AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.3.2.5

Concentration of solutions

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**9**
Available paper years	**2018–2025**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

5.3.2.5 Concentration of solutions

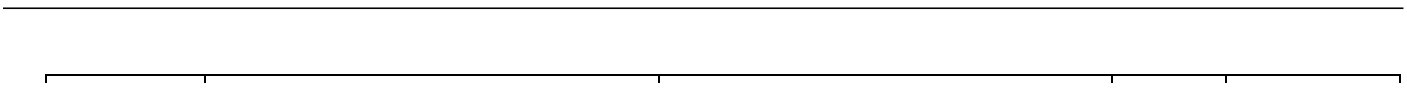
Answer 01 · Mark scheme June 2018 | 8464/C/1H | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	chlorine		1	AO2 5.4.3.4
01.2	copper is less reactive than hydrogen		1	AO2 5.4.3.4
01.3	1.8 (mg)	allow an answer in range 1.7–1.9	1	AO3 5.4.3.4
01.4	$\frac{3.02 + 3.01 + x}{3} = 3.06$ 3.15 (mg)	an answer of 3.15 (mg) scores **2** marks allow any other suitable method if no other mark awarded allow 9.18 for **1** mark	1 1	AO2 5.4.3.4
01.5	$\frac{50}{1000}$ **or** $\frac{1}{20}$ **or** 0.05 (0.05) × 300 15 (g) **or** $\frac{300}{1000}$ **or** $\frac{3}{10}$ **or** 0.03 (1) (0.3) × 50 (1) 15 (g) (1)	an answer of 15 (g) scores **3** marks the second mark is dependent on the first mark being scored the second mark is dependent on the first mark being scored if no other mark awarded allow 150 **or** 15 000 for **1** mark	1 1 1	AO2 5.3.2.5
Total			**8**	

5.3.2.5 Concentration of solutions

Answer 01 · Mark scheme

June 2018 | 8464/C/1H | Original Q1



5.3.2.5 Concentration of solutions

Answer 02 · Mark scheme June 2019 | 8464/C/2H | Original Q4

04.1	growing plants (on low-grade ore) plants are burnt (to produce ash) (ash dissolved in acid to produce) solution of a copper compound electrolysis (of solution of a copper compound) **or** displacement (by adding scrap iron to a solution of a copper compound)	allow named plant allow named copper compound allow addition of scrap iron (to a solution of a copper compound)	1 1 1 1	AO1 5.10.1.4
04.2	 M_r $CuSO_4$ = 159.5 $\frac{0.319}{159.5}$ = 0.002 (mol)	an answer of 0.002 **or** 2×10^{-3} (mol) scores **3** marks allow correct use of incorrectly calculated value for M_r allow 2×10^{-3} (mol)	 1 1 1	AO2 5.3.2.1 5.3.2.5
04.3	both reaction profiles start at the same energy level and end at the same energy level.		1	AO3 5.6.1.4

5.3.2.5 Concentration of solutions

Answer 02 · Mark scheme

04.4	the amount of carbon dioxide used to produce the ethanol is the same as the amount of carbon dioxide given off when the ethanol is burned	**alternative approach** there is sufficient carbon dioxide (in the atmosphere) (1) because carbon dioxide is constantly produced from burning fossil fuels (1) if no other mark awarded allow for **1** mark burning ethanol produces carbon dioxide	1 1	AO3 5.9.2.2 5.9.3.1

5.3.2.5 Concentration of solutions

Answer 02 · Mark scheme

June 2019 | 8464/C/2H | Original Q4

04.5	meets needs of current generation without compromising needs of future generations	 allow so there are enough resources for future generations ignore references to harming / damaging planet / environment	1 1	AO1 5.10.1.1

Total			**12**

5.3.2.5 Concentration of solutions

Answer 02 · Mark scheme

June 2019 | 8464/C/2H | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.

