# GCSE MARKING SCHEME

**SUMMER 2024**

**GCSE**
**CHEMISTRY - UNIT 1**

**3410U10-1**
**3410UA0-1**

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## About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

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# GCSE CHEMISTRY UNIT 1: CHEMICAL SUBSTANCES, REACTIONS AND ESSENTIAL RESOURCES

## SUMMER 2024 MARK SCHEME

## GENERAL INSTRUCTIONS

Marking rules

All work should be seen to have been marked.

Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.

Crossed out responses not replaced should be marked.

Credit will be given for correct and relevant alternative responses which are not recorded in the mark scheme.

Extended response question

A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide which mark to award within the level. Award the higher mark in the level if there is a good match with both the content statements and the communication statement.

Marking abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

cao = correct answer only
ecf = error carried forward
bod = benefit of doubt



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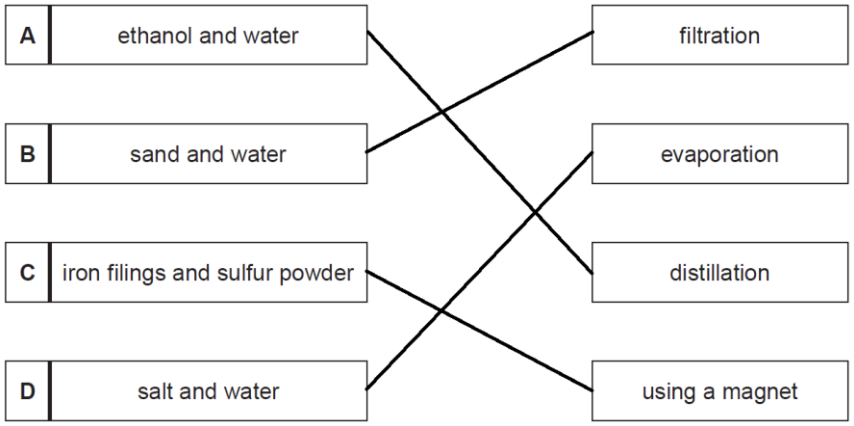
## FOUNDATION TIER ONLY QUESTIONS

| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| 1 | (a) | | | <br>award (1) for each correct line<br><br>accept distillation for salt and water<br>accept evaporation for ethanol and water | 4 | | | 4 | | 4 |
| | (b) | | | **D** / salt and water | | 1 | | 1 | | 1 |
| | | | | **Question 1 total** | **4** | **1** | **0** | **5** | **0** | **5** |



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| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| **2** | (a) | (i) | | lithium melts into a ball and sinks ☐<br>lithium fizzes and moves around the surface of the water ✓<br>lithium catches fire and burns with a blue flame ☐ | 1 | | | 1 | | 1 |
| | | (ii) | | neutral ☐ acid ☐ alkali ✓ | 1 | | | 1 | | 1 |
| | | (iii) | | **liOH** **LiOH** (circled) **$Li(OH)_2$** **$Li_2OH$** | | 1 | | 1 | | 1 |
| | (b) | (i) | | $2Li + Cl_2 \rightarrow 2LiCl_2$ ☐<br>$2Li + Cl_2 \rightarrow 2Li_2Cl$ ☐<br>$2Li + Cl_2 \rightarrow 2LiCl$ ✓ | | 1 | | 1 | | |



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| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| | | (ii) | | green flame<br>red flame<br>lilac flame<br><br>yellow precipitate<br>blue precipitate<br>white precipitate<br><br>award (1) for each correct observation | | 2 | | 2 | | 2 |
| | (c) | | | 7 + 7 + 16 ✓<br>7 + 16<br>7 + 7 + 16 + 16<br>7 + 16 + 16 | | 1 | | 1 | 1 | |
| | | | | **Question 2 total** | **2** | **5** | **0** | **7** | **1** | **5** |



