



## Mark schemes

<b>1</b>	(a) positive	<i>accept + <b>or</b> +ve <b>or</b> plus</i>	1	
	(b) chlorine		1	
	(c) (i) hydroxide	<i>Any indication of hydro...</i>	1	
	(ii) destroys / damages / dissolves (owtte) the hair / follicle / root	<i>allow burns / reacts with the hair ignore incorrect name of compound</i>	1	<b>[4]</b>
<b>2</b>	(a) water / H <sub>2</sub> O / hydrogen oxide		1	
	(b) eg H (atom) loses an electron to form H <sup>+</sup> <b>or</b> <u>only</u> a proton left		1	
	(c) is partially ionised in water		1	
	(d) (i) eg same concentration / quantity of Mg	<i>accept: volume of acid / ribbon for both / same time accept: volume of gas measured under the same conditions</i>	1	
	(ii) C A D B		1	
	(e) (i) OH <sup>-</sup>		1	
	(ii) acidic		1	<b>[7]</b>

3

- (a) hydrogen /  $H^+$  /  $2H^+$  /  $H_3O^+$   
*allow H / 2H*  
*do **not** accept  $H_2$*   
*apply list principle* 1
- (b) (i) 143  
*correct answer with or without working = 2 marks*  
*ignore units*  
*if answer is not correct*  
 *$40 + (2 \times 35.5) + (2 \times 16)$  gains 1 mark* 2
- (ii) 49.7% (49.6 to 50)  
*correct answer with or without working = 2 marks*  
*answer 49 gains 1 mark*  
*if answer is not correct:*  
 *$(71 \div 143) \times 100$  gains 1 mark*  
*allow error carried forward from part (b)(i)*  
*ie.  $(71$  or their  $(2 \times 35.5) \div$  answer to (b)(i))  $\times 100$  gains 2 marks if*  
*calculated correctly and 1 mark if not calculated correctly.*  
**Special case**  $35.5 \div 143 \times 100 = 24.8$   
*to 25% or  $35.5 \div$  answer to (b)(i)  $\times 100$  correctly calculated for 1*  
*mark* 2
- (iii) 9.9 to 10g  
*allow ecf from (b)(i) or (b)(ii)* 1
- (c) (i) an alkali  
*apply list principle*  
*accept named alkali*  
*accept hydroxide*  
*accept soluble base*  
*ignore base* 1
- (ii) a solid / insoluble substance (owtte) 1

(iii) filter / filtration

*allow decant / centrifuge*

*accept filtration followed by evaporation **or** filtration and evaporation*

*do **not** accept filtration or evaporation*

*do **not** accept evaporation and filtration*

1

[9]

4

(a) (i) any **one** from:

- they are positive / cations
  - they are H<sup>+</sup>
  - opposite charges attract
- ignore atom*

1

(ii) potassium is more reactive (or reverse)

*assume 'it' refers to hydrogen*

*allow potassium reacts with water*

*allow potassium is very reactive **or** most reactive metal / element*

*allow hydrogen gains electrons more easily / is reduced more easily*

*accept potassium is higher up the reactivity series*

1

(b) 6 **and** 2

*accept correct multiples and fractions*

1

(c) (i) the reaction / it is reversible **or** a description of a reversible reaction

*allow 'it is an equilibrium'*

*allow reversible symbol drawn correctly*

*allow 'the reverse / back reaction'*

1

(ii) **lithium nitride**

assume that 'it' or if they do not specify means lithium nitride

assume lithium / lithium nitrate refers to lithium nitride

- hydrogen is bonded / held / absorbed / has formed a compound / reacted with lithium nitride

1

plus **one** of:

- does not explode / cause a fire
- is not free / less hydrogen
- is not under pressure
- does not leak
- is only released slowly
- compound of hydrogen with lithium nitride / product is (more) stable / less reactive / less chance of a reaction  
*accept converse for hydrogen as below*  
*assume that gas / hydrogen means gas in the cylinder*
  - hydrogen (in cylinder) / gas is not bonded / held absorbed / in a compound / reacted with lithium nitride*

1

*plus **one** of:*

- can explode / cause a fire*
- is free*
- is under pressure*
- can leak*
- releases quickly*

1

1

- (d) (i) loss of an electron **or** loses electrons  
*do not accept any ref. to oxygen*

1

- (ii) full outer shell of 8 electrons on circle  
*need not be paired*  
*can be x, dot or e*  
*do **not** accept if extra electrons added to inner shell*

1

**[10]**

<b>5</b>	(a) (i) hydroxide	1	
	(ii) blue	1	
	(b) (i) pipette	1	
	(ii) burette	1	
	(iii) changes colour	1	
	(c) repeat		
	<i>allow check results with another group or student</i>	1	<b>[6]</b>
<b>6</b>	(a) gives out (heat)	1	
	(b) D	1	
	(c) L	1	
	(d) magnesium chloride	1	<b>[4]</b>
<b>7</b>	(a) sensible line of best fit which goes through or close to all the points <b>except</b> the anomalous point <i>allow wobbly / short double lines</i> <i>± ½ square</i>	1	
	(b) loss of gas / loss of CO <sub>2</sub> <i>idea of gas produced / formed</i>	1	
	(c) 7	1	

- (d) (i) steeper line from around the same starting point  
and left of the points  
*allow crosses if they are fully correct for 1 mark*

1

levelling off at 99  
*accept short level line at 99*  
*± ½ square*

1

- (ii) any **three** from:

