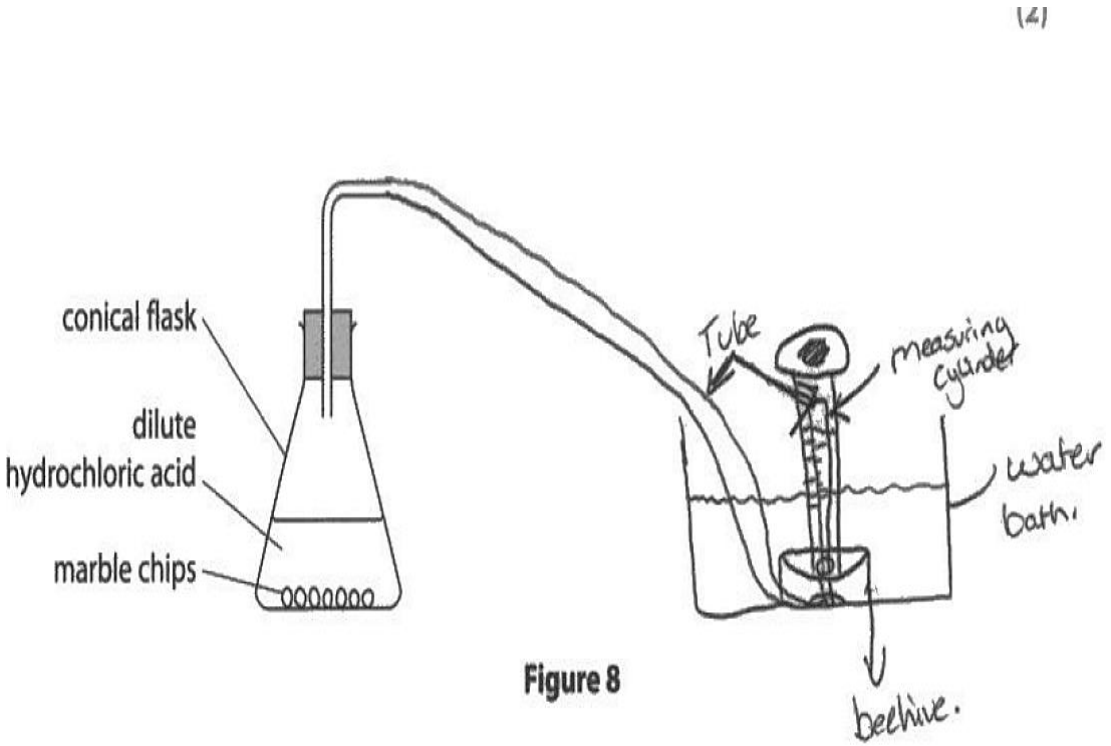


Figure 8

Question 5f

(f) In this experiment there is an excess of dilute hydrochloric acid.

State what you would **see** in the conical flask at the end of the experiment.

(1)

Common errors

- Stating what they would see during experiment
- Excess hydrochloric acid
- Not stating what they would **see**

Question 5f examples

Example 1

State what you would **see** in the conical flask at the end of the experiment.

(1)

~~Chor~~ Lestova chunks of the marbles.

Example 2

State what you would **see** in the conical flask at the end of the experiment.

(1)

small remain of water and no marble chips as it would all react

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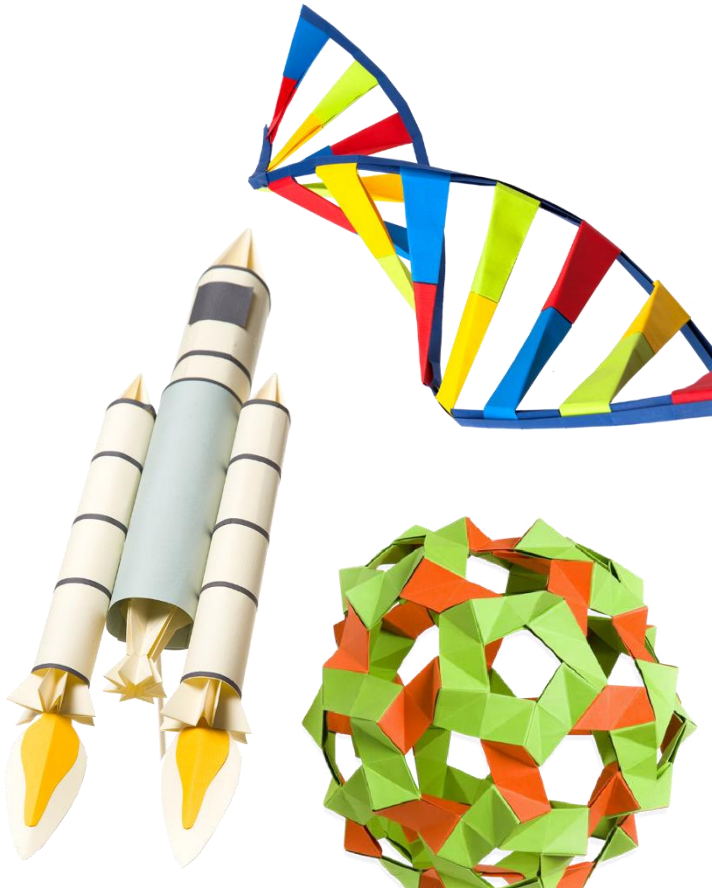
Overview of exam: 1SCO/1CH



