

Acids, Alkalis and Salts

Q1. (2018) – 1c

1(c)(i)	ammonia + nitric acid → ammonium nitrate	accept reactants in either order ignore formula	(1) AO 2 1
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Q2. (2018)

5(a)	flammable	allow inflammable	(1) AO 3 2b
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Q3. (2018) – 5c

5(c)	An explanation linking one of the following pairs of points <ul style="list-style-type: none"> wear gloves (1) {so does not contact/to protect your} skin (1) OR <ul style="list-style-type: none"> wear goggles (1) {so does not contact/to protect} the eyes (1) OR <ul style="list-style-type: none"> use in fume cupboard / mask (1) so you do not inhale it (1) 	second mark dependent on first ignore protective/safety clothing	(2) AO 3 2a AO 3 2b
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Q4. (2018) – 5d (ii)

5(d)(ii)	barium sulfate	do not allow barium sulfide	(1) AO 1 2
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Q5. (2018) – 8b

8(b)	hydrochloric (acid)	allow HCl ignore HCL, hCl, HCL ₂ etc	(1) AO 2 1
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Q6. (2018) – 8c

8(c)(i)	A description including <ul style="list-style-type: none"> apply lighted splint (1) (squeaky) pop (1) 	allow flame / ignite gas / fire ignore 'squeaky pop test' / glowing splint second mark is dependent on first	(2) AO 1 1
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Q7. (2019) – 7a (ii)

7(a)(ii)	$\text{KOH} + \text{HNO}_3 \rightarrow \text{KNO}_3 (1) + \text{H}_2\text{O} (1)$	incorrect balancing of correct species 1 mark max allow OH_2 / HOH / NO_3K	(2)
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Q8. (2019) – 7d

*7(d)	<p>Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlines in the generic mark scheme.</p> <p>The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <p>A01 (3 marks) A02 (3 marks)</p> <ul style="list-style-type: none"> • pipette to measure out the ammonia solution (25 cm³) • into a suitable container, e.g. conical flask • add few drops of methyl orange indicator • put flask on a white tile • fill burette with sulfuric acid solution • read level of liquid in burette • add acid from the burette • swirl flask gently / mix • add drop-wise near end-point • until {indicator just changes colour} • read level on burette • repeat experiment until concordant results obtained • mix the same volumes of sulfuric acid and ammonia solution (determined from the titration experiment) • but leaving out the indicator/methyl orange • pour solution into an evaporating dish • heat the solution to point of crystallisation • leave to cool • filter off crystals • leave to dry 	EXP (6)
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Q9. (2020) – 1b

A)

1(b)(i)	sodium + hydrochloric acid (1) → sodium chloride + hydrogen (1)	allow reactants either way round allow products either way round reject 'sodium chlorine' allow $\text{Na} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2$ (1) $2\text{Na} + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2$ (2)	(2)
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B)

1(b)(ii)	B flammable A corrosive has a different hazard symbol C oxidising has a different hazard symbol D toxic has a different hazard symbol	(1)
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Q10. (2020) – 4b

A)

4(b)(i)	aluminium chloride	reject 'aluminium chlorine'	(1)
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B)

4(b)(ii)	neutralisation	allow acid + base allow 'acid-base' allow 'exothermic'	(1)
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Q11. (2020) – 9b

A)

9(b)(i)	Any TWO from <ul style="list-style-type: none"> • no more bubbles / fizzing (1) • no further change in colour (1) • {solid / copper carbonate} remains at bottom of flask / no more {solid / copper carbonate} dissolves (1) 	ignore references to pH allow cloudy/opaque liquid ignore no more copper carbonate will react	(2)
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B)

*9(b)(ii)	<p>Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <p>AO2 and AO3 (6 marks)</p> <ul style="list-style-type: none"> • filter mixture • using filter funnel and paper • collect filtrate / copper sulfate solution • in conical flask / suitable (named) container • pour into an evaporating basin • heat on water bath / on tripod over Bunsen • until half volume / concentrated / partially evaporated / crystals start to appear around the edge • remove from heat and cover with filter paper • allow to cool • and crystallise • separate crystals using a suitable method • put/place crystals onto absorbent/filter paper • dry in a warm place 	(6)
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Q12. (2020) – 10b