- particles / molecules / atoms/ ions have more energy  
*allow given / gain / get energy*
- move faster  
*ignore move about more*  
*ignore vibrate more / faster*
- collide more often  
  
**or** more chance of collisions  
  
**or** bump into each other more  
*ignore collide quicker / faster*
- collide with more force / energy  
  
**or** more particles have the activation energy  
  
**or** more collisions result in reaction  
  
**or** more collisions are successful

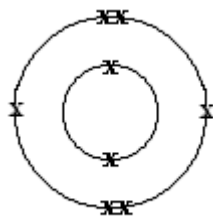
3

**[8]****8**

- (a)  $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$   
*accept correct multiples / fractions*

1

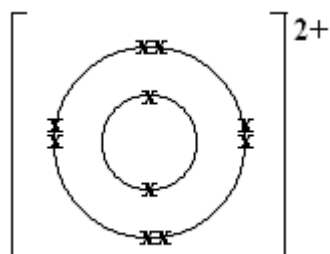
(b)



*electrons do not need to be paired*  
*accept dots / circles / e instead of crosses*  
 do **not** allow 2.6 without diagram

1

(c)



*electrons do not need to be paired*  
*allow without bracket s/ must have the charge*  
*accept dots / circles / e instead of crosses*  
*ignore extra empty outer shells*  
*ignore nucleus*  
 do **not** allow  $[2.8]^{2+}$  without diagram

1

(d) oppositely charged (ions / atoms)

*allow positive and negative(ions / atoms)*

1

(they) attract

*must be in correct context*  
*accept held by electrostatic forces*  
*ignore ionic bonding*  
**maximum 1** if they refer to intermolecular forces / attractions /  
 covalent bonds

1



- (e) magnesium chloride  
*accept MgCl<sub>2</sub> (if correctly written)*

1

**[6]****9**

- (a) (i) burette

1

- (ii) conical flask  
*accept conical / flask*

1

- (b) (i) an indicator

1

- (ii) changed colour

1

- (iii) titration

1

- (c) 3

*correct answer = 2 marks  
(1 × 3) or (1 × 750/250) = 1 mark*

1

- (d) (i) hydrogen

2

- (ii) is partially ionised

1

**[9]****10**

- (a) (i) (phosphoric) acid  
*allow phosphoric acid*

1

- (ii) hydrogen

1

- (b) (i) faster / quicker / speeds it up (owtte)  
*allow answers based on activation energy  
ignore helps it to react*

1

(ii) most of the starting materials end up as useful products

1

(iii)  $\text{H}_2\text{O}$

*allow HOH or OH<sub>2</sub>*

1

**[5]****11**

(a) (i) sulfuric

*accept H<sub>2</sub>SO<sub>4</sub>*

*accept sulphuric*

*allow phonetic spellings*

1

(ii)  $\text{CuO} + \text{H}_2\text{SO}_4 \rightarrow \text{CuSO}_4 + \text{H}_2\text{O}$

*1 mark for reactants*

*1 mark for products*

*ignore state symbols*

*max 1 mark for incorrect balancing*

2

(b) any **two** from:

- particles gain energy **or** particles have more energy

*allow have more activation energy*

- particles move faster

*allow they collide faster / quicker*

*ignore move / vibrate more*

- collide more often

*allow more collisions*

- collide more energetically

- more of the collisions are successful

**or** more particles have the activation energy

**NB** *more successful collisions alone = 1 mark*

*if particles are identified as electrons = max 1 mark*

2

**[5]**

- 12** (i) potassium hydroxide  
*accept correct formulae* 1
- water 1
- (ii) fertiliser 1
- (iii) H<sup>+</sup>  
*accept hydrogen but **not** H* 1
- [4]**

- 13** (a) H<sup>+</sup>(aq) + OH<sup>-</sup>(aq) → H<sub>2</sub>O(l) **or**  
H<sub>3</sub>O<sup>+</sup>(aq) + OH<sup>-</sup>(aq) → H<sub>2</sub>O(l)  
*mark for correct equation*  
*mark for state symbols*  
*any other symbols = 0 marks*  
*accept correct spectator ions e.g.*  
*Na<sup>+</sup>(aq) + OH<sup>-</sup>(aq) + H<sup>+</sup>(aq) + Cl<sup>-</sup>(aq) → Na<sup>+</sup>(aq) + Cl<sup>-</sup>(aq) + H<sub>2</sub>O(l)*
- 2

- (b) (i) nitric acid **and** ammonia (solution)  
HNO<sub>3</sub>            NH<sub>3</sub> / NH<sub>4</sub>OH  
*mark for both*  
*accept ammonium hydroxide /*  
*NH<sub>4</sub>OH instead of ammonia*  
*do **not** accept ammonia hydroxide*  
*do **not** accept hydrogen nitrate solution*  
*accept correct formulae*
- 1
- (ii) provides oxygen or oxidising (agent) **or** oxidant  
*do **not** accept it contains oxygen alone*  
***or** rich in oxygen*
- 1

**[4]**

<b>14</b>	nitric acid	1	
	potassium hydroxide	1	
	water	1	<b>[3]</b>

<b>15</b>	(a) hydrogen	1	
	(b) litmus paper / Universal Indicator paper / pH paper	1	
	(c) because they have a negative charge <b>or</b> opposite charges attract	1	
	(d) kill bacteria / germs, etc. <b>or</b> sterilise / disinfect	1	
	(e) hydroxide (ion)	1	
			<b>[6]</b>