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| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| **3** | (a) | | | 12% (2)<br><br>if answer incorrect award (1) for either of following<br>35 + 32 + 6 + 3 + 12<br>88 | | 2 | | 2 | 2 | |
| | (b) | (i) | | CaO | | 1 | | 1 | | |
| | | (ii) | | **displacement** **decomposition** **precipitation** **neutralisation** | 1 | | | 1 | | 1 |
| | | (iii) | | solid forms ☐<br>colour changes ☐<br>ice forms ☐<br>steam is given off ☑ | 1 | | | 1 | | 1 |



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| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| | (c) | | | award (1) each for any **two** of following<br>• more (local) jobs<br>• good for the (local) economy e.g. workers / customers spend money in area<br>• provides materials (for buildings) / to make cement<br>• (local) road system is improved | 2 | | | 2 | | |
| | | | | **Question 3 total** | **4** | **3** | **0** | **7** | **2** | **2** |



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| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| **4** | (a) | | | <table><tr><th>Particle</th><th>Mass</th><th>Charge</th></tr><tr><td>proton</td><td>1</td><td>+1</td></tr><tr><td>neutron</td><td>1</td><td>0</td></tr><tr><td>electron</td><td>0</td><td>–1</td></tr></table><br>award (1) for each correct answer | 2 | | | 2 | | |
| | (b) | | | award (1) for each correct answer<br>7<br>14<br>2,5<br>5 no ecf from incorrect electronic structure | | 4 | | 4 | | |
| | | | | **Question 4 total** | **2** | **4** | **0** | **6** | **0** | **0** |



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| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| **5** | (a) | | | **C** | | 1 | | 1 | | |
| | (b) | | | **B** (1)<br><br>award (1) for reason e.g.<br>contains (atoms of) two different elements that are chemically bonded / joined together<br>contains carbon and oxygen (atoms) that are chemically bonded / joined together<br><br>neutral answer – contains two atoms that are chemically bonded / joined together | | 2 | | 2 | | |
| | (c) | (i) | | | | 1 | | 1 | | |
| | | (ii) | | 46 | | 1 | | 1 | 1 | |
| | | (iii) | | $N_2 + \boxed{2} O_2 \longrightarrow \boxed{2} NO_2$ | | 1 | | 1 | 1 | |
| | | | | **Question 5 total** | **0** | **6** | **0** | **6** | **2** | **0** |



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| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| 6 | (a) | | | it freezes ☐<br>it dissolves ✓<br>it condenses ☐<br>it melts ☐ | 1 | | | 1 | | 1 |
| | (b) | | | pH 11 to pH 7 ☐<br>pH 4 to pH 7 ✓<br>pH 7 to pH 11 ☐<br>pH 7 to pH 4 ☐ | | | 1 | 1 | | 1 |



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| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| | (c) | | | <table><tr><th>Statement</th><th>Wet scrubbing only</th><th>Dry scrubbing only</th><th>Both wet and dry scrubbing</th></tr><tr><td>Can be used in large power plants</td><td>✓</td><td></td><td></td></tr><tr><td>At least 90% efficient</td><td></td><td></td><td>✓</td></tr><tr><td>Neutralises sulfur dioxide</td><td></td><td></td><td>✓</td></tr></table> | | | 3 | 3 | | |
| | (d) | | | award (1) for each of following<br>• large decrease between 1990 and 1995 OWTTE<br>• small decrease (every 5 years) after 1995 OWTTE<br><br>if neither of these marks given then award (1) for decreases (from 1990 to 2015) | | | 2 | 2 | | |
| | | | | **Question 6 total** | **1** | **0** | **6** | **7** | **0** | **2** |



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| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| 7 | (a) | | | sample **C** is soft water ✓<br>all the samples are hard water<br>samples **A** and **B** are hard water ✓<br>sample **B** contains temporary hardness<br>sample **A** contains temporary hardness ✓<br>samples **A** and **B** contain permanent hardness | | | 3 | 3 | | 3 |
| | (b) | | | award (1) for either of following<br>ion exchange<br>add washing soda / sodium carbonate | 1 | | | 1 | | |