10(b)(i)	<p>An explanation linking</p> <ul style="list-style-type: none"> • solution from titration contains an indicator (1) • therefore second solution used with no indicator / indicator would contaminate salt (1) 	<p>(2)</p> <p>MP2 dependent on MP1</p> <p>allow original mixture was contaminated by indicator so doesn't form a pure salt (2)</p>
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Q13. (2021) – 1b

A)

1(b)(i)	<p>P: burette (1)</p> <p>Q: pipette (1)</p>	<p>(2)</p> <p>AO1</p>
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B)

1(b)(ii)	P / burette	<p>(1)</p> <p>AO1</p>
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Q14. (2021) – 4b (ii, iii)

A)

4(b)(ii)	<p>C put a lighted splint at the open end of the test tube is the only correct answer</p> <p>A, B and D are incorrect because they would not work</p>	<p>(1)</p> <p>AO2</p>
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B)

4(b)(iii)	<p>(squeaky) pop / flame</p> <p>ignore references to ignites reject references to relights</p>	<p>(1)</p> <p>AO1</p>
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Q15. (2021)

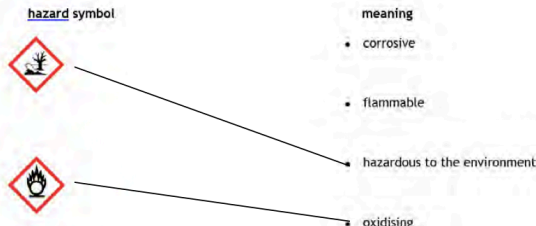
A)

6(a)(i)	wear safety goggles/ gloves	<p>(1)</p> <p>AO3</p>
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B)

6(a)(ii)	Measure mass of solid/ use a specified mass of solid	ignore changes to stirring ignore use a full spatula	(1) AO3
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Q16. (2021) – 7c

7(c)		1 mark for each symbol. If more than one line comes from a symbol, that mark cannot be scored	(2) AO1
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Q17. (2021) – 8c (ii, iii, iv)

A)

8(c)(ii)	H ⁺	if any other ions included 0 marks	(1) AO1
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B)

8(c)(iii)	neutralisation	allow exothermic reject endothermic	(1) AO1
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C)

8(c)(iv)	A description including any two from: <ul style="list-style-type: none"> powder disappears (1) effervescence/ bubbles/ fizzing (1) blue solution forms (1) 	allow dissolves	(2) AO2
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Q18. (2022) – 1c

1(c)	ammonia + nitric acid (1) ammonium nitrate (1)	allow reactants in either order if symbol equation given, formulae must be fully correct if both word and symbol equations are given, ignore symbols	(2) AO2-1
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Q19. (2022) – 4e

4(e)	an explanation linking: <ul style="list-style-type: none"> neutralisation reaction (1) {hydrogen ions / H⁺} react with {hydroxide ions / OH⁻} (1) to form water (1) 	allow reaction between an acid and a {base/alkali} allow acid + alkali (1) → salt + water (1) H ⁺ + OH ⁻ (1) → H ₂ O (1)	(3) AO2-1
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Q20. (2022) – 6b

6(b)(i)	solid (forms) / (goes) cloudy / {solution/ liquid/ mixture} will go colourless	ignore crystals ignore any colour given for solid ignore liquid changes colour / colour change ignore precipitate reject any answer including fizzing/ bubbles/ effervescence	(1) AO2-2
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Q21. (2022) – 8c

A)

8(c)(i)	B health hazard is the only correct answer A, C and D are incorrect as this is the symbol for a health hazard	(1) AO1-1
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B)

8(c)(ii)	(safety) goggles / gloves	allow safety glasses / eye protection ignore glasses and all other suggestions	(1) AO1-1
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Q22. (2022) – 9c