**16**

(a) 100

*ignore units**40 + 12 + (3 × 16) for 1 mark*

1

(b) 40

*(ecf from part (a) can get 2 marks)* $\frac{40}{\text{their (a)}} \times 100$  for 1 mark

1

(c) 0.5

*(ecf from part (b) can get 2 marks)* $1.25 \times \left( \frac{\text{their (b)}}{100} \right)$  or other correct working for 1 mark

2

(d) gas produced or carbon dioxide / CO<sub>2</sub> produced

1

**[7]**

17

(a)  $M_r(\text{SiO}_2) = 60$

*if  $M_r$  incorrect ecf for max 2*

1

$60 \text{ g SiO}_2 \rightarrow 28 \text{ g Si}$

*correct answer for 3 marks*

1

$2.14 \text{ g SiO}_2 \rightarrow 1 \text{ g Si}$

*allow 2, 2.1, 2.14 (or anything rounding to 2.14), 2.16 or 2.2**a unit is not required but an incorrect unit loses the third mark*

OR  $M_r(\text{SiO}_2) = 60$  (1)

moles if silicon needed =  $\frac{1}{28} = 0.0357$

mass of  $\text{SiO}_2$  needed =  $0.0357 \times 60$  (1)

= 2.14 g (1)

*allow 2, 2.1, 2.14 (or anything rounding to 2.14), 2.16 or 2.2*

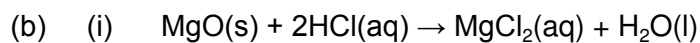
OR  $M_r(\text{SiO}_2) = 60$  (1)

mass  $\text{SiO}_2 = 1 \times \left(\frac{60}{28}\right)$  (1)

= 2.14 g (1)

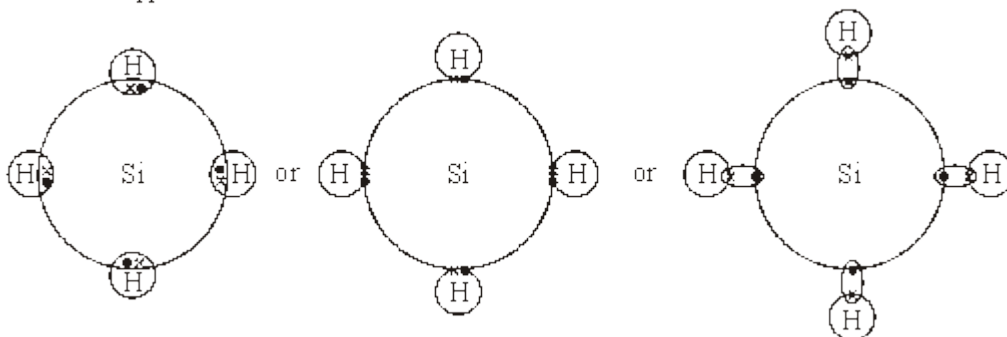
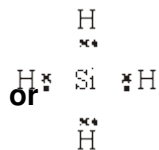
*allow 2, 2.1, 2.4 (or anything rounding to 2.14), 2.16 or 2.2*

3

*penalise incorrect symbols correctly balanced equation for 1 mark**state symbols for 1 mark**allow correct multiples / fractions*

2

(ii)



*ignore inner shell electrons of silicon  
allow correct drawings without symbols  
must clearly indicate four shared pairs of electrons with one  
electron from each atom*

(iii)

**Si****H**

$$\frac{1.4}{28}$$

$$\frac{0.15}{1}$$

1

$$= 0.05$$

$$= 0.15$$

1

1

3

*for whole number ratio can be implied*

1

Si H<sub>3</sub>

*accept H<sub>3</sub> Si or any correct formula with 1:3 ratio*

*if in step 1 they get either of ratios incorrect they lose first 2 marks  
but can be ecf for 3rd and 4th mark*

*evidence of mass / A<sub>r</sub> 1 mark*

*proportions of each 1 mark*

*whole number ratio 1 mark*

*correct formula 1 mark*

1

(iv) **C***accept c*

1

(c) any **four** from:

- giant structure / macromolecule / lattice / giant molecule  
*allow giant molecular / giant atomic structure*
- each silicon atom joined to four other atoms  
*(or diagram)*
- covalent bonds
- bonds are strong **or** large amount of energy needed to break bonds  
*accept hard to break bonds*
- large number of bonds to be broken  
*mention of giant **ionic** structure **or** intermolecular forces **or** intermolecular bonds max 1 mark*  
*diamond **or** carbon discussion max 3 marks unless clearly linked to silicon*

4

**[15]****18**

(a)

***must** be a description of a titration no titration = **0** marks***Quality of written communication***for correct sequencing of 2 of first 3 bullet points i.e. 1 + 2  
**or** 2 + 3 **or** 1 + 3*

1

any **three** from:

- nitric acid in burette  
*do **not** accept biuret*  
*can be inferred from 3rd point*
- add nitric acid until indicator changes (colour)  
*can be named acid-base indicator*  
*colour change does not have to be correct*
- note (burette) volume used **or** final reading
- accuracy: e.g. repeat  
*accept white tile **or** dropwise near end **or** white background **or** swirling the flask **or** read meniscus at eye level*

