

## Mark schemes

1.

(a) any **one** from:

- metal  
*allow ammonium hydroxide*
- (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  $\text{CaCO}_3$  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 pH3 / 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 CO<sub>2</sub> 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

[7]

5.

- (a) (i) sodium hydroxide solution  
blue
- (ii) barium chloride  
white
- (b) fully ionised in water
- (c) (i)  $\text{H}^+$  ions
- (ii) lower than
- (d) (i) (indicator) changed colour / goes colourless  
*ignore clear / discoloured*
- (ii) 13.9  
**or**  
(titration) 2
- (iii) 13.2  
*ecf from (d)(ii)*

1

1

1

1

1

1

1

1

1

1

[10]

6.

- (a) sodium oxide  
*allow  $\text{Na}_2\text{O}$*
- (b) oxidation
- (c) 13
- (d) sodium hydroxide
- (e)  $\text{OH}^-$

1

1

1

1

1

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

or 0.25 (dm<sup>3</sup>)

or

(mass per cm<sup>3</sup> =)  $\frac{40}{1000}$  (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]**