5.3.2.5 Concentration of solutions

Answer 03 · Mark scheme November 2020 | 8464/C/2H | Original Q4

04.1	dependent		1	AO1 5.10.1.2

04.2	not all water had been removed from the sample heat to constant mass **alternative approach:** mass included (droplets of) water on the bottom of the evaporating basin (1) dry the bottom of the evaporating basin (1)	allow description of process allow bottom of evaporating basin was wet ignore spillages ignore weighing errors allow wipe off droplets	1 1	AO3 5.10.1.2

04.3	$\frac{0.22 + 0.23 + 0.20 + \mathbf{X}}{4} = 0.21$ (**X** =) 0.19 (g)		1 1	AO2 5.10.1.2

04.4	 **C** biggest difference between the maximum and minimum values	allow ecf from question **04.3** allow calculated range if all ranges are shown **A** 0.04; **B** 0.06; **C** 0.15 and **D** 0.12	 1 1	AO2 5.10.1.2

5.3.2.5 Concentration of solutions

Answer 03 · Mark scheme

November 2020 | 8464/C/2H | Original Q4

04.5	(conversion m^3 to cm^3) 1 m^3 = 1 x 10^6 cm^3		1	AO2 5.3.2.5 5.10.1.2
	(mass =) $1 \times 10^6 \times \frac{0.016}{25}$	allow correct use of an incorrect / no conversion value	1	
	= 640 (g)		1	
	= 6.4 × 10^2 (g)	allow a correctly calculated answer in standard form from an incorrect calculation of mass	1	

Total			**11**

5.3.2.5 Concentration of solutions

Answer 03 · Mark scheme

November 2020 | 8464/C/2H | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.

5.3.2.5 Concentration of solutions

Answer 04 · Mark scheme

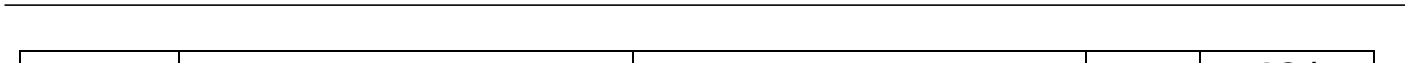
November 2021 | 8464/C/2H | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	at high temperatures (in the engine) nitrogen reacts with oxygen (to produce nitrogen dioxide)		1 1 1	AO1 5.9.3.1
05.2	(**X**=) (33×7) – [(37×3)+35+34+29] = 22 (micrograms per m^3)	allow 33x7 = (37x3)+35+34+29+**X**	1 1	AO2 5.9.3.1
05.3	countryside data has smallest values (so) 2 is a higher proportion / percentage of the value	 allow (so) countryside is ± 2 out of a value between 6 to 8	1 1	AO3 5.9.3.1
05.4	$2\,NO_2 \rightarrow N_2 + 2\,O_2$	allow multiples or halves allow 1 mark for N_2 **and** O_2	2	AO2 5.3.1.1 5.10.1.1
05.5	a resource which will run out	allow a non-sustainable resource	1	AO1 5.10.1.1
05.6	(because carbon dioxide is emitted in) extracting / processing raw materials (and) manufacturing (and) disposal at the end of its useful life		1 1 1	AO2 5.9.2.4 5.10.2.1
Total			**13**	