3



(b) e.g. formula method:

$$25 \times M_{\text{NH}_3} = 0.25 \times 20$$

1

$$M_{\text{NH}_3} = 0.2$$

*correct answer alone = 2*

**OR**

moles  $\text{NH}_3$  = moles  $\text{HNO}_3$

$$= \frac{20}{1000} \times 0.25 = 0.005 \text{ moles (1)}$$

concentration  $\text{NH}_3$

$$= \frac{0.005 \times 1000}{25} = 0.2 \text{ (1)}$$

1

(c) sodium hydroxide **or** potassium hydroxide **or** lithium hydroxide **or** calcium hydroxide

*ignore mention of alkali*

1

ammonia produced

*accept gas produced turns (damp) (red) litmus blue (not blue litmus)  
**or** alkaline gas produced*

*any suitable named indicator e.g. UI with consequential marking  
white fumes / smoke with (concentrated) HCl*

*do **not** accept white gas wrong test = 0 marks*

1

[8]

19

(a) (i) water

*accept  $\text{H}_2\text{O}$*

*accept correct ringed answer in box*

1

(ii) neutralisation

*accept underlining or any indication, eg tick*

1

(b) sodium hydroxide

1

sulphuric acid

*apply list principle total*

1

[4]

20

hydrogen ions (from acid) or protons /  $H^+$

1

react with hydroxide ions (from alkali) /  $OH^-$

1

to produce water

$H^+ + OH^- \longrightarrow H_2O$  gains all **3** marks  
 ignore state symbols  
 molecules of hydrogen ions and molecules of  
 hydroxide ions produce water = **2** marks  
 if they fail to get any of the above marks they can  
 get **1** mark for neutralisation / product neutral

1

[3]

21

(a) (i) to remove or separate copper oxide

*accept to remove or separate*

*unreacted or excess base*

*accept to remove or separate insoluble solids*

1

(ii) heat (the solution)

*accept heat the water*

*accept evaporate the water*

**rapid** cooling/cool to lower temperature

*accept boil the water or solution*

**not** increase surface area, put in  
 draught

**not** increase the temperature

1

(iii) aqueous

*accept in water*

*accept solution*

**not** soluble in water

1

(b) add water/liquid/solution

1

colour changes to blue

1

[5]

22

(a) (i) **must** be chemical symbol

Ca

1

C

$CaCO_3 = 2$  marks

1

O not O<sub>2</sub>

1

(ii) carbon dioxide

**must** be name

1

(b) (i) *points all correct 2 marks*  
*one point incorrect 1 mark*  
*two points incorrect 0 marks*

2

suitable line -narrow neat single curve

**not** dot to dot

1

(ii) reaction with X forms less gas

**must** include X or Y

do **not** penalise for H<sub>2</sub>/O<sub>2</sub> if (a) (ii) already penalised

do **not** accept is finished in less time **or** slower/faster reaction **or** lower on graph

1

(iii) any two from:

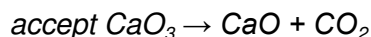
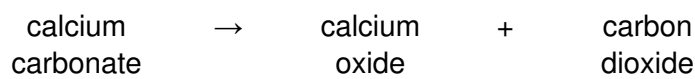
- concentration (of acid) decreases/less reacting particles/molecules  
*not acid/CaCO<sub>3</sub> runs out/is used up*
- surface area of calcium carbonate decreases  
*not strength of acid decreases*
- less collisions between reacting particles  
*not smaller (amount of) CaCO<sub>3</sub>*

2

[10]

23

(a) (i)



1

(ii) (thermal) decomposition

*accept endothermic*

*accept reversible*

1

(b) (i) neutralisation

*accept exothermic*

1

(ii) sulphuric (acid) H<sub>2</sub>SO<sub>4</sub>

2

(c) (i) to speed up the reaction

*accept to increase the rate of reaction **or** to increase the number **or** rate of collisions*

*do **not** accept "dissolves" copper oxide faster*

1

(ii) all acid reacts

*accept there will be no acid left **or** acid used up*

1

**acid is neutralised** (for 2 marks)

*do **not** accept to form a concentrated **or** saturated solution*

1

(excess) copper oxide collects in filter paper

*accept larger particles (of copper oxide) cannot pass through filter paper*

1

copper sulphate solution passes through the filter paper

*accept dissolved copper sulphate passes through filter paper **or** smaller particles (of copper sulphate) in solution (liquid) pass through filter paper*

*accept (black) solid collects in filter paper and filtrate **or** soluble solid **or** (blue) solution (liquid) passes through filter paper for 1 mark only*

1

**[10]****24**

(a) 0 – 6

1

(b) more accurate

1

(c) burette

1

(d) sodium hydroxide / potassium hydroxide / ammonia / any other soluble Group I or II hydroxide

1

(e) (i) named indicator / litmus / U.I. / methyl orange / methyl red / phenolphthalein

1

(iii) colour at end point

1

**[6]****25**

(i) electrolysis

1

(ii) oxidation

1

(iii) hydroxide ions **or** OH<sup>-</sup>

*accept sodium hydroxide **or** hydroxide **or** OH for one mark only*

2

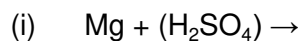
- (iv)  $H^+ + e^-$  1
- $H_2$   
*ignore any state symbols* 1
- $2H^+ + 2e^- \rightarrow H_2$   
*accept  $H^+ + e^- \rightarrow H$  for **one** mark only* 1
- [7]**

