



A-Level Chemistry
Inorganic Practical
Questions
Mark Scheme

Time available: 76 minutes
Marks available: 61 marks

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Mark schemes

1.

- (a) Identity of gas: Carbon dioxide / CO_2 1

Test: When gas bubbled through limewater, a white ppt formed

When gas bubbled through limewater, it turns milky/cloudy

M2 dependent on M1

1

- (b) Effervescence (with Na_2CO_3), so contains H^+ ions / Effervescence (with Na_2CO_3), so is acidic

The result from Test 1 shows the presence of H^+ / acidic

1

White ppt (with AgNO_3), so contains chloride ions

The result from Test 2 shows the presence of chloride ions.

1

Allow balanced equation for each test that links to each observation

- (c) (Warm with some) NaOH , 1

Damp red litmus at the mouth of the tube turns blue

Do not allow red litmus dipped in solution

1

Add (acidified) BaCl_2 / $\text{Ba}(\text{NO}_3)_2$

If reagent incorrect, cannot score observation mark

1

White ppt formed

If reagent incomplete, mark on

1

Use of $\text{Ba}(\text{OH})_2$ can score M1 and M3

- (d) The second mass is smaller / the mass after step 4 is smaller than the mass after step 2 1

AgCl dissolves in dilute ammonia / some ppt dissolves as AgCl is soluble in dilute ammonia

The ppt formed by chloride ions dissolves in dilute ammonia.

1

[10]

2.

This question is marked using levels of response. Refer to the Mark Scheme Instructions for Examiners for guidance on how to mark this question.

Level 3 5-6 marks	All stages are covered and the explanation of each stage is correct and virtually complete Answer communicates the whole explanation, including equations, coherently and shows a logical progression through all three stages
Level 2 3-4 marks	All stages are covered but the explanation of each stage may be incomplete or may contain inaccuracies OR two stages covered and the explanations are generally correct and virtually complete Answer is coherent and shows some progression through all three stages. Some steps in each stage may be incomplete
Level 1 1-2 marks	Two stages are covered but the explanation of each stage may be incomplete or may contain inaccuracies OR only one stage is covered but the explanation is generally correct and virtually complete Answer shows some progression between two stages
Level 0 0 marks	Insufficient correct Chemistry to warrant a mark

Indicative Chemistry content

Stage 1 Formula

1a) divides % masses by A_r for each element

(N = 0.221; H = 6.18; Al = 0.221; S = 0.441; O = 4.41)

1b) divides throughout by smallest and confirms formula as $\text{NH}_{28}\text{AlS}_2\text{O}_{20}$

Correct formula ticks 1a and 1b irrespective of method

1c) $x = 12$

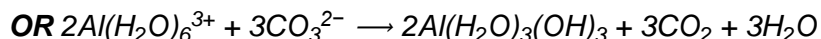
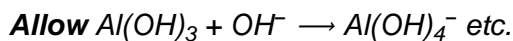
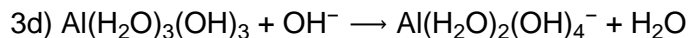
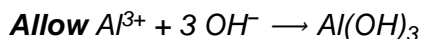
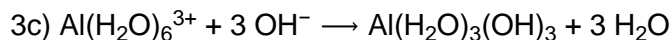
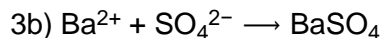
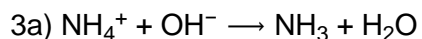
Stage 2 Ion ID

2a) addition of NaOH/OH^- and warming gives gas that turns (damp) red litmus blue (= ammonia) showing NH_4^+ (water bath = warm)

2b) white ppt with acidified $\text{BaCl}_2/\text{Ba}^{2+} = \text{SO}_4^{2-}$

2c) addition of NaOH/OH^- until in excess gives white ppt that redissolves = Al^{3+} **OR** addition of carbonate giving white ppt and effervescence/fizzing/bubbles/gas formed