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| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| | (c) | | | sodium nitrate ☐<br>zinc chloride ☐<br>calcium sulfate ✓<br>potassium oxide ☐ | 1 | | | 1 | | |
| | (d) | | | award (1) for any of following<br>• good for healthy bones / teeth<br>• reduces the risk of heart disease<br><br>neutral answer – tastes better | 1 | | | 1 | | |
| | | | | **Question 7 total** | **3** | **0** | **3** | **6** | **0** | **3** |



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| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| **8** | (a) | (i) | | award (2) for all points plotted correctly (tolerance ±½ square)<br>award (1) for 3 / 4 points plotted correctly<br><br>award (1) for suitable curve | | 3 | | 3 | 2 | 1 |
| | | (ii) | I | 15 $cm^3$<br>accept any value in the range 14-16 $cm^3$<br><br>allow ecf from graph | | | 1 | 1 | | |
| | | | II | 0.25 $cm^3/s$ (2)<br>accept any value in the range 0.23-27<br><br>if incorrect award (1) for either of following<br>dividing by 60<br>$\frac{15}{1}$<br><br>allow ecf from part I | | 2 | | 2 | 2 | |
| | (b) | | | award (1) each for any two of following<br>• increase the temperature (of the acid)<br>• increase the concentration (of the acid)<br>• use smaller pieces (of magnesium) / increase the surface area (of the magnesium) / use (magnesium) powder<br><br>neutral answer – catalyst | 2 | | | 2 | | 2 |



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| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| | (c) | | | 85% (2)<br><br>if incorrect award (1) for $\frac{1.7}{2.0}$ / 0.85 | | 2 | | 2 | 2 | |
| | | | | **Question 8 total** | **2** | **7** | **1** | **10** | **6** | **3** |



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| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| **9** | | | | **Indicative content**<br><br>Peter<br>large amounts of fluoride are poisonous but the very low concentration in fluoridated water is not poisonous<br>fluoride is added to toothpaste<br><br>Imran<br>fluoride doesn't clean teeth, it strengthens tooth enamel and prevents tooth decay<br><br>Catrin<br>not good to have no choice (mass medication / unethical / against human rights)<br>fluoride occurs naturally in the water in some areas<br><br>Susan<br>making teeth turn yellow / fluorosis happens if you have too much fluoride | 5 | | 1 | 6 | | |



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| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| | | | | **5-6 marks**<br>A good understanding of the issues around fluoridation<br>*There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.*<br><br>**3-4 marks**<br>Some knowledge of the issues around fluoridation<br>*There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.*<br><br>**1-2 marks**<br>Simple comment on one or two of the pupil responses<br>*There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with very little structure. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.*<br><br>**0 marks**<br>*No attempt made or no response worthy of credit.* | | | | | | |
| | | | | **Question 9 total** | **5** | **0** | **1** | **6** | **0** | **0** |



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## COMMON QUESTIONS

| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| **10/1** | (a) | (i) | | **C** | | | 1 | 1 | | |
| | | (ii) | | **D** and **F** (1)<br><br>they have boiling points below 20 °C / room temperature (1)<br>accept 'they have boiled/turned to gas before 20 °C / room temperature'<br><br>neutral answer – boiling points are negative / below 0°C | | | 2 | 2 | | |
| | | (iii) | | **C** (1)<br><br>it has a high melting point/high boiling point (like a metal) but is a poor electrical conductor/poor malleability (like a non-metal) (1)<br><br>neutral answer – it has metal and non-metal properties | | | 2 | 2 | | |
| | (b) | | | $\boxed{2}\ Al + Fe_2O_3 \longrightarrow Al_2O_3 + 2Fe$<br><br>award (1) for correct formula of product<br><br>award (1) for correct balancing only if formula is correct | | 2 | | 2 | 1 | |
| | | | | **Question 10/1 total** | **0** | **2** | **5** | **7** | **1** | **0** |