Student performance

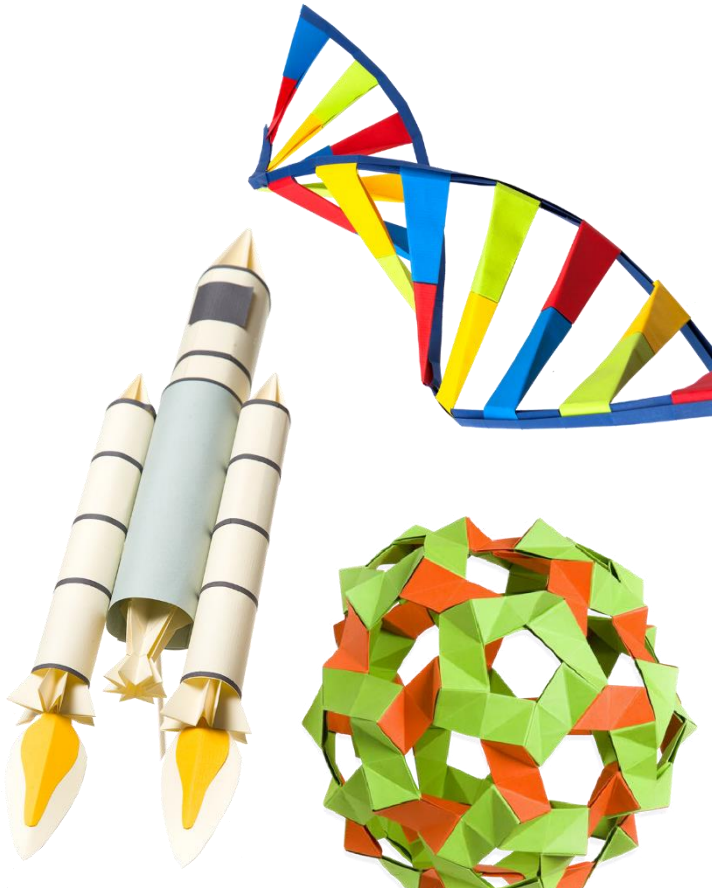
Positive comments

- Candidates could balance simple equations
- Candidates could plot and interpret graphs
- Candidates could interpret practical data
- Candidates could draw dot and cross diagrams

Areas for improvement

- Interpreting state symbols
- Electronic configurations
- Electrical conductivity
- Copper sulfate electrolysis
- Strength and concentration of acids
- Calculating number of moles
- Scientific terminology

1SCO/1CH:
Question analysis



Question 1 aii

$Ba(OH)_2(s)$ + ... $HCl(aq) \rightarrow BaCl_2(aq) + 2H_2O(l)$

(ii) State what you would **see** during the reaction.

(1)

Common errors

- Bubbles
- Colour change

Question 1aii examles

Example 1

(ii) State what you would **see** during the reaction.

(1)

You would see the $Ba(OH)_2$ melt into a liquid

Example 2

(ii) State what you would **see** during the reaction.

(1)

neutralisation.

Question 2aii

(ii) Explain why solid sodium carbonate **cannot** conduct electricity but a solution of sodium carbonate **can** conduct electricity.

(3)

Common errors

- Use of electrons to carry current
- Use of particles
- Incorrect or missing behaviour of ions in lattice/solution
- Poor terminology

Question 2aii example

(ii) Explain why solid sodium carbonate **cannot** conduct electricity but a solution of sodium carbonate **can** conduct electricity.

(3)

solid sodium carbonate don't have free electron they don't carry charged particles so it does not conduct electricity but a solution of Na_2CO_3 conduct electricity because it hair charged electron so it can free to move and are decolised.

Question 6b

The formula of lead ethanoate is $Pb(CH_3COO)_2$.

Calculate the number of **atoms** that combine together to form 16.25 g of lead ethanoate.

(relative atomic masses: H = 1.00, C = 12.0, O = 16.0, Pb = 207

Avogadro number = 6.02×10^{23})

(4)

Common errors

- Not showing working
- Incorrect calculation of relative formula mass
- Incorrect calculation of number of moles
- Not multiplying by 15

Question 6b examples.