5.3.2.5 Concentration of solutions

Answer 04 · Mark scheme

November 2021 | 8464/C/2H | Original Q5



5.3.2.5 Concentration of solutions

Answer 05 · Mark scheme

June 2022 | 8464/C/1H | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	K_2SO_4		1	AO2 5.1.1.1 5.4.3.4 RPA9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	(volume of hydrogen) 30 (cm^3) **and** (volume of oxygen) 15 (cm^3)		1	AO2 5.4.3.4 RPA9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	(because) the ratio of volume of hydrogen : oxygen is 2 : 1 (and this is the) **same** as the ratio of hydrogen (atoms) : oxygen (atoms) in (formula of) H_2O **OR** (because) the ratio of volume of hydrogen : oxygen is **not** 2 : 1 (1) (and this is) **different** to the ratio of hydrogen (atoms) : oxygen (atoms) in (formula of) H_2O (1)	**must** relate to the volumes given in question **02.2**	1 1	AO3 5.4.3.4 RPA9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	9 ± 3 cm^3		1	AO2 5.3.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	(conversion) ($\frac{25}{1000}$ =) 0.025 (dm^3)		1	AO2 5.3.2.5 5.4.3.4
	(concentration =) $\frac{0.86}{0.025}$	allow correct use of incorrect / no conversion	1	
	= 34.4 (g per dm^3)	allow 34 (g per dm^3)	1	
	OR			
	(conversion) $\frac{1000}{25}$ (1)			
	= 40 (1)			
	(40 × 0.86) = 34.4 (g per dm^3) (1)	allow correct use of incorrect / no conversion allow 34 (g per dm^3)		
	OR			
	(concentration =) $\frac{0.86}{25}$ (1)			
	= 0.0344 (1)			
	(conversion) (0.0344 × 1000) = 34.4 (g per dm^3) (1)	allow 34 (g per dm^3)		

Total Question 2		**8**

5.3.2.5 Concentration of solutions

Answer 06 · Mark scheme

Question 2

<table>
<tr><th>Question</th><th>Answers</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td rowspan="3">02.1</td><td>Level 2: Scientifically relevant features are identified, the way(s) in which they are similar / different is made clear and (where appropriate) the magnitude of the similarity / difference is noted.</td><td>4–6</td><td rowspan="3">AO1
5.10.1.3</td></tr>
<tr><td>Level 1: Relevant features are identified and differences noted.</td><td>1–3</td></tr>
<tr><td>No relevant content</td><td>0</td></tr>
<tr><td></td><td>
Indicative content
<table>
<tr><th>ground water</th><th>waste water</th></tr>
<tr><td>easier to obtain</td><td>more difficult to obtain</td></tr>
<tr><td>fewer processes</td><td>more processes</td></tr>
<tr><td>takes less time</td><td>takes more time</td></tr>
<tr><td>filtered through filter beds

to remove insoluble particles</td><td>screening and grit removal

to remove large particles</td></tr>
<tr><td></td><td>sedimentation

to produce sewage sludge and effluent</td></tr>
<tr><td></td><td>aerobic biological treatment of effluent

to reduce solid waste</td></tr>
<tr><td>sterilised

using chlorine, ozone or uv light

to kill bacteria</td><td>and then sterilised

using chlorine, ozone or uv light

to kill bacteria</td></tr>
<tr><td></td><td>sludge is anaerobically digested

by specific bacteria

to remove organic matter</td></tr>
</table>
</td><td></td><td></td></tr>
</table>

Answer 06 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	distillation		1	AO1 5.10.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	(conversion) ($\frac{150}{1000}$ =) 0.15 (dm^3) (concentration =) $\frac{2.40}{0.15}$ = 16 (g/dm^3) **OR** (conversion) $\frac{1000}{150}$ (1) = 6.67 (1) (6.67 × 2.4) = 16 (g/dm^3) (1) **OR** (concentration =) $\frac{2.4}{150}$ (1) = 0.016 (1) (conversion) (0.016 × 1000) = 16 (g/dm^3) (1)	allow correct use of incorrect / no conversion	1 1 1	AO2 5.3.2.5

Total Question 2		10

Answer 07 · Mark scheme

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	neutralisation	allow exothermic	1	AO1 5.4.2.2 RPA8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	(M_r =) (1 × 2) + 32 + (4 × 16) = 98		1 1	AO2 5.3.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	(A_r O × 4 =) 4 × 16 **or** 64 (percentage of oxygen =) $\frac{64}{110} \times 100$ = 58.18 = 58 (%)	 allow correct use of incorrectly determined mass of oxygen allow a correctly calculated answer to 2 significant figures from an incorrect calculation which uses the values in the question	1 1 1 1	AO2 5.3.1.2

5.3.2.5 Concentration of solutions

Answer 07 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	(unit conversion) (25 cm^3 ÷ 1000) = 0.025 dm^3		1	AO2 5.3.2.5
	(conc =) $\frac{0.30}{0.025}$ (g/dm^3)	allow correct use of incorrect / no unit conversion	1	
	= 12 (g/dm^3)		1	
	alternative approach: $\frac{0.30}{25}$ (g/cm^3) (1)			
	= 0.012 (g/cm^3) (1)			
	(unit conversion) (0.012 × 1000) = 12 (g/dm^3) (1)	allow correct conversion of an incorrect concentration calculation		