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| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| **11/2** | (a) | | | ink spot near bottom of chromatography paper (1)<br>accept any position on bottom third of paper<br><br>water level below ink spot and above bottom of chromatography paper (1) | 2 | | | 2 | | 2 |
| | (b) | (i) | | complete answer must link solubility with speed of travel / distance travelled (in the same time)<br><br>they have different solubilities (in water) (1)<br><br>they travel at different speeds / different distances (in the same time) (1)<br><br>link may be implied e.g.<br>• dye that moves fastest is the most soluble (2)<br>• dye that travels furthest (in the same time) is most soluble (2)<br><br>neutral answer – reference to $R_f$ value | 2 | | | 2 | | 2 |
| | | (ii) | | spot at 2.0 cm (1)<br><br>spot at 5.6 cm (1) | | 2 | | 2 | 1 | 2 |
| | | | | **Question 11/2 total** | **4** | **2** | **0** | **6** | **1** | **6** |



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| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| **12/3** | (a) | | | convection currents in the mantle / layer below the crust | 1 | | | 1 | | |
| | (b) | | | **Constructive**<br>magma rises (through gap) (1)<br>cools/solidifies to form new (igneous) rock / new land (1)<br><br>**Destructive**<br>award (1) each for any **two** of following<br>more dense / oceanic plate forced downwards<br>more dense / oceanic plate melts (to form magma)<br>less dense plate forced upwards to create mountains | 4 | | | 4 | | |
| | (c) | | | 15 000 000 / 15 million (2)<br><br>if incorrect award (1) for either of following<br><br>600 km = 600000 m<br>40 mm = 0.04 m per year | | 2 | | 2 | 2 | |
| | | | | **Question 12/3 total** | **5** | **2** | **0** | **7** | **2** | **0** |



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## HIGHER TIER ONLY QUESTIONS

| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| **4** | (a) | (i) | | award (1) for either of following<br>• equal number of protons and electrons<br>• both have 12 protons and 12 electrons<br><br>do not accept any reference to neutrons | | 1 | | 1 | | |
| | | (ii) | | award (1) for either of following<br>• has more protons than electrons<br>• has 12 protons and 10 electrons<br><br>neutral answer – it has a 2+ charge | | 1 | | 1 | | |
| | | (iii) | | they have the same number of protons **and** different numbers of neutrons<br><br>neutral answer – **X** has 2 more neutrons | | | | 1 | | |
| | (b) | (i) | | 2,8,1 | | 1 | | 1 | | |
| | | (ii) | | Group 1<br>Period 3 **both** needed<br><br>no ecf possible | | 1 | | 1 | | |
| | | | | **Question 4 total** | **0** | **5** | **0** | **5** | **0** | **0** |



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| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| **5** | (a) | | | $ZnSO_4$ | | 1 | | 1 | | |
| | (b) | | | award (1) for suitable scales on **both** axes<br><br>award (1) for all points plotted correctly (tolerance ±1 square)<br><br>award (1) for suitable curve | | 3 | | 3 | 2 | |
| | (c) | | | curve sketched above / to the left of original curve drawn – must start from 0,0 and be horizontal at 70 $cm^3$ before reaching 120 s | | | 1 | 1 | | |
| | (d) | | | rate is lower / reaction is slower (1)<br><br>fewer particles in the same volume (1)<br><br>less chance of (successful) collisions / fewer (successful) collisions per second / lower frequency of (successful) collisions (1) | 3 | | | 3 | | 2 |
| | (e) | | | award (1) for either of following<br>• lowers the amount of energy needed for a reaction to take place<br>• lowers the activation energy<br><br>neutral answer – catalyst not used up during reaction | 1 | | | 1 | | 1 |
| | | | | **Question 5 total** | **4** | **4** | **1** | **9** | **2** | **3** |