Example 1

$Mr = 207 + 2(12 + 3 + 12 + 16 + 16) = 325$

$n = \frac{m}{M}$

$= \frac{16.25}{325}$

$= 0.05$ moles

no. of ~~molecules~~ atoms $= 0.05 \times 6.02 \times 10^{23} \times 15$

$= 4.515 \times 10^{23}$

number of atoms = 4.515×10^{23}

Example 2

$\text{Moles} = \frac{\text{mass}}{Mr}$

$\frac{16.25}{526} = 0.03\text{mol}$

$(207) + (2(12) + (1\times3) + (\ldots) + (6) + (16)$

$= 526$

atoms = mol x avogadro constant

$= 003\ldots \times 6.02 \times 10^{23} = 1.806 \times 10^{22}$

1.806 = 1806

number of atoms = 1.806×10^{22}

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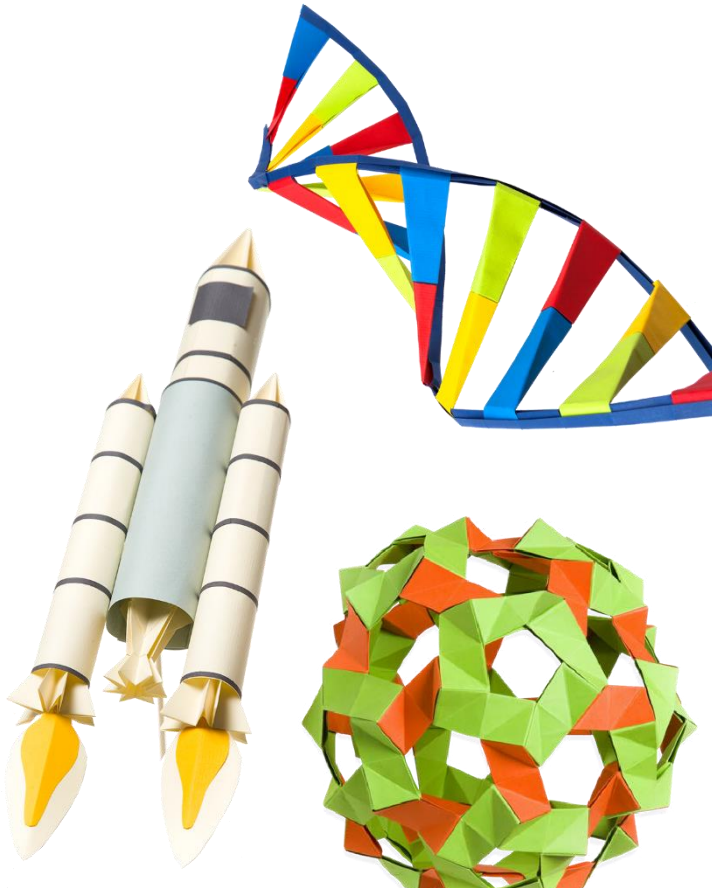
Overview of exam: 1SCO/2CH



Student performance

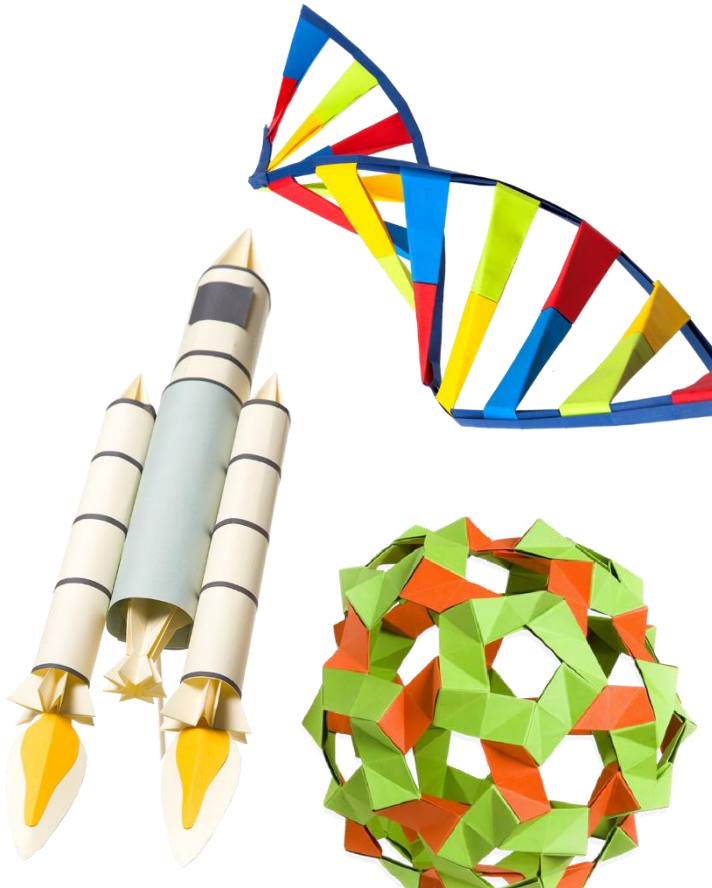
Positive comments

- Candidates could interpret graphs
- Candidates understood factors that affect rate of reaction
- Candidates understood properties of inert gases
- Candidates could carry out percentage calculations
- Candidates could calculate energy changes