*9(c)	<p>Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <p>AO1 (3 marks) AO3 (3 marks) magnesium carbonate</p> <ul style="list-style-type: none"> bubbles / fizzing / effervescence magnesium carbonate gets smaller / disappears (allow 'dissolves') metal carbonate + acid → metal salt + carbon dioxide + water magnesium carbonate + sulfuric acid → magnesium sulfate + carbon dioxide + water therefore, gas is carbon dioxide test using limewater limewater will turn cloudy <p>magnesium</p> <ul style="list-style-type: none"> bubbles / fizzing / effervescence metal gets smaller / disappears (allow 'dissolves') gas is hydrogen metal + acid → salt + hydrogen test gas with a lit splint (lit splint) burns with a squeaky pop magnesium + sulfuric acid → magnesium sulfate + hydrogen <p>Credit symbol equations. Incorrect/ incomplete equations could be partially credited for identifying product(s).</p>	(6) AO1 AO3
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Q23. (2023)

A)

5(a)(i)	ON LEFT: potassium chloride AND ON RIGHT: potassium nitrate	AO2-1 (1)
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B)

5(a)(ii)	D is the correct answer A, B and C are the hazard symbols for corrosive, flammable and harmful	AO2-1 (1)
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Q24. (2023) – 5b (i, iv)

A)

5(b)(i)	measuring cylinder	allow burette / pipette / syringe	AO3-3 (1)
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B)

5(b)(iv) Group A	any one of the following <ul style="list-style-type: none"> volume / concentration of {potassium carbonate / carbonate / potassium solution} concentration of (calcium) nitrate time allowed for settling 	allow amount of (potassium) carbonate ignore 'volume' alone ignore {amount / volume} of calcium nitrate ignore time (alone) allow temperature allow diameter of test tube	AO3-3b (1)
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Q25. (2023) – 7a (ii)

7(a)(ii)	C nitric acid is the only correct answer A is incorrect because ethanoic acid makes ethanoate salts. B is incorrect because hydrochloric acid makes chloride salts. D is incorrect because sulfuric acid makes sulfate salts	AO1-1 (1)
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Q26. (2023) – 7b

7(b)(i) Group A	LHS: ammonia + sulfuric acid → (1) RHS: → ammonium sulfate (1)	allow words in either order reject additional reagents and products do not allow ammonium on LHS or ammonia on RHS	AO2-1 (2)
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Q27. (2023) – 7c

***7(c)**
Group A

Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlines in the generic mark scheme.
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AO1 (6 marks)

- pipette to measure out the sulfuric acid
- into a suitable container, e.g. conical flask
- add few drops of (suitable) indicator
- put flask on a white tile
- fill burette with ammonia solution
- read level of liquid in burette
- add ammonia solution from the burette
- swirl flask gently / mix
- add drop-wise near end-point
- until indicator just changes colour
- read level on burette
- repeat experiment until concordant results

CRYSTALLISATION

- mix the same volumes of sulfuric acid and ammonia solution (determined from the titration experiment)
- but leaving out the indicator
- pour solution into an evaporating dish
- heat the solution to point of crystallisation
- leave to cool
- filter off / decant crystals
- leave to dry / pat dry with filter paper

AO1-2
(6)

Q28. (2023) – 8a, 8b, 8d (iii), 8f

A)

8(a)
Group A

stir/ swirl/ shake (the beaker)

allow mix, warm/ heat
ignore wait (until reaction over/ until powder disappears)

AO1-2
(1)

B)

8(b)
Group B

in either order:

calcium chloride (1)

water (1)

allow phonetic spellings but reject calcium chlorine

allow CaCl_2 but formula must be correct for the mark
ignore 'solution' / any state symbols
allow H_2O but formula must be correct for the mark
if three products given, allow (1) **only** if both correct products are given.
four or more products scores (0)

AO2-1
(2)

C)

8(d)(iii)
Group B

An explanation linking:

START

- solution is acidic / acids have low pH / high {concentration/ amount} of H^+ ions/ excess H^+ ions (1)

REACTION

- neutralisation/ $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$ / {the hydroxide/ alkali} reacts with the {acid/ H^+ } (1)