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| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| **6** | (a) | | | lithium chloride / LiCl<br><br>accept lithium / Li | | 1 | | 1 | | 1 |
| | (b) | | | NaOH | | 1 | | 1 | | 1 |
| | (c) | | | $\boxed{4}\ Li + O_2 \longrightarrow 2\ Li_2O$<br><br>award (1) for correct formula of oxygen gas<br>award (1) for correct formula of lithium oxide<br><br>award (1) for correct balancing only if both formulae are correct | | 3 | | 3 | | |
| | | | | **Question 6 total** | **0** | **5** | **0** | **5** | **0** | **2** |



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| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| 7 | (a) | (i) | | helium, argon, xenon ☐<br>helium, neon, argon ☐<br>argon, krypton, xenon ☐<br>krypton, xenon, radon ✓ | | | 1 | 1 | | |
| | | (ii) | | $XeF_2$ ✓<br>$KrF_2$ ☐<br>$XeCl_2$ ☐<br>$KrCl_2$ ☐ | | | 1 | 1 | | |
| | | (iii) | | 23 °C ✓ 71 °C ☐ 110 °C ☐ | | | 1 | 1 | | |



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| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| | | (iv) | | award (1) for description of smaller atom<br>neon has fewer electron shells<br>neon is a smaller atom (than argon / krypton / xenon)<br>neon's outer electrons are closer to the nucleus (than in argon / krypton / xenon)<br>neon has an atomic radius < 80 pm<br><br>award (1) for effect of small size<br>less shielding (than argon / krypton / xenon)<br>stronger attraction between outer electron and nucleus (than in argon / krypton / xenon)<br>outer electrons are more difficult to remove (than in argon / krypton / xenon) | | | 2 | 2 | | |
| | (b) | | | award (1) for use and (1) for relevant linked property e.g.<br>• weather balloons / airships / party balloons ⇨ helium has very low density / lower density than air<br>• underwater breathing apparatus ⇨ helium is inert<br>• MRI scanners ⇨ helium has a very low boiling point<br><br>accept other sensible answers e.g.<br>airships ⇨ helium is inert | 2 | | | 2 | | |
| | | | | **Question 7 total** | **2** | **0** | **5** | **7** | **0** | **0** |



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| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| 8 | | | | **Indicative content**<br><br>**Method**<br>each halogen will be added to each halide solution in order to see if a reaction occurs<br><br>**Observations**<br>• colour change in sodium iodide with both chlorine and bromine<br>• colour change in sodium bromide with chlorine<br>• no reaction when iodine is added to sodium chloride or sodium bromide or when bromine is added to sodium chloride<br><br>**Conclusions**<br>• chlorine displaces both bromine and iodine from bromide/iodide solutions<br>• chlorine is therefore most reactive<br>• bromine displaces iodine from iodide solution and is therefore more reactive than iodine<br>• iodine does not displace chlorine or bromine and is therefore least reactive<br>• more reactive halogens displace less reactive halogens from solution<br>• trend in reactivity - chlorine > bromine > iodine<br><br>**Equations**<br>• $Cl_2 + 2NaBr \rightarrow 2NaCl + Br_2$<br>• $Cl_2 + 2NaI \rightarrow 2NaCl + I_2$<br>• $Br_2 + 2NaI \rightarrow 2NaBr + I_2$ | 6 | | | 6 | | 4 |



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| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| | | | | **5-6 marks**<br>Clear method, correct observations and conclusions; good attempt at an equation<br>*There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.*<br><br>**3-4 marks**<br>Reference to more than one reaction between halogens and halides; two observations and partial conclusion<br>*There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.*<br><br>**1-2 marks**<br>Reference to reacting a halogen with a halide; one observation and attempt at conclusion<br>*There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with very little structure. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.*<br><br>**0 marks**<br>*No attempt made or no response worthy of credit.* | | | | | | |
| | | | | **Question 8 total** | **6** | **0** | **0** | **6** | **0** | **4** |