Areas for improvement

- Understanding different types of formula
- Work out ionic formulae
- Practice drawing practical equipment
- Practice rounding calculation answers to specific numbers of decimal places/significant figures
- Balancing equations
- Understand core practicals
- Scientific terminology

1SCO/2CH:
Question analysis



Question 3c

(c) Incomplete combustion of fuels may produce carbon monoxide.

Write the balanced equation for the incomplete combustion of heptane, C_7H_{16}, where all of the carbon atoms form carbon monoxide.

(2)

Common errors included:

- Hydrogen as a product
- Carbon dioxide as a product
- Incorrect formula for oxygen
- Incorrect balancing

Question 3c examples

Example 1

(c) Incomplete combustion of fuels may produce carbon monoxide.

Write the balanced equation for the incomplete combustion of heptane, C_7H_{16}, where all of the carbon atoms form carbon monoxide.

$C_7H_{16} + O_2 \rightarrow CO + H_2O + CO_2$

Example 2

Write the balanced equation for the incomplete combustion of heptane, C_7H_{16}, where all of the carbon atoms form carbon monoxide.

(2)

$C_7H_{16} + 4O_2 \rightarrow 8H_2O + 7CO$

(Total for Question 3 = 9 marks)

Question 4bii

(ii) A hydrocarbon, C_xH_y, is burned in excess oxygen, forming 26.4 g of carbon dioxide and 5.4 g of water.

The relative formula mass of C_xH_y is 78.

Calculate the molecular formula of the hydrocarbon C_xH_y.

(relative atomic masses: H = 1.0, C = 12;
relative formula masses: H_2O = 18, CO_2 = 44)

(4)

Common errors

- Not multiplying moles of hydrogen by 2
- Not showing working

Question 4bii examples

Example 1

(ii) A hydrocarbon, C_xH_y, is burned in excess oxygen, forming 26.4 g of carbon dioxide and 5.4 g of water.

The relative formula mass of C_xH_y is 78.

Calculate the molecular formula of the hydrocarbon C_xH_y.

(relative atomic masses: H = 1.0, C = 12;
relative formula masses: H_2O = 18, CO_2 = 44)

(4)

C_6H_6

molecular formula = ...

Example 2

(ii) A hydrocarbon, C_xH_y, is burned in excess oxygen, forming 26.4 g of carbon dioxide and 5.4 g of water.

The relative formula mass of C_xH_y is 78.

Calculate the molecular formula of the hydrocarbon C_xH_y.

(relative atomic masses: H = 1.0, C = 12;
relative formula masses: H_2O = 18, CO_2 = 44)

(4)

CO_2 H_2O

1 mol = 26.4 / 44 = 0.6 : 5.4 / 18 = 0.3

C_2H_1

÷small 0.6 / 0.6 : 0.3 / 0.6

C_4H_2

C_6H_3

1 : 0.5

$C_6 : H_3$

molecular formula = ...

(Total for Question 4 = 9 marks)

Question 6di

*(d) (i) The order of reactivity of the halogens can be found by displacement reactions.

A student was provided with

- solutions of bromine, chlorine and iodine
- solutions of sodium bromide, sodium chloride and sodium iodide.

Describe experiments the student could carry out using these solutions to find the order of reactivity of bromine, chlorine and iodine, explaining how the results would show the order of reactivity.

You should use equations to support your answer.