END

- {amount/ concentration} of H^+ ions has reduced/ {amount/ concentration} of OH^- ions has increased / excess OH^- ions/ (excess of) hydroxide ions have pH > 7 (1)

allow for low pH:
pH less than 7 / pH 1-6 / pH = 1
ignore there is no alkali
ignore references to 'strong' or 'weak'

allow acid $\rightarrow$ neutral $\rightarrow$ alkali (2)

allow calcium hydroxide is {an alkali/a base}
ignore description of pattern – as calcium hydroxide added pH increases (0)
ignore 'becomes alkaline' / is alkaline/ is less acidic

AO2-1
(3)

D)

8(f)
Group A

goggles / gloves / eye protection

allow safety glasses
ignore wearing lab coats
ignore references to general lab safety, e.g. tie hair back, stand up

AO1-2
(1)

Q29. (2023) – 9b (ii)

9(b)(ii) Group B	a description to include the following points <ul style="list-style-type: none"> • apply lighted splint (to the gas) (1) • (squeaky) pop (1) 	allow apply flame / ignite ignore 'squeaky pop test' reject glowing splint MP2 depends on MP1	AO1-2 (2)
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Q30. (2024) – 2b

2(b)(i)	ammonia + sulfuric acid → (1) → ammonium sulfate (1)	reject ammonium reject ammonia sulfate	(2) AO2-1
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Q31. (2024) – 4d (ii)

4(b)(ii)	24.7(0) with or without working scores 2 24.70 + 24.80 + 24.60 = 74.1 (1) $\frac{74.1}{3} = 24.7(0)$ (1)	allow 27.65 + 24.70 + 24.80 + 24.60 = 101.75 (0) then $\frac{101.75}{4} = 25.4375$ (1) / or correctly rounded to a min of 3 sig figs	(2) AO3-1
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Q32. (2024) – 8a (ii)

1(a)(ii)	barium hydroxide {disappears / gets smaller} / (it) becomes clear	allow 'solid' for barium hydroxide allow barium hydroxide dissolves ignore any colours mentioned / colour change/ any incorrect observations ignore becomes a {liquid / solution} reject bubbles	(1) AO2-2
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Q33. (2024) – 8b (ii)

8(b)(ii)	An explanation linking: <ul style="list-style-type: none"> • to ensure that the mixture is evenly spread (1) • to make substances {react / dissolve} / to speed up the {reaction / dissolving} (1) 	allow to mix the reactants allow so pH (in mixture) is uniform / concentration is uniform / to get an accurate pH ignore more accurate / valid / fair test allow 'so the reaction is complete' / 'to dissociate all the hydroxide ions'	(2) AO2-2
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Q34. (2024) – 8c

8(c)	A corrosive is the only correct answer B, C and D are incorrect as this is the symbol for a corrosive substance		(1) AO1-1
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Q35. (2024) – 8d

8(d)	measure the {mass / amount} of the barium hydroxide / use known {masses / amounts} rather than a spatula full each time use a balance / scales	allow weighing / weigh before and after ignore scale	(1) AO3-3
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Q36. (2024) – 9c

9(c)

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AO1 (3 marks) AO3 (3 marks)

- solid **A** is powdered zinc
- metal + acid → metal salt + hydrogen
- zinc + sulfuric acid → zinc sulfate + hydrogen
- bubbles seen so gas is produced
- does not turn limewater cloudy so gas is not carbon dioxide
- test for hydrogen is lit splint
- lit splint makes squeaky pop
- so gas produced is hydrogen

- solid **B** is copper oxide
- metal oxide + acid → metal salt + water
- copper oxide + sulfuric acid → copper sulfate + water
- no gas is produced
- copper oxide is black
- some left in excess at bottom of test tube
- copper sulfate solution is blue

- solid **C** is sodium carbonate
- metal carbonate + sulfuric acid → metal sulfate + carbon dioxide + water
- sodium carbonate + sulfuric acid → metal sulfate + carbon dioxide + water
- bubbles seen so gas is produced
- test for carbon dioxide is limewater
- limewater turned cloudy so gas produced is carbon dioxide
- no reaction with lit splint
- so no hydrogen gas produced

(6)
AO1;
AO3