Total Question 2	10

5.3.2.5 Concentration of solutions

Answer 08 · Mark scheme

June 2023 | 8464/C/1H | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	filter (to remove excess magnesium) (then) crystallisation (of magnesium chloride solution)	 allow (then) evaporation (of water from magnesium chloride solution)	1 1	AO1 5.1.1.2 5.4.2.1 5.4.2.3 RPA8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	(magnesium atoms are) oxidised (because the atoms) lose (two) electrons		1 1	AO2 5.4.1.4 5.4.2.1 5.4.2.3 RPA8

5.3.2.5 Concentration of solutions

Answer 08 · Mark scheme

June 2023 | 8464/C/1H | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	(moles Mg =) $\frac{0.72}{24}$		1	AO2 5.3.1.1 5.3.2.2 5.4.2.1 5.4.2.3 RPA8
	= 0.03		1	
	(moles Mg = moles $MgCl_2$) (so mass $MgCl_2$ =) 0.03 × 95	allow a correct calculation using an incorrectly calculated value of moles of magnesium allow a correct calculation using an incorrectly calculated value of moles of magnesium chloride	1	
	= 2.85 (g)		1	
	($100.0\ cm^3 = 0.100\ dm^3$ concentration = $\frac{\text{mass}}{\text{volume}}$)			
	= $\frac{2.85}{0.100}$	allow correct use of incorrectly calculated mass of magnesium chloride	1	
	= 28.5 (g/dm^3)		1	

Total Question 6	10

5.3.2.5 Concentration of solutions

Answer 09 · Mark scheme

June 2025 | 8464/C/1H | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	any **one** from: • do experiment in a fume cupboard • do experiment in a well-ventilated laboratory / room	ignore references to safety glasses or gloves allow use an extractor fan allow descriptions of well-ventilated such as open windows allow use a gas mask	1	AO3 5.4.3.4 RPA9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	all 6 points plotted correctly line of best fit	allow a tolerance of ± ½ a small square allow **1** mark for 4 or 5 points plotted correctly	2 1	AO2 5.4.3.4 RPA9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	any **one** from: • the increase in mass (for successive 60 second intervals) decreases • after 300 seconds the mass remains constant	allow evidence of two correctly determined changes in mass (for 60 second intervals) from **Table 1** allow the difference in mass (every 60 seconds) is not the same	1	AO3 5.4.3.1 5.4.3.4 RPA9

5.3.2.5 Concentration of solutions

Answer 09 · Mark scheme

June 2025 | 8464/C/1H | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	(volume conversion 25 cm^3 =) 0.025 (dm^3)		1	AO2 5.3.2.5
	(concentration =) $\frac{5.5}{0.025}$	allow correct use of an incorrect / no conversion of volume	1	
	= 220 (g/dm^3)		1	
	OR			
	(concentration =) $\frac{5.5}{25}$ (1)			
	= 0.22 (g/cm^3) (1)			
	(conversion = 0.22 × 1000) = 220 (g/dm^3) (1)	allow correct use of an incorrectly determined concentration in g/cm^3 using the values in the question		
	OR			
	(ratio of volume $\frac{1000}{25}$ =) 40 (1)			
	(so ratio of mass =) 40 × 5.5 (1)			
	= 220 (g/dm^3) (1)			

5.3.2.5 Concentration of solutions

Answer 09 · Mark scheme

June 2025 | 8464/C/1H | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	hydrogen is less reactive than potassium		1	AO2 5.4.3.4 RPA9

Total Question 1	**9**

5.3.2.5 Concentration of solutions

Answer 01 · Examiner comments

June 2018 | 8464/C/1H | Original Q1

Question 1 (standard demand)

01.1 Halogens are produced at the positive electrode if the solution contains a halide ion. 51% of students correctly selected chlorine as the gas produced.