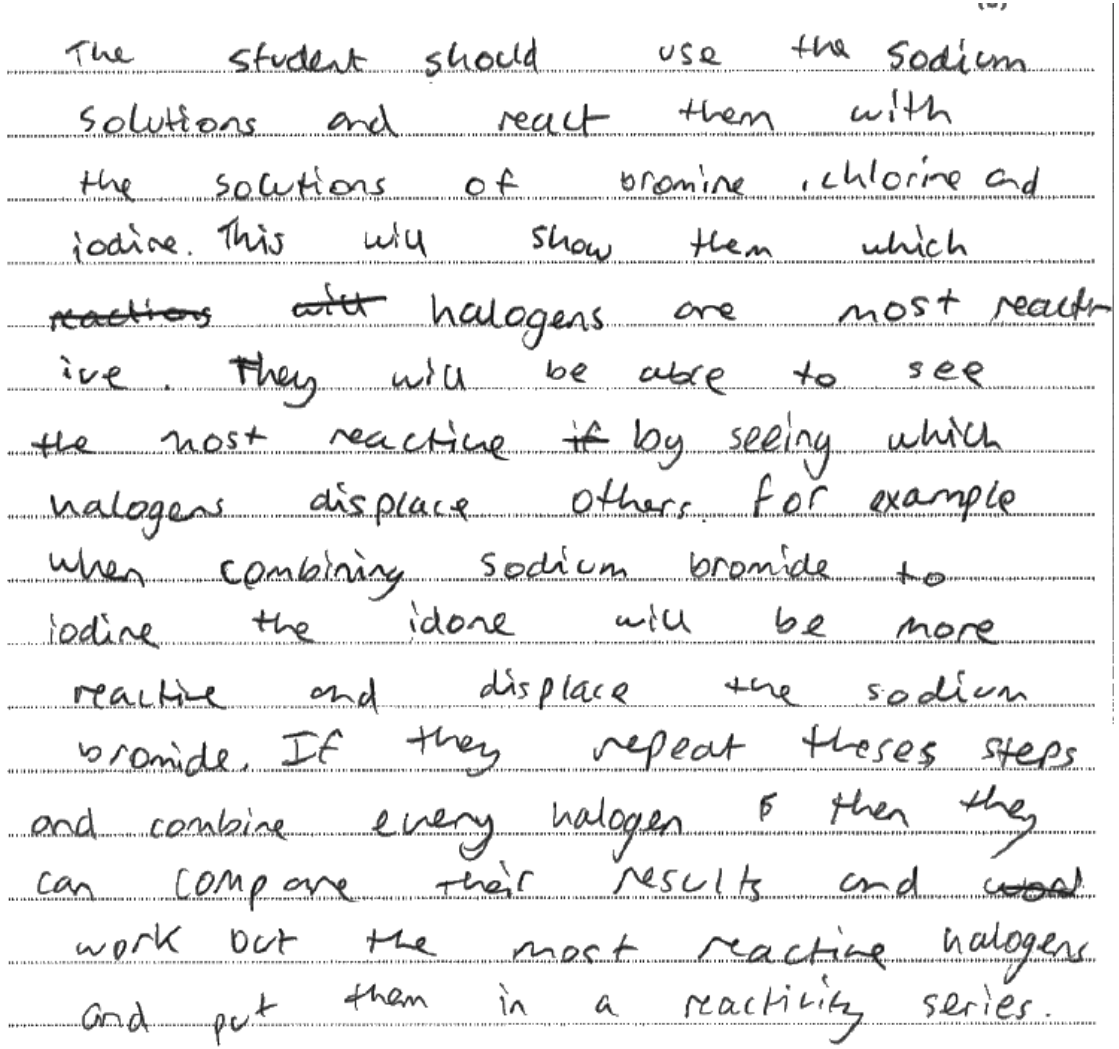
(6)

Common errors

- Halogens react with water
- Monitoring pH
- Monitoring temperature
- Measuring volume of gas produced
- Reacting sodium rather than sodium halides
- Not including equations
- Including explanations of reactivity

