

- (b) The student has separated a **pure** sample of substance **B** from the mixture.
Suggest how the student can check that the sample of substance **B** is pure.

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..... [2]

21 Zinc nitrate can be made by reacting zinc oxide with nitric acid, HNO_3 .

(a) Write a **balanced symbol** equation for this reaction.

..... [2]

(b) A student suggests this method for preparing zinc nitrate.

1. Measure 50 cm^3 of dilute nitric acid into a beaker.
2. Add one spatula measure of zinc oxide.
3. Heat the mixture until crystals of zinc nitrate are made.

Her method will **not** make a pure dry sample of zinc nitrate.

What improvements should she make to the method to make sure that:

- the reaction is complete
- the zinc nitrate can be separated from the nitric acid and the zinc oxide?

Explain your answer.

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..... [4]

(c) Describe why this reaction is a neutralisation reaction.

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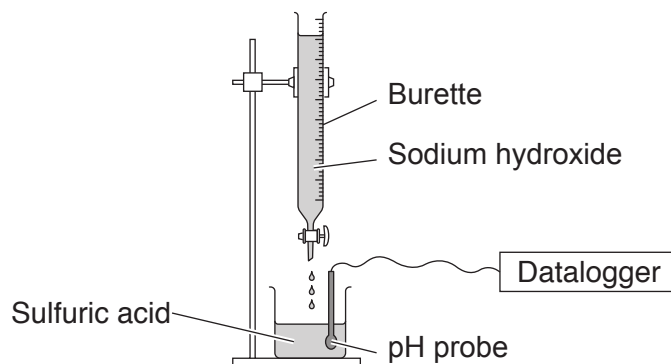
Question		Answer	Marks	AO element	Guidance
20	(a)*	<p><i>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</i></p> <p>Level 3 (5–6 marks)</p> <p>Suggestion would enable pure samples of all three components to be obtained in the correct sequence with clear explanations of why the methods work. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p>Level 2 (3–4 marks)</p> <p>Suggestion would enable pure samples of two of the components of the mixture to be obtained with an attempt at an explanation. <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p>Level 1 (1–2 marks)</p> <p>Suggestion would enable a pure sample of one of the components to be obtained. <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p>0 marks <i>No response or no response worthy of credit.</i></p>	6	2 x 1.2 2 x 2.2 2 x 3.3a	<p>AO1.2: Knowledge of process of fractional distillation</p> <ul style="list-style-type: none"> • Use fractional distillation to separate substance A from substance B. • Substance B will come off first as it has lowest boiling point. • Stronger forces between molecules in substance A / ora. <p>AO2.2: Apply knowledge of process of fractional distillation</p> <ul style="list-style-type: none"> • Fractional distillation works as substances A and B have different boiling points. • As substance C is insoluble in water. • Because there are differing forces of attraction between the molecules. <p>AO3.3a: Analyse information in the table to develop experimental procedure</p> <ul style="list-style-type: none"> • Heat mixture to boil off substances A and B leaving pure C. • Filter mixture to remove substance C. • Substance C can be washed with water and dried.

Question			Answer	Marks	AO element	Guidance
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	(b)		measure its melting point or boiling point (1) if pure melting point or boiling point will be sharp / if impure melting point is lowered / if impure boiling point is elevated (1)	2	1.2 2.1	
21	(a)		$\text{ZnO} + 2\text{HNO}_3 \rightarrow \text{Zn}(\text{NO}_3)_2 + \text{H}_2\text{O}$ correct formulae (1) balancing (1)	2	2.2	balancing mark is conditional on correct formulae ALLOW any correct multiple e.g. $2\text{ZnO} + 4\text{HNO}_3 \rightarrow 2\text{Zn}(\text{NO}_3)_2 + 2\text{H}_2\text{O}$ (2) ALLOW = or \rightleftharpoons or \rightleftharpoons for arrow DO NOT ALLOW 'and' or & for + ALLOW one mark for correct balanced equation with minor errors in case, subscript and superscript

Question		Answer	Marks	AO element	Guidance
					e.g. $\text{ZnO} + 2\text{HNO}_3 \rightarrow \text{Zn}(\text{NO}_3)_2 + \text{H}_2$
	(b)	<p>Any four from:</p> <p>idea that an excess of zinc oxide must be added (1)</p> <p>so reaction is complete / all nitric acid is reacted (1)</p> <p>filter off excess zinc oxide (1)</p> <p>evaporate off some of the water (1)</p> <p>allow to crystallise (1)</p>	4	3.3b	
	(c)	<p>reaction between nitric acid (HNO_3), an acid and zinc oxide (ZnO), a base (1)</p> <p>to make zinc nitrate ($\text{Zn}(\text{NO}_3)_2$), a salt and water (only) (1)</p>	2	1.1	<p>Only award marks if reactions and products are named in the answer</p> <p>ALLOW the use of just chemical formulae</p>

Question		Answer	Marks	AO element	Guidance
22	(a)	The oxidising agent is oxygen and the reducing agent is magnesium (1)	1	1.2	
	(b)	<p>$24.3 / 6.022 \times 10^{23}$ (1)</p> <p>4.04×10^{-23} (1)</p>	2	2.1	1 mark for $4.03520425 \times 10^{-23}$ or correctly rounded up but not to 3 sig. fig.
23	(a)	<p>electrolysis needs to run for longer than 30 seconds (1)</p> <p>otherwise insufficient change at electrodes (1)</p> <p>after electrolysis anode and cathode need to be washed (1) and then dried (1) before measuring the mass</p>	4	<p>2 x 3.2a</p> <p>2 x 3.3b</p>	

(b) Student **B** does a titration.



Sodium hydroxide solution is slowly added to the beaker of dilute sulfuric acid.

The pH probe is connected to a datalogger.

Suggest how student **B**'s method is better than student **A**'s.

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..... [1]

Question		Answer	Marks	AO element	Guidance
20	(a)	<p>ANY FOUR FROM: Do not add more sodium hydroxide after the indicator changes colour ✓ As indicator changes colour at endpoint / idea that addition of more sodium hydroxide will make the solution alkaline ✓</p> <p>Add the sodium hydroxide dropwise or slowly (towards the endpoint) ✓ As indicator should change colour on addition of one drop (of alkali) ✓</p> <p>Idea of using a single indicator rather than a mixed indicator (such as universal indicator) ✓ As single indicator will give a sharp endpoint ✓</p> <p>Idea of swirling the conical flask during the addition of sodium hydroxide ✓ To ensure mixing of acid and alkali / AW ✓</p> <p>Idea of washing down the side of the conical flask with distilled water close to the endpoint ✓ Idea of ensuring all the alkali enters the reaction mixture ✓</p> <p>Use a white tile under the conical flask ✓ Idea of seeing the endpoint more clearly ✓</p>	4	4 x 3.3b	<p>All marking points are independent IGNORE repeat the titration IGNORE idea of using a pH probe or meter</p> <p>ALLOW idea of obtaining an exact endpoint</p> <p>ALLOW named single indicator eg methyl orange</p> <p>ALLOW idea that method is incorrect, and they read the burette to find out how much alkali reacts with 25.0 cm³ of sulfuric acid</p>
	(b)	Idea that endpoint can be determined more accurately using a pH probe / datalogger ✓	1	3.3b	<p>ALLOW idea that a pH probe or datalogger doesn't rely on human judgement ALLOW idea that pH probe or datalogger gives a numerical value / specific pH IGNORE pH probe / datalogger is more reliable</p>