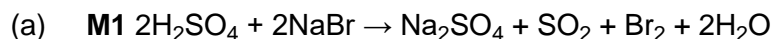
Stage 3 Equations (Ignore state symbols)



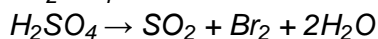
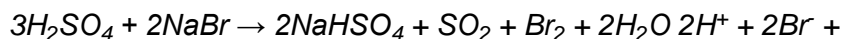
Equation with CO_3^{2-} 'ticks' 3c AND 3d

[6]

3.



allow ionic and equation forming NaHSO_4



not equation from HBr unless formation of HBr shown in separate equation

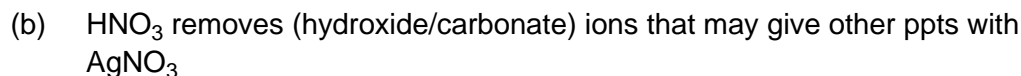
1

M2 orange/brown fumes/solution

not liquid / yellow solid / bad eggs smell / white ppt

ignore choking gas/fumes / steamy/white fumes

1

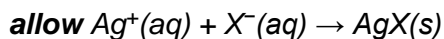
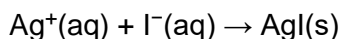
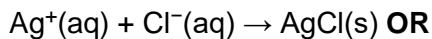


1

AgNO_3 produces ppts with chloride/iodide/halide

not chlorine/iodine/halogen

1



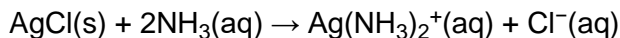
state symbols not required but **not** if wrong

1

NH_3 dissolves AgCl (leaving yellow AgI)

allow chloride/iodide salt/ppt

1

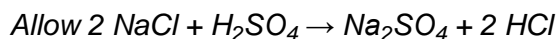
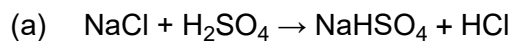


allow with $\text{Ag}^+(\text{aq})$

1

[7]

4.

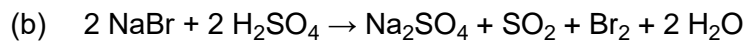


1

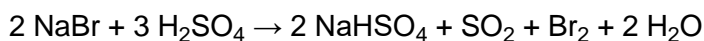
Proton donor

Allow (Bronsted-Lowry) acid

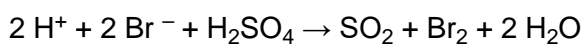
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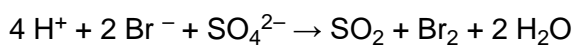
Or



Or



Or



1

brown gas or brown fumes or orange gas or orange fumes

Do not accept yellow solid

Ignore fizzing and misty fumes

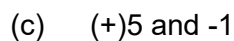
1

Oxidising agent

Allow electron acceptor

Ignore acid / proton donor

1



1

(d) Is oxidised and reduced

Allow undergoes disproportionation

Allows gains and loses electrons

1

(e) D AgBr

Ignore state symbols

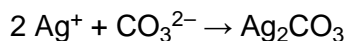
1

E Ag₂CO₃

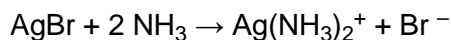
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F CO₂

1



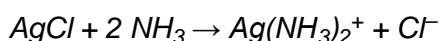
1



Or $\rightarrow \text{Ag}(\text{NH}_3)_2\text{Br}$

One mark for $\text{Ag}(\text{NH}_3)_2^+$ and 1 mark for equation

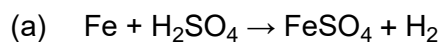
If D = AgCl, then allow 2 marks for



2

[13]

5.