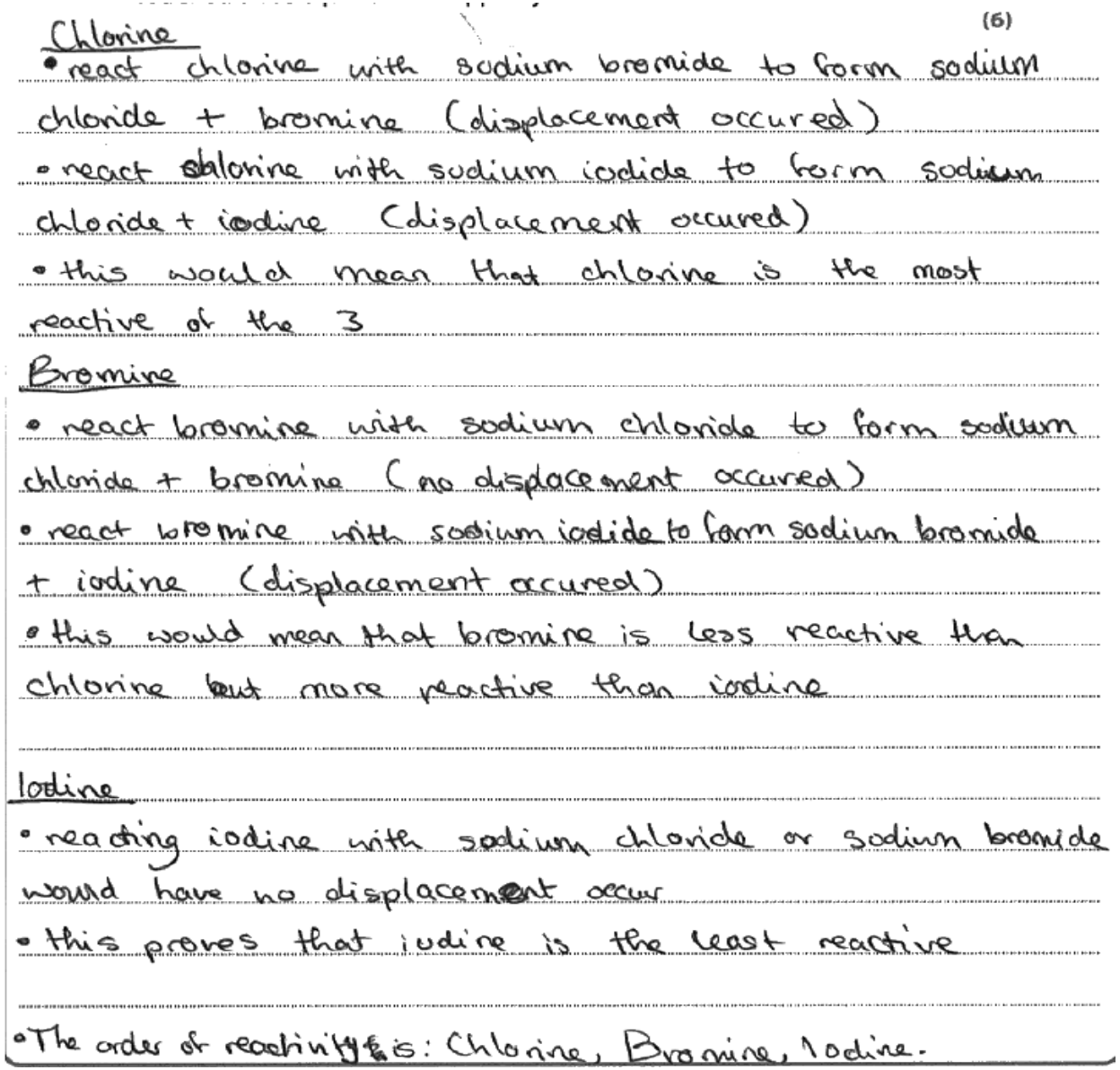
- 6-mark question
- Level based mark scheme
- Practical knowledge
- Displacement reactions

Question 6di examples



The student should use the sodium solutions and react them with the solutions of bromine, chlorine and iodine. This will show them which ~~reactions~~ ~~of~~ halogens are most reactive. They will be able to see the most reactive ~~if~~ by seeing which halogens displace others for example when combining sodium bromide to iodine the idone will be more reactive and displace the sodium bromide. If they repeat theses steps and combine every halogen & then they can compare their results and ~~would~~ work out the most reactive halogens and put them in a reactivity series.

Example 1



(6)

Chlorine

- react chlorine with sodium bromide to form sodium chloride + bromine (displacement occured)
- react chlorine with sodium iodide to form sodium chloride + iodine (displacement occured)
- this would mean that chlorine is the most reactive of the 3

Bromine

- react bromine with sodium chloride to form sodium chloride + bromine (no displacement occured)
- react bromine with sodium iodide to form sodium bromide + iodine (displacement occured)
- this would mean that bromine is less reactive than chlorine but more reactive than iodine

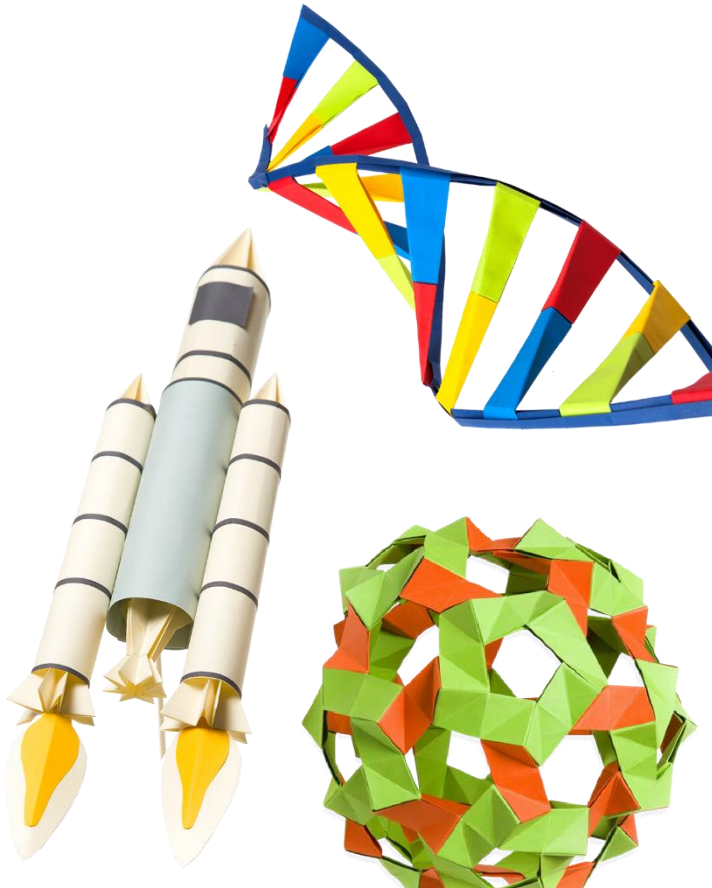
Iodine

- reacting iodine with sodium chloride or sodium bromide would have no displacement occur
- this proves that iodine is the least reactive

- The order of reactivity is: Chlorine, Bromine, Iodine.