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| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| **9** | (a) | (i) | | (thermal) decomposition | 1 | | | 1 | | 1 |
| | | (ii) | | carbon dioxide / $CO_2$ | 1 | | | 1 | | 1 |
| | | (iii) | | award (1) for any of following<br>• steam given off<br>• sizzling / spitting<br>• puffs up / breaks up / crumbles | 1 | | | 1 | | 1 |
| | | (iv) | | $CaO + H_2O \rightarrow Ca(OH)_2$<br><br>award (1) for correct formulae of reactants<br>award (1) for correct formula of product | | 2 | | 2 | | |
| | (b) | | | award (1) for any of following<br>• the Bunsen burner flame is not hot enough (to decompose sodium carbonate)<br>• sodium carbonate is more stable than calcium carbonate<br>• Group 1 carbonates are more stable than calcium carbonate<br>• Group 1 carbonates are more stable than Group 2 carbonates<br><br>neutral answer – sodium is more reactive than calcium | 1 | | | 1 | | 1 |
| | (c) | | | award (1) for either of following<br>• calcium hydroxide gives a brick red colour<br>• barium hydroxide gives an apple green flame | | 1 | | 1 | | 1 |
| | | | | **Question 9 total** | **4** | **3** | **0** | **7** | **0** | **5** |



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| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| **10** | (a) | (i) | | temporary hard water (1)<br><br>award (1) for any of following<br>• same volume of soap solution needed (to produce a lather) after boiling as sample **C** / soft water<br>• same volume of soap solution needed (to produce a lather) after boiling as after adding washing soda<br>• it is soft after boiling / hardness is removed by boiling<br><br>neutral answers -<br>less soap needed after boiling<br>hardness decreased after boiling | | | 2 | 2 | | 2 |
| | | (ii) | | **D** (1)<br><br>award (1) for either of following<br>• less soap solution needed (to produce a lather) after boiling but still more than needed for sample **C** / soft water<br>• boiling did not remove all the hardness / partly softened by boiling<br>• less soap needed after boiling and less again after washing soda | | | 2 | 2 | | 2 |



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| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| | (b) | | | award (1) for similarity in results e.g.<br>• (both groups can draw the) same conclusions for samples **A**, **C** and **D**<br>• volumes in the second experiment are approximately three quarters the values in the first experiment for samples **A**, **C** and **D**<br>• results for samples **A**, **C** and **D** are reproducible<br><br>award (1) for different conclusions drawn for sample **B** e.g.<br>• first group found sample **B** to be permanently hard water but the second group found that is contains some temporary hardness and some permanent hardness | | | 2 | 2 | | 2 |
| | (c) | | | calcium / magnesium **ions** swap places with / replaced by / exchanged for sodium **ions** (2)<br><br>there must be one reference to ions<br><br>if not complete answer award (1) for either of following<br>calcium / magnesium **ions** removed / replaced<br>sodium **ions** added<br><br>if no mention of **ions** anywhere award (1) for<br>calcium / magnesium swaps places with / replaced by / exchanged for sodium<br><br>do not accept 'displace' | 2 | | | 2 | | |
| | (d) | (i) | | $3.2 \times 10^{-3}$ mol (2)<br><br>award (1) for 0.0032 | | 2 | | 2 | 2 | |



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| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| | | (ii) | | moles $MgCl_2$ = $\frac{0.384}{95}$ = $4.04 \times 10^{-3}$ mol<br><br>more **$Mg^{2+}$ ions** in second sample / magnesium chloride sample therefore it has more hardness (1)<br>accept more moles of magnesium chloride than magnesium sulfate (in the same mass because $M_r$ of magnesium chloride is smaller)<br><br>ecf possible from part (d) (i) | | | 2 | 2 | 1 | |
| | | | | **Question 10 total** | **2** | **2** | **8** | **12** | **3** | **6** |