01.2 Students could have linked their knowledge of the reactivity series, with which ion is discharged when an aqueous solution is electrolysed. In this case, the production of copper at the negative electrode informs students that copper is less reactive than hydrogen. 46% of students were able to correctly deduce this.

01.3 Students needed to look at the data and see that the mass produced at three minutes was missing from the table. Experimental errors account for the trend not being exactly directly proportional. In this instance 63% of students noticed the relationship and correctly deduced the mass. The mark scheme did allow a small range around the expected answer.

01.4 68% of students achieved full marks for this question giving an answer of 3.15 (mg), however, a significant number did so without showing their working. This was not an issue where they obtained the correct answer, but some didn't and therefore gained no credit as it was not possible to see how they had obtained their answer.

A working mark was available and showing 9.18 (mg) was the most likely way that this was gained by students.

5.3.2.5 Concentration of solutions

Answer 01 · Examiner comments June 2018 | 8464/C/1H | Original Q1

01.5 A unit conversion between cm^3 and dm^3 in this question requires a division of either:

- 50 by 1000 to convert cm^3 to dm^3 or
- 300 by 1000 to convert mass per dm^3 to mass per cm^3

This conversion is essential to make progress in this calculation. 14% of students understood this concept and achieved the maximum three marks for this question.

A significant number either divided 300 by 50 with an answer of 6 or multiplied 300 by 50. The latter led to a compensatory mark for 15 000.

Answer 02 · Examiner comments June 2019 | 8464/C/2H | Original Q4

Question 4 (standard/high demand)

04.1 The majority of students who obtained marks on this question did so from the first 2 marking points, although then many continued to describe the next process incorrectly as 'electrolysing the copper metal from the ash'. Converting the copper compounds found in the ash into a suitable copper solution or electrolyte, was rarely seen in the student responses. A significant minority of students who gained no marks on this question did not seem familiar with the process of phytomining, and gave answers based around normal mining, or heating the rock until the copper melted.

04.2 Around 73% of students gained some credit on this question, predominantly for correctly calculating the M_r of copper sulfate (159.5), although 111.5 (addition of all the A_r given in the question) was given regularly. The most common mistake was to multiply the figures (0.319 x 159.5) rather than divide ($\frac{0.319}{159.5}$). 15% of students scored all three marks, many giving their answers in standard form (2×10^{-3}), which, although not asked for, was accepted.

04.3 About 84% of students gained this mark with no pattern seen in the incorrect responses.

04.4 Only a few students achieved both marks by correctly linking the idea that the amount of CO_2 used to produce ethanol would be the same as would be released when the ethanol was burned. The vast majority of correct answers for both marks were based on the large amount of CO_2 in the air, and its regular replacement by burning fossil fuels. About 23% of students achieved 1 mark for highlighting that there was sufficient carbon dioxide in the atmosphere or that it is produced from the combustion of ethanol.

04.5 Around 17% of students gained credit on this question by recalling the definition of sustainability from the specification or were able to give an equivalent statement. Most students answered in terms of environmental issues or renewable routes, including 'long lasting' and 'won't run out'.

5.3.2.5 Concentration of solutions

Answer 04 · Examiner comments November 2021 | 8464/C/2H | Original Q5

Question 5 (standard, standard / high and high demand)

The idea that nitrogen and oxygen from the air react together in the engine was not well known. Many students incorrectly stated that nitrogen dioxide was present in the fuel. Heat from the engine was insufficient to gain marking point 1 as there must be an indication of high temperature.

Non-renewable was a common response for a “finite resource” which did not gain credit as marks were awarded for the definition.

Students appeared to have a good understanding of the idea of a carbon footprint. Some excellent answers were seen where carbon emissions were linked to each stage in the life cycle of the car. Some students simply focused on the manufacture of both the car and its raw materials and failed to address the disposal.

Answer 05 · Examiner comments June 2022 | 8464/C/1H | Original Q2

Question 2 (Standard demand)

02.1 Students were given the formula of the potassium and sulfate ions and asked to deduce the formula of potassium sulfate. Just over 50% of students correctly determined the formula as K_2SO_4. The formulae KSO_4 and $K(SO_4)_2$ proved to be good distractors.