Example 2

Teaching strategies.



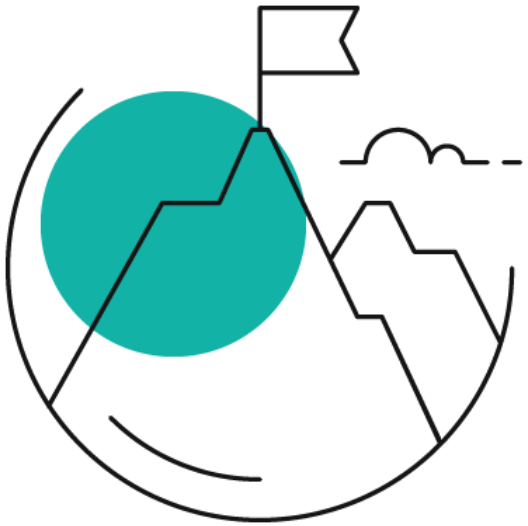
Misconceptions

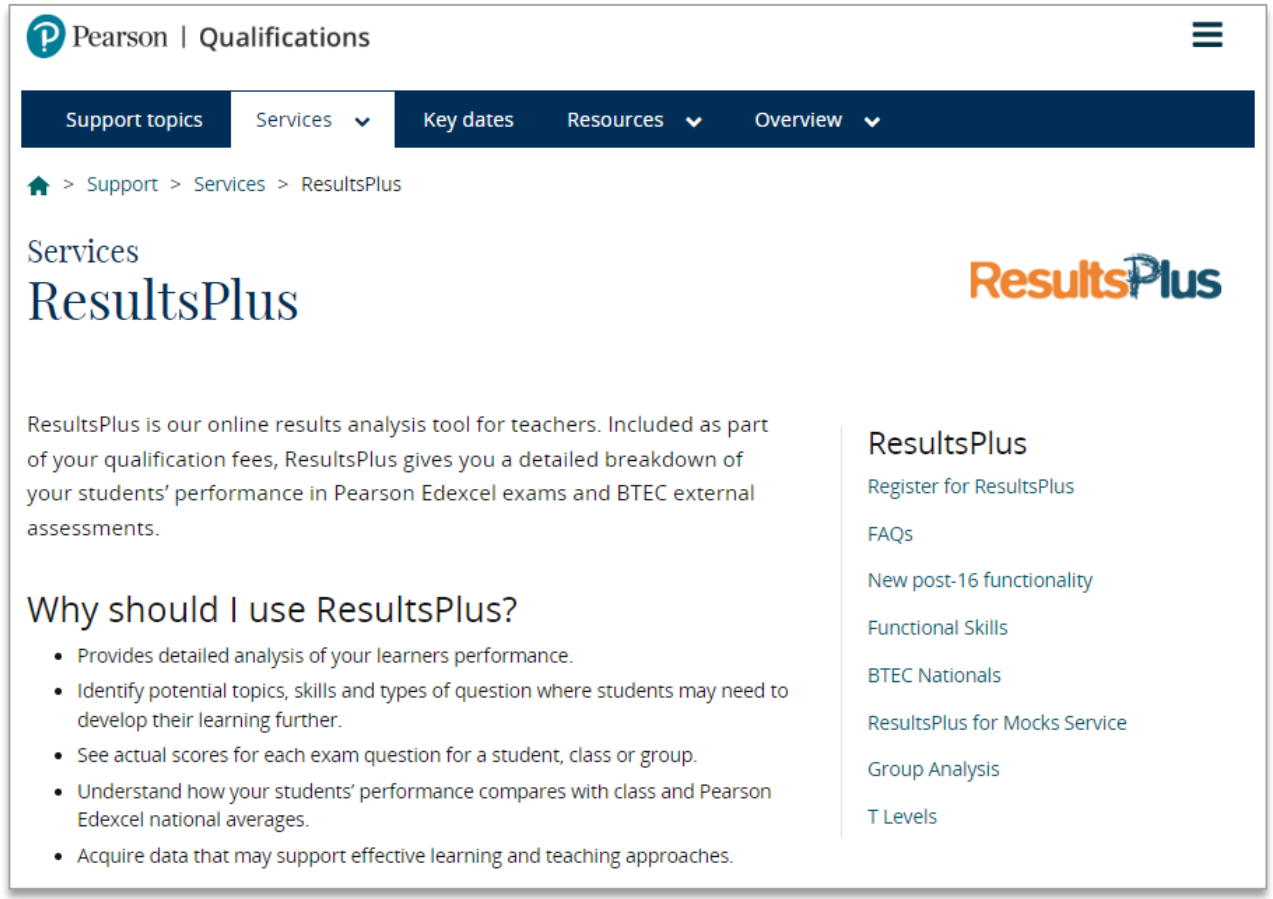
- Identify misconceptions
- Discuss misconceptions openly
- Provide correct information
- Reinforce correct understanding
- Continually review and assess

