

Mark schemes



1.

(a) any **one** from:

- metal
- (metal) hydroxide
allow ammonium hydroxide
- (metal) carbonate
allow ammonium carbonate
- alkali
allow soluble base
allow ammonia

1

allow named example
allow correct formula
ignore base

(b) $\text{Ca}(\text{NO}_3)_2$

allow $\text{Ca}^{2+}(\text{NO}_3^-)_2$

1

(c) **Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.

5–6

Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.

3–4

Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.

1–2

No relevant content

0



Indicative content

- use magnesium oxide and sulfuric acid
- add sulfuric acid to a beaker
- warm sulfuric acid
- add magnesium oxide
- stir
- continue adding until magnesium oxide is in excess

- filter
- using a filter paper and funnel
- to remove excess magnesium oxide

- heat solution in an evaporating basin
- to crystallisation point
- leave to crystallise
- pat dry with filter paper

credit may be given for diagrams

[8]

2.

(a) neutralisation

ignore reference to exothermic or endothermic

1

(b) $2 \text{HCl} + \text{CaO} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O}$

accept multiples and fractions

formulae

ignore state symbols

1

balancing (dependent on first mark)

1

(c) (the carbonate has) fizzing / bubbles / effervescence

ignore dissolving

ignore gas produced

1

(d) add excess calcium carbonate to acid (and stir) / add CaCO_3 until fizzing stops

ignore heating the acid

accept answer using calcium oxide in place of calcium carbonate

1

(remove excess calcium carbonate by) filter(ing)

1

warm until a saturated solution forms / point of crystallisation / crystals start to form

*do **not** accept heat until all water gone*

1



leave to cool

dependent on previous mark

*If solution **not** heated allow leave to evaporate (1)*

until crystals form (1)

1

(e) (i) white precipitate / solid (forms)

1

insoluble in excess **or** remains **or** no (further) change in excess

dependent on a precipitate / solid forming

1

(ii) same result with magnesium (ions)

*do **not** accept reference to any other ion(s) that do not give a white precipitate*

accept other named ions that do give a white precipitate

1

(iii) flame test **or** description of flame test

1

gives a red flame

*accept brick red **or** orange-red **or** scarlet*

*do **not** accept crimson*

1

[13]

3.

(a) (i) H^+

1

(ii) OH^-

1

(b) with ethanoic acid:

'it' refers to ethanoic acid

UI goes Orange/yellow

1

but HCl goes red/pink

1

or

ethanoic acid has pH 4 or above but less than 7 (1)

but HCl has a pH 3 / or lower (1)

(c) completely

1

(d) (i) conical flask

1



(ii) titration 1

(iii) repeat
or
take average
allow compare with another student's results

1

[8]

4.

(a) limewater **or** calcium hydroxide solution 1

(reacts with carbon dioxide and) turns cloudy / milky

linked to first point

if no other mark awarded 'puts out lighted splint' gains 1 mark

1

(b) (i) any **two** from:

- same volume / amount of the acids
- concentration of the acids
- temperature
- same surface area / size / mass / amount of calcium carbonate
- same measuring equipment

2

(ii) any **three** from:

- (after about 4 minutes) the sulfuric acid stops reacting **or** nitric acid continues to react
accept more CO₂ with nitric acid at any time after 4 minutes
- (initially) the reaction with sulfuric acid is faster
- (the reaction stops) because calcium sulfate is a solid
allow sulfuric acid produces a solid
- (the reaction continues) because calcium nitrate is soluble / in solution / aqueous
allow nitric acid produces an (aqueous) solution
- because the calcium sulfate prevents the sulfuric acid reacting with the calcium carbonate
- (the rate is faster) because sulfuric acid contains two hydrogens

3



5.	(a) (i) sodium hydroxide solution	1	
	blue		1
	(ii) barium chloride		1
	white		1
	(b) fully ionised in water		1
	(c) (i) H ⁺ ions		1
	(ii) lower than		1
	(d) (i) (indicator) changed colour / goes colourless <i>ignore clear / discoloured</i>		1
	(ii) 13.9 or (titration) 2		1
	(iii) 13.2 <i>ecf from (d)(ii)</i>		1
			[10]
6.	(a) sodium oxide <i>allow Na₂O</i>		1
	(b) oxidation		1
	(c) 13		1
	(d) sodium hydroxide		1
	(e) OH ⁻		1



(f) (volume =) $\frac{250}{1000}$ or $\frac{1}{4}$

or 0.25 (dm³)

1

or

(mass per cm³ =) $\frac{40}{1000}$ (g)

or 0.04 (g)

($\frac{250}{1000} \times 40 =$) 10 (g)

1

an answer of 10 (g) scores 2 marks

(g) all points correct

allow a tolerance of $\pm\frac{1}{2}$ a small square

allow 1 mark for 3 points correct

ignore any attempt at a line of best fit

2

(h) 39 °C

allow any value from 34 to 46 (°C)

1

[10]