**26**

- (a) any four from:
- sulphuric acid measure by pipette  
*or diagram*
  - potassium hydroxide in burette  
*or diagram*
  - if solutions reversed, award
  - note initial reading
  - use of indicator
  - note final reading **or** amount used
- 4
- (b)  $\frac{34 \times 2}{1000}$  1
- = 0.068 1
- (c)  $\frac{1}{2}$  or 0.5 moles  $H_2SO_4$  react with 1 mole KOH 1
- moles  $H_2SO_4$  in  $25.0 \text{ cm}^3 = 0.068 \times 0.5$  1
- $\therefore$  moles  $H_2SO_4$  in  $1 \text{ dm}^3 = \frac{0.068 \times 0.5 \times 1000}{25} = 1.36 \text{ mol/dm}^3$  1

**[9]**

27



1



1



*deduct 1 mark if not balanced only if all three correct  
accept alternative metal of similar reactivity for example Zn **or** Fe  
candidate would not then be awarded first mark for Mg  
then error carried forward*

*deduct 1 mark if not balanced only if all three correct*

1

(ii) to remove the (excess) magnesium

*accept separate*

*accept insoluble substances **or** solids **or** residue*

*do **not** accept unreactive substances **or** impurities **or** remove  
magnesium from sulphuric acid*

1

(iii) to evaporate (some of the water **or** solution)

1

to form crystals **or** crystallise

*accept to form a saturated solution*

***or** concentrated solution*

*do **not** accept to leave  $\text{MgSO}_4$*

1

**[6]**

28

(a) (i) test: limewater

*accept calcium hydroxide solution*

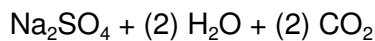
1

result: 'goes' cloudy

*accept white **or** milky*

*do **not** accept misty **or** chalky test must be correct before result  
mark can be considered*

1



1

correctly balanced

1

- (b) (i)  $H^+ + OH^-$  1
- $\rightarrow H_2O$
- deduct **one** mark if incorrectly balanced
- accept  $H_3O^+$  instead of  $H^+$  then  $2H_2O$  needed for balance*
- 1
- (ii) pH increases 1
- accept numerical indication*
- (c) addition of sulphuric acid 1
- correct use of an indicator
- accept idea of forming a neutral solution*
- 1
- crystallisation (of neutral solution)
- accept description using evaporation*
- 1

**[10]****29**

- (a) (i)  $H_2SO_4$  **or** red (acidic) pH < 7 1
- accept names of compounds*
- accept correct use of acidic*
- NaOH **or** purple (alkaline) pH > 7 1
- alkaline and neutral without any mention of pH for 1 mark only*
- NaCl **or** green (neutral) pH 7 1
- ignore high **or** low pH*
- (ii) hydrogen (ion) 1
- accept proton*
- accept hydroxonium ion*
- $H^+$
- accept  $H_3O^+$  for hydroxonium ion*
- 1



- (b) (i) neutralisation 1
- (ii) NaOH + HCl 1  
*ignore state symbols*
- NaCl + H<sub>2</sub>O 1  
*ignore state symbols*  
*maximum of 1 mark if incorrectly balanced*
- (c) (i) sodium – 2 . 8 . 1 1  
*accept 2.8.1 written*
- chlorine – 2 . 8 . 7 1  
*accept 2.8.7 written*
- (ii) ion(s) 1
- (iii) attraction between oppositely charged particles (ions) 1  
*accept attraction between + and – particles (ions)*  
*accept electrostatic attraction*
- (d) chloride ions lose electrons to form chlorine 1  
 $Cl^- - e^- \rightarrow Cl$
- hydrogen ions gain electrons to form hydrogen 1  
 $H^+ + e^- \rightarrow H$
- sodium hydroxide remains in solution 1  
*Na + and OH<sup>-</sup> remain in solution to form sodium hydroxide*

**[15]****30**

- (a) hydrochloric acid in burette 1
- indicator 1
- note volume at end / neutralisation point 1  
*titre must be HCl*

(b) 1 mole HCl = 36.5g /36.5

1

$$\therefore \frac{73}{36.5} = 2 \text{ moles / dm}^3$$

*2 for correct answer*

1

(c) (i)  $\frac{10 \times 2}{1000}$

*allow e.c.f. ie their (b)  $\times \frac{10}{1000}$*

*2 for correct answer*

1

= 0.02 moles

1

(ii)  $0.02 \times \frac{1000}{25} = 0.8 \text{ mol / dm}^3$

1

*allow e.c.f. ie their (c)(i)  $\times \frac{1000}{25}$*

1

[9]

31

(a) (i) (s) (aq) (1) (g)

*2 or 3 correct 1 mark*  
*1 correct 0 marks*

2

(ii) calcium chloride

1

(b) (i) points

*deduct 1 mark for each error to a maximum of 2 marks*

2

line

*accept a single line 'best fit' curve*  
*accept reasonable attempt at curve*

1

(ii) increase temperature **or** heat

*accept increase surface area **or***  
*increase concentration **or** description*

1

- (iii) 75% or  $\frac{3}{4}$   
*not pure 1 mark*  
*only 60 cm<sup>3</sup> (instead of 80 cm<sup>3</sup> of gas)*

**or**  $\frac{60}{80} \times 100$  **1 mark**

3

[10]

32

- (a) (i) iron **must** be named  
*do **not** accept Fe*

1

- (ii) hydrogen

1

and oxygen mixtures

1

burn rapidly

1

- (b) (i) lowers concentration  
*accept dilutes the acid*  
*do **not** accept cooling*