The Will to Teach website

Teaching Strategies

- Examiner Report and Results Plus
- Waking talking mocks
- Discussion
- Practice exam papers





Conclusion

In this session we covered the following areas:

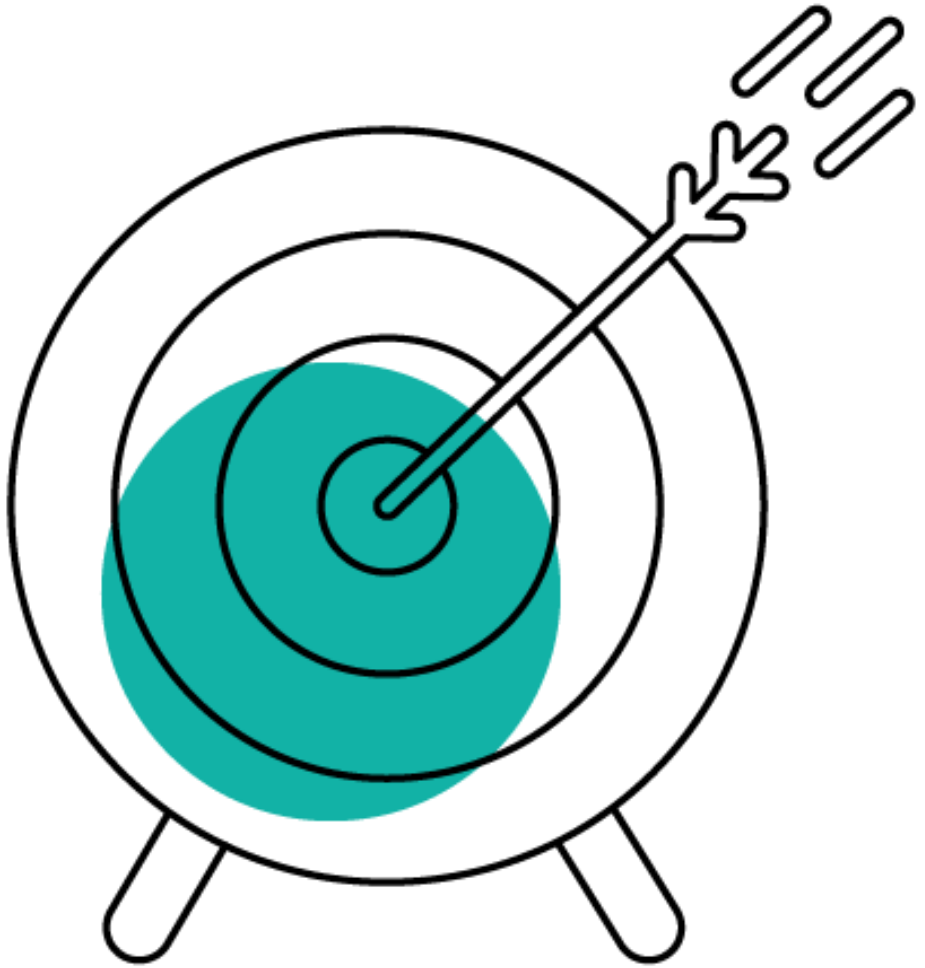
- Overview of exam
- Detailed analysis of questions
- Common mistakes and how to avoid them

Key learning:

- Exam technique
- Scientific terminology
- Practice

Resources

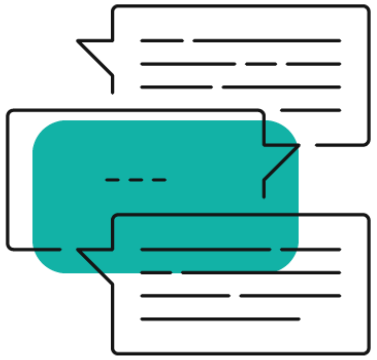
- ResultsPlus
- Exam Wizard



Support

Subject Advisor Support

Our subject advisors are experts in their fields and are here to support you throughout the year.



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Following this event, you will receive an invitation to share your thoughts about the session. Your feedback is invaluable to us, as it helps us tailor our professional development materials to better meet your needs. Please don’t hesitate to let us know what you’d like to see more of and what areas you think could be improved.

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