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| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| **11** | (a) | (i) | | $2Fe + 3Br_2 \rightarrow 2FeBr_3$<br><br>award (1) for correct formulae of reactants<br>award (1) for correct formula of product<br><br>award (1) for correct balancing only if all formulae are correct | | 3 | | 3 | | |
| | | (ii) | | add silver nitrate (solution) (1)<br>iron(III) bromide gives a cream precipitate (1)<br>iron(II) iodide gives a yellow precipitate (1)<br><br>accept other sensible test e.g.<br>add chlorine (water) (1)<br>iron(III) bromide gives orange colour (1)<br>iron(II) iodide gives brown/dark colour (1)<br><br>add sodium hydroxide (solution) (1)<br>iron(III) bromide gives a brown precipitate (1)<br>iron(II) iodide gives a green precipitate (1) | 2 | 1 | | 3 | | 3 |
| | (b) | | | $\frac{19.4}{19} : \frac{16.3}{80}$ (1)<br><br>0.204 : 1.021 (1)<br><br>1 : 5 ratio ⇨ $BrF_5$ (1)<br><br>award (2) for correct answer with no working<br><br>ecf possible<br><br>award (2) for $Br_5F$ (where $A_r$ divided by mass with working shown)<br>award (1) for $Br_5F$ with no working | | 3 | | 3 | 3 | |
| | | | | **Question 11 total** | **2** | **7** | **0** | **9** | **3** | **3** |



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**FOUNDATION TIER**

**SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES**

| Question | AO1 | AO2 | AO3 | TOTAL | MATHS | PRAC |
|---|---|---|---|---|---|---|
| 1 | 4 | 1 | 0 | **5** | **0** | **5** |
| 2 | 2 | 5 | 0 | **7** | **1** | **5** |
| 3 | 4 | 3 | 0 | **7** | **2** | **2** |
| 4 | 2 | 4 | 0 | **6** | **0** | **0** |
| 5 | 0 | 6 | 0 | **6** | **2** | **0** |
| 6 | 1 | 0 | 6 | **7** | **0** | **2** |
| 7 | 3 | 0 | 3 | **6** | **0** | **3** |
| 8 | 2 | 7 | 1 | **10** | **6** | **3** |
| 9 | 5 | 0 | 1 | **6** | **0** | **0** |
| 10 | 0 | 2 | 5 | **7** | **1** | **0** |
| 11 | 4 | 2 | 0 | **6** | **1** | **6** |
| 12 | 5 | 2 | 0 | **7** | **2** | **0** |
| **Total** | **32** | **32** | **16** | **80** | **15** | **26** |



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## HIGHER TIER

## SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

| Question | AO1 | AO2 | AO3 | TOTAL | MATHS | PRAC |
|---|---|---|---|---|---|---|
| 1 | 0 | 2 | 5 | **7** | **1** | **0** |
| 2 | 4 | 2 | 0 | **6** | **1** | **6** |
| 3 | 5 | 2 | 0 | **7** | **2** | **0** |
| 4 | 0 | 5 | 0 | **5** | **0** | **0** |
| 5 | 4 | 4 | 1 | **9** | **2** | **3** |
| 6 | 0 | 5 | 0 | **5** | **0** | **2** |
| 7 | 2 | 0 | 5 | **7** | **0** | **0** |
| 8 | 6 | 0 | 0 | **6** | **0** | **4** |
| 9 | 4 | 3 | 0 | **7** | **0** | **5** |
| 10 | 2 | 2 | 8 | **12** | **3** | **6** |
| 11 | 2 | 7 | 0 | **9** | **3** | **3** |
| **Total** | **30** | **32** | **18** | **80** | **12** | **29** |



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