1

less collisions (between particles)

1

- (ii) H<sup>+</sup> (aq)  
*accept H<sub>3</sub>O<sup>+</sup> only if 2 in front of H<sub>2</sub>O*

1

OH<sup>-</sup> (aq)

*if spectator ions correctly included on both sides, maximum = 1 mark*

1

- (iii) Ca(OH)<sub>2</sub> weak alkali  
*accept NaOH strong alkali*

1

Ca(OH)<sub>2</sub> causes no problems

*accept NaOH causes named problem*  
*(eg caustic **or** exothermic **or** burns **or** corrosive)*

1

[10]

**33**

- (a) pipette / burette 1
- (b) named indicator eg methyl orange / phenolphthalein  
*not universal*  
*accept litmus but not litmus paper* 1
- (c)  $\frac{25 \times 0.4}{1000}$  *2 for correct answer* 1
- = 0.01 1
- (d) 1KOH  $\equiv$  1 HCl
- $\therefore$  0.01 moles HCl in 35 cm<sup>3</sup> 1
- $\therefore \frac{0.01 \times 1000}{35} = 0.29$
- 2 for correct answer*  
*0.3 = (1) (with correct working = (2))* 1

**[6]****34**

- (a) (i) fertilisers  
*for 1 mark* 1
- (ii) 7  
*for 1 mark* 1
- (iii) 5  
*for 1 mark*  
*(ignore other units)* 1
- (b) (i) both nitrogen and hydrogen  
*for 1 mark* 1

- (ii) two of:  
 nitrogen;  
 hydrogen/methane/natural gas;  
 oxygen/air;  
 water;  
 any fuel  
 (allow symbols, do not allow nitrogen oxides)  
*any two for 1 mark each*

2

- (c) (i) alkali/alkaline/base/basic  
*for 1 mark*

1

- (ii) must be nitrate  
*for 1 mark*

1

- (iii) thermometer or any other temperature measuring device  
*for 1 mark*

1

**[9]****35**

- (a) sodium

1

- (b) neutralisation

1

- (c) increase/inc. number

1

- (d)  $H^+$

1

- (e)  $OH^-$

1

- (f)  $H^+ + OH^- \rightarrow H_2O$

1

**[6]****36**

- (i) neutralisation/acid base reaction  
*for 1 mark*

1

- (ii) 17 (tonnes)  
give 80 (tonnes) (even if only in working)  
*for 1 mark each*

320 (tonnes) or alternative method)  
*3 marks for correct answer*

(if 17 and 80 not given allow 1 mark for correct answer using their figures)

3

**[4]****37**

- (a) (i)  $H^+ + OH^- \rightarrow H_2O$  /  $H_3O^+ + OH^- \rightarrow 2H_2O$   
*for 1 mark*

1

- (ii) 1 point from e.g.  
smaller bits  
bigger surface area  
faster reaction  
dissolve faster  
more particles open to attack by acid  
*any 1 for 1 mark*

1

- (iii)  $MgCO_3$  or  $Mg^{2+}CO_3^{2-}$  or  $CO_3 Mg$   
*for 1 mark*

1

- (b) (i) 2 HCl  
*for 1 mark*

1

- (ii) aqueous/dissolved in water (not in solution)  
*for 1 mark*

1

- (iii)  $CO_2$ /gas evolved/gas has mass  
*for 1 mark*

1

- (c) (i) plotting points  
scales  
curve  
labelling axes including units  
*for 1 mark each*

4

- (d) faster  
same final mass  
*for 1 mark each*

2

[12]

38

- (a) (i) hydrogen/H<sub>2</sub>  
*for 1 mark*

1

- (ii) i.e.  $2\text{Cl}^- - 2\text{e}^- \rightarrow \text{Cl}_2$   
*for 1 mark*

1

- (iii) hydroxide or OH<sup>-</sup>  
*for 1 mark*

1

- (iv) sodium hydroxide/caustic soda/NaOH/bleach/  
chemical name of bleach  
*for 1 mark*

1

- (b) (i) Na<sub>2</sub>CO<sub>3</sub> or (Na<sup>+</sup>)<sub>2</sub> CO<sub>3</sub><sup>2-</sup>  
*for 1 mark*

1

- (ii) coal  
water/H<sub>2</sub>O  
limestone/CaCO<sub>3</sub>/calcium carbonate  
*any one for 1 mark*

1

- (iii) calcium chloride/CaCl<sub>2</sub>/sodium hydrogen  
carbonate/NaHCO<sub>3</sub>  
*for 1 mark*

1

- (iv) decomposition/heating of limestone  
decomposition/heating of coal  
decomposition/heating of sodium  
hydrogen carbonate

*any 1 for 1 mark*

1

described change e.g.  $\text{NaHCO}_3 \rightarrow \text{Na}_2\text{CO}_3$

(Use judgement)

breakdown (owtte.)