02.2 Just over 45% of students were able to correctly read the volumes of hydrogen and oxygen in the measuring cylinders. Many wrote the volumes of solution left in the measuring cylinder rather than the gas, stating 20 cm^3 for hydrogen and 35 cm^3 for oxygen.

02.3 This question was a good discriminator. A third of students answered this correctly. Students were given a hypothesis linking the ratio of the volumes of gases collected in an electrolysis experiment with the ratio of hydrogen to oxygen atoms in a water molecule. When students deduced that the volumes of hydrogen gas and oxygen gas collected were 30 cm^3 and 15 cm^3, they were able to simplify this ratio to 2:1 which they recognised as the ratio of hydrogen atoms to oxygen atoms in a water molecule and were thus able to confirm the hypothesis. When the ratio of their volumes was not 2:1 many lacked the confidence to state that the hypothesis was incorrect.

02.4 Just over 40% of students identified that the measure of uncertainty in the 4 experiments was 9 ± 3 cm^3. The mean volume was 9 cm^3 and the range of reading was from 6 to 11 cm^3. The option of 9 ± 2 cm^3 proved to be a good distractor.

02.5 A quarter of students gained all 3 marks with a similar number gaining 2 of the 3 marks available. The most common method was to divide the mass of 0.86 g by the volume of 25 cm^3. Some students then went onto carry out the unit conversion of cm^3 into dm^3 which required multiplying their answer (in g/cm^3) by 1000.There was still a small minority of students who showed no working at all.

5.3.2.5 Concentration of solutions

Answer 06 · Examiner comments June 2022 | 8464/C/2H | Original Q2

Question 2

The topic of water purification was generally not well known.

02.1 Over 50% of students were able to score at least 3 marks comparing the methods of treatment of ground and wastewater to make potable water. This was for simple statements that both waters need to be filtered and/or sterilised, and that ground water is easier to treat than wastewater. The idea that both waters need to be distilled was very commonly seen, mistaking this with sea water.

02.2 About 70% of students were able to identify distillation to desalinate sea water. The most common incorrect response was filtration.

02.3 Over half of students were able to score two marks on this item, with the conversion of cm^3 to dm^3 being the most likely mark missed. 1 in 5 students gained 3 marks here.

Answer 07 · Examiner comments June 2023 | 8464/C/1H | Original Q2

Question 2 (standard demand)

02.1 More than a third of students knew that the reaction was either neutralisation or exothermic. Displacement and endothermic were common incorrect responses.

02.2 Over 80% of students correctly calculated the relative formula mass of sulfuric acid from the given formula.

02.3 This question was a good discriminator. Just under half of students answered this correctly. A further 20% gained 3 marks; either failing to recognise that there are four oxygen atoms in lithium sulphate or for not giving their answer to 2 significant figures.

02.4 This question was a good discriminator. A third of students gained all 3 marks. The most common method was to start by evaluating the mass of 0.30 g divided by the volume of 25 cm^3. A third of students failed to then carry out the unit conversion of cm^3 into dm^3.

5.3.2.5 Concentration of solutions

Answer 08 · Examiner comments

June 2023 | 8464/C/1H | Original Q6

Question 6 (standard/high and high demand)

06.1 Students found difficulty in describing how to obtain magnesium chloride from the reaction solution. Just over one third of students gained at least one mark. A number of students did not filter out the excess magnesium before crystallising the solution and many referred to magnesium displacing hydrogen.

06.2 A common response was that magnesium displaces the hydrogen without any explanation; many students did not appreciate that this is a redox reaction. Students should realise that metals always undergo oxidation which can be related to dot and cross diagrams in ionic bonding. In this question identifying what is oxidised (ie the metal) is easier than identifying what is reduced ie H+ ion (not hydrogen). Magnesium is oxidised during the reaction with hydrochloric acid as magnesium atoms lose two electrons. Students found it challenging to describe what happens to the magnesium atoms with only a quarter gaining more than one mark. Many students who stated that magnesium atoms were oxidised then went on to state it was because they gained oxygen. A common mistake was to say that atoms (not electrons) were lost.