Allow $\text{Fe} + 2\text{H}^+ \rightarrow \text{Fe}^{2+} + \text{H}_2$

Allow $\text{Fe} + 2\text{H}^+ + \text{SO}_4^{2-} \rightarrow \text{Fe}^{2+} + \text{SO}_4^{2-} + \text{H}_2$

Allow $\text{Fe} + \text{H}_2\text{SO}_4 \rightarrow \text{Fe}^{2+} + \text{SO}_4^{2-} + \text{H}_2$

Allow $\text{Fe} + 2\text{H}^+ + \text{SO}_4^{2-} \rightarrow \text{FeSO}_4 + \text{H}_2$

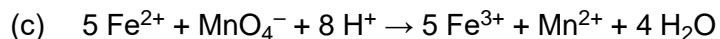
Allow multiples

Ignore state symbols

1

(b) 22.65 (cm³)

1



Allow multiples

Ignore state symbols

NOT if electrons shown

1

(d) colourless / (pale) green to (hint of) pink

NOT to purple

Allow to pale / hint of purple

1

(e) pipette

burette

both needed

Allow (graduated/volumetric) pipette

Allow (graduated/volumetric) burette

NOT dropping pipette

1

(f) 1.47(%)

Allow 1.5(%)

1

[6]

6.

(a) Q is calcium or magnesium

1

bromide

1

R is aluminium

1

chloride

1

S is iron(III)

1

sulfate

1

Mark this question independently

(b) $\text{Ba}^{2+} + \text{SO}_4^{2-} \longrightarrow \text{BaSO}_4$

1

$[\text{Fe}(\text{H}_2\text{O})_6]^{3+} + 3\text{OH}^- \longrightarrow \text{Fe}(\text{H}_2\text{O})_3(\text{OH})_3 + 3\text{H}_2\text{O}$

1

$2[\text{Fe}(\text{H}_2\text{O})_6]^{3+} + 3\text{CO}_3^{2-} \longrightarrow 2\text{Fe}(\text{H}_2\text{O})_3(\text{OH})_3 + 3\text{H}_2\text{O} + 3\text{CO}_2$

1

$[\text{Fe}(\text{H}_2\text{O})_6]^{3+} + 4\text{Cl}^- \longrightarrow [\text{FeCl}_4]^- + 6\text{H}_2\text{O}$

1

[10]

7.

(a) $\text{FeSO}_4 + \text{Na}_2\text{C}_2\text{O}_4 \rightarrow \text{FeC}_2\text{O}_4 + \text{Na}_2\text{SO}_4$

Allow multiples, including fractions.

Allow $\text{Fe}^{2+} + \text{C}_2\text{O}_4^{2-} \rightarrow \text{FeC}_2\text{O}_4$

Allow correct equation which includes water of crystallisation.

1

(b) $M_r \text{FeSO}_4 \cdot 7\text{H}_2\text{O} = 277.9$

Allow if shown clearly in the calculation.

Allow 278

1

Moles = $6.95 / 277.9 = 2.5(0) \times 10^{-2}$

Do not penalise precision but must be to a minimum of two significant figures.

Allow correct calculation using incorrect M_r .

Correct answer without working scores this mark only.

1

(c) $3(.00) \times 10^{-2}$

1

(d) Theoretical mass = $2.50 \times 10^{-2} \times 179.8 = 4.50\text{g}$

as long as 2.50×10^{-2} is the smaller of parts (b) and (c) **(M1)**

Allow consequential answer from parts (b) and (c).

Allow theoretical mass = (smaller of parts (b) and (c)) $\times 179.8$

*If larger of parts (b) and (c) used, lose **M1** but can score **M2**.*

Allow answers based on moles of reactant and product.

1

Yield = $3.31 \times 100 / 4.50 = 73.6\%$ **(M2)**

Award this mark only if answer given to 3 significant figures.

Correct answer without working scores this mark only, provided answer given to 3 significant figures.

1

(e) Some left in solution / some lost during filtration

Do not allow 'incomplete reaction'.

Do not allow 'reaction is reversible'.

1

(f) MnO_4^- will oxidise the iron(II) ion and the ethanedioate ion

1

MnO_4^- does not oxidise the Cu^{2+} ion / larger volume needed for iron(II) ethanedioate

1

[9]