by heat

*for 1 mark each*

2

- (v) carbon dioxide/ $\text{CO}_2$  or ammonia/ $\text{NH}_3$

*for 1 mark*

1

- (c) (i) zinc carbonate/ $\text{ZnCO}_3$ /zinc  
hydroxide/ $\text{Zn(OH)}_2$

*for 1 mark*

1

- (ii) It is insoluble  
zinc carbonate is insoluble in water

*for 1 mark*

1

**[13]**

**39**

- (a) potassium / K

*for 1 mark*

1

- (b) carbon dioxide /  $\text{CO}_2$

*for 1 mark*

1

- (c) losing  
electrons  
gaining  
electrons

*for 1 mark each*

4



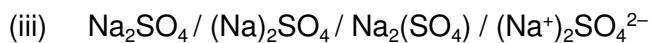
- (d) (i) power supply, (not mains)  
beaker containing solution,  
(inert) electrodes and circuit  
ammeter or bulb/  
(or see bubbling etc. at electrodes written by drawing)  
*for 1 mark each* 4
- (ii) reading on ammeter/bulb lights / (solution) conducts (electricity)  
bubbling / gas produced  
hydrogen produced  
chlorine / oxygen produced  
ions move  
to electrodes (must be linked to ions move)  
negative ions move to the positive electrode  
and/or positive ions move to the negative electrode  
negative ions lose electrons  
and/or positive ions gain electrons  
*any 3 for 1 mark each* 3

**[13]****40**

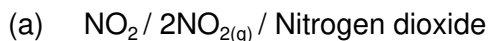
- (a) (2) : (6) : (2)  
*All 3 correct gains 2 marks*  
*2 correct gains 1 mark* 2
- (b) no water present/moist air cannot enter/do not thoroughly mix/  
must be in solution etc.  
*for 1 mark* 1
- (c) (i) hydroxide (ion) / OH<sup>-</sup>  
*for 1 mark* 1
- (ii) hydrogen (ion) / H<sup>+</sup>  
*for 1 mark* 1
- (iii) water/H<sub>2</sub>O/hydrogen oxide  
*for 1 mark* 1

**[6]**

<b>41</b>	(a) (i) test tube / boiling tube <i>for 1 mark</i>	1
	(ii) $\text{Na}_2\text{CO}_3$ NaCl <i>each for 1 mark</i>	2
	(b) (i) flask measuring cylinder <i>each for 1 mark</i>	2
	(ii) used smaller pieces <i>gains 1 mark</i>  <b>but</b> larger surface area for reaction <i>gains 2 marks</i>	2
	(c) (i) steeper line straight line <i>each for 1 mark</i>	2
	(ii) reaction occurs when particles collide higher temperature, higher speed of particles so harder collisions more frequent collisions <i>any three for 1 mark each</i>	3
		<b>[12]</b>
<b>42</b>	(i) sulphuric acid / $\text{H}_2\text{SO}_4$ <i>accept sulfuric</i> <i>1 for one mark</i>	1
	(ii) exothermic <i>for one mark</i>	1

*for one mark**lower case O(Na<sub>2</sub>SO<sub>4</sub>) not accepted / tops of subscripted letters should be in line or lower than lower case letters of symbols*

1

**[3]****43***for one mark*

1

(b) particles of gas move / they move

*reject spread out**particles move randomly / mix / go between air molecules / diffusion**any two for 1 mark each*

2

(c) faster reaction / more surface area (*not* smaller pieces)*for one mark*

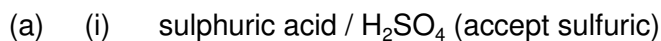
1

(d) (i) **either** lower temperature / particles move slower  
fewer collisions (owtte) / less energetic collisions / owtte  
**or** acid diluted (owtte)  
fewer collisions (owtte)*for 1 mark each*

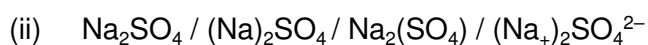
2

(ii) alkali neutralises the acid / stops the reaction  
**or** water will only slow the reaction not stop it*either for 1 mark*

1

**[7]****44***for one mark*

1

*for one mark**lower case O (Na<sub>2</sub>SO<sub>4</sub>) not accepted/tops of subscripted numbers should be in line with or lower than lower case letters of symbols / upper case 'a' not accepted*

1

- (b) (i) exothermic  
*for one mark* 1
- (ii) 60 KJ  
*for one mark* 1
- (iii) energy given out when bonds form  
energy taken in when bonds break  
energy given out is greater than energy taken in (owtte)  
*for 1 mark each* 3
- (iv) activation energy is low / many molecules have enough energy to react  
for one mark 1
- [8]**

**45**

sodium nitrate 1



*do not credit lower case N or O, upper case A*

1

potassium sulphate

1



*accept potassium hydrogen sulphate or  $\text{KHSO}_4$   
do not credit lower case K, S or O  
ignore charges on ions*

1

**[4]****46**

(a) ammonium nitrate  
*accept  $\text{NH}_4\text{NO}_3$   
do **not** accept ammonia nitrate* 1

(b) different reactions need different catalysts 1

- (c) they are used over and over again  
*accept they are reused*  
*accept they are not used up*  
*accept they are not changed*  
*recycling is neutral* 1
- (d) any **two** from  
 they speed up reactions  
 they reduce energy requirements  
*accept allow reactions to take place at a lower temperature*  
 they reduce costs  
*accept make process more economic* 2
- (e) (high pressure) increases the  
 frequency of collisions  
*accept more collisions*  
*move faster is neutral* 1
- this increases the rate of reaction  
*accept 'more successful collisions' for 2 marks* 1

[7]

47

- (a) (i) allow a number between 2.5 and 3  
 (inclusive)  
*accept just under 3 or about 3* 1
- (ii) alkaline **or** alkali 1
- (iii) 25  
*ignore any reference to units* 1
- (b) (i) a circle round KOH or 2 KOH 1
- (ii)  $K_2SO_4$   
*do not credit potassium sulphate* 1