06.3 Students found this calculation challenging but the question proved to be a good discriminator. A third of students gained at least one mark for initially calculating the number of moles of magnesium. About 20% went on to calculate the mass of magnesium chloride produced as 2.85 grams. Only a small percentage of students then went on to determine the concentration of the magnesium chloride solution produced; students struggled with the conversion of 100 cm^3 into dm^3 so a wide variety of answers were seen where a mass of 2.85 grams had been multiplied by ‘some factor of 10’.

Answer 09 · Examiner comments

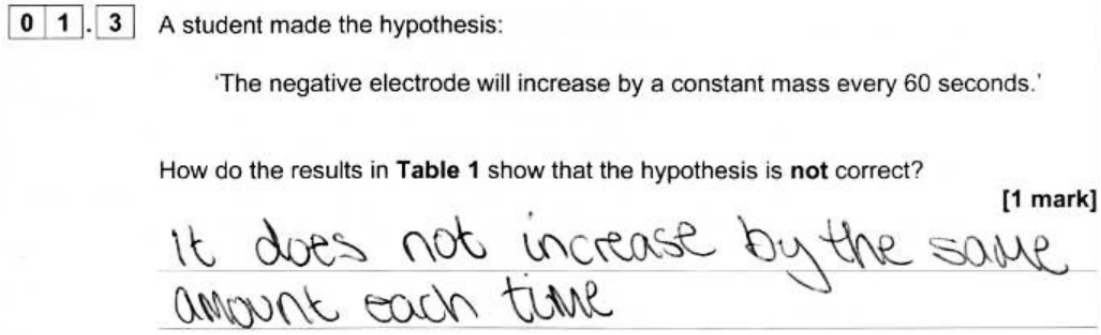
June 2025 | 8464/C/1H | Original Q1

Question 1 (Standard demand)

01.1 The most common response of reducing the risk of harm from chlorine gas was 'wear a mask' which was insufficient to gain credit, as was 'face mask', when what was required was the use of 'a gas mask'. Conducting the experiment 'in a fume cupboard' was a less commonly seen correct response as was ventilation which was well-remembered from the required practical.

01.2 The majority of students were able to plot the six points. Drawing a line of best fit remains slightly more problematic: lines failed to go through the points, lines between the points were drawn with a ruler or double lines are drawn, lines were stopped and restarted and many were drawn with a thick pen or blunt pencil that was more than half a small square thick. Numerous students drew a straight line, despite the points clearly indicating a curve and some drew both a straight line and a curve.

01.3 This question was well answered. Some students referred to the graph for their answer, when the question demanded that they use the results from Table 1. The results show that as time increased in 60 second intervals the mass of the negative electrode increased but at a decreasing rate until 300 seconds when the mass remained constant. Rather than stating 'increase/changes in mass' in their responses, some students referred to 'it'; this was ambiguous and did not gain credit. The most common correct answer was that the mass was constant after 300 sec. Using two correctly determined changes in mass was creditworthy, but simply quoting numbers from the table was insufficient.


0 1 . 3 A student made the hypothesis:

'The negative electrode will increase by a constant mass every 60 seconds.'

How do the results in **Table 1** show that the hypothesis is **not** correct?

[1 mark]

it does not increase by the same amount each time

An example of a response where 'it' was been used; this was ambiguous and was not creditworthy.

01.4 This calculation was well done. Many students were able to convert 25 cm^3 to 0.025 dm^3 for 1 mark. Some attempted the unit conversion but either divided by 100 or multiplied by 100 or 1000. Numerous students laid out their working clearly, giving units throughout, although few used words e.g. 'concentration ='. Those who didn't quote an equation for concentration occasionally went on to get mass and volume the wrong way up or multiplied them.

01.5 More than three quarters of students knew that when potassium chloride solution is electrolysed hydrogen gas was given off at the negative electrode because hydrogen is less reactive than potassium. The reverse statement hydrogen is more reactive than potassium was the most popular incorrect distractor.

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