[5]

- 48** (a) Bunsen (burner)  
*accept spirit burner do not credit candle* 1
- (b) blue 1
- white  
*credit (1) if both colours correct but answers are reversed* 1
- to cool the tube (B)  
*accept answers which anticipate part (d) e.g. 'to condense the water vapour' or gases or vapours* 1
- (d) (i) water  
*do not credit 'condensation'* 1
- (ii) (Water) vapour from the crystals (from tube A)  
*accept steam or steam from tube A* 1
- condenses **or** cools  
*accept turns to (liquid) water* 1
- (e) add water  
gets hot **or** hotter **or** warm **or** warmer turns into solution  
dissolves  
*or the temperature rises or there is an exothermic reaction  
accept steams or hisses ignore any reference to colour(s)* 2
- (f) sulphuric acid  
*accept H<sub>2</sub>SO<sub>4</sub> only if correct in every detail* 1
- [10]**

**49** NOTE

In this question and throughout the Paper, if the name of a chemical is asked for, then the formula is acceptable only if it is correct in every detail. If the name is correct and the candidate has tried to be 'helpful' by giving, in addition, an incorrect version of the formula, then this is acceptable provided it does not lead to ambiguity.

- (i) nitric (acid)  
*accept HNO<sub>3</sub>*  
1
- (ii) sulphuric (acid)  
*accept H<sub>2</sub>SO<sub>4</sub>*  
1
- (iii) heat given out  
*or temperature rise*  
*or energy given out*  
*or steam*  
*do not credit just 'use a thermometer'*  
*do not credit just 'change in temperature'*  
1
- (iv) neutralisation  
*accept neutralise*  
*accept neutral*  
*accept formation of salt or water*  
*do not credit exothermic*  
1

**[4]****50**

- (a)  $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{CO}_2 + \text{H}_2\text{O}$   
*one mark for CO<sub>2</sub> and H<sub>2</sub>O or H<sub>2</sub>CO<sub>3</sub>*  
*one mark for balancing the equation*  
2
- (b) (i) linear suitable scale for y axis  
*± one small square*  
1
- accurate plots  
*deduct one mark for each error plot*  
1
- smooth curve through the points **or** a line of best fit  
*this mark requires a neat smooth curve*  
1

- (ii) curve becomes almost horizontal at **or** above 268.5  
*do not credit a straight line reaching 268.5 at 11 mins*  
*accept a plot at 268.6*

1

- (iii) steeper initial part to curve

1

becoming nearly horizontal between 268.6 and 268.4 g

1

**[8]****51**

- (a) gas

1

- (b) (i)

acid

*ignore any reference to a particular kind of acid*

1

- (ii) 7

1

- (c) 1

*credit potassium **or** K written into Group 1*

1

- (d) (i) reacts rapidly **or** quickly **or** fast

*credit melts **or** fizzes **or** dissolves **or** violently **or** less violently (than K)*

1

sodium hydroxide **or** hydrogen

*credit NaOH **or** H<sub>2</sub>*

1

- (ii) add universal indicator

*credit add indicator **or** litmus **or** use pH paper*

1

turns blue **or** purple

*credit 'it goes purple' providing something has been added to the water*

1



(e) any two from

heat **or** warm

cut it up **or** have smaller pieces or larger surface area

*do not accept more lithium **or** less water*

stir

2

[10]

52

(a) (i) 8

ammonia

*do not credit ammonium*

sulphuric acid

*do not credit just sulphuric; credit sulfuric acid*

*do not credit hydrogen sulphate*

3

(ii) (as a) fertiliser

1

(iii) nitric (acid)

*accept  $\text{HNO}_3$  if correct in every detail*

1

(b) (i) chemical change (in which)

***or** under suitable conditions*

1

product(s) can be converted to reactant(s)

***or** direction of reaction can be reversed*

***or** equilibrium can be achieved*

*do not credit reaction can be reversed*

1

(ii) air

***or** (the) atmosphere*

1

(iii) made of atoms

1

which are all the same

*credit the idea that the particles (in an element) are all the same even if the name of the particles (the first mark) is incorrect*

*or which have the same number of protons*

*or which have the same atomic number / proton number*

*it cannot be broken down into anything simpler (2) marks*

1

**[10]****53**

(a) sodium ions and chloride ions (not chlorine)

*allow sodium chloride/salt/common salt*

*for 1 mark*

1

(b)  $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$

$\text{H}^+$  from (hydrochloric) acid

$\text{OH}^-$  from alkali/sodium hydroxide

lose 1 mark if no charge shown disregard other ions

*each for 1 mark*

3

**[4]****54**

(a) (i) sodium ions and chloride ions

*(allow sodium chloride/salt) [not "chlorine"] for 1 mark*

1

(ii) sodium ions and chloride ions

*(allow sodium chloride/salt) for 1 mark*

$\text{H}^+$  ions (*allow hydrochloric acid*)

*for 1 mark*

2

(b)  $H^+ + OH^- \rightarrow H_2O$  [N.B  $Na^+$  and  $Cl^-$  may also be present]

$H^+$  ions from acid

$OH^-$  ions from alkali

*each for 1 mark*

[N.B First mark lost if changes on ions not shown]

3

[6]

55

(i) carbon dioxide (*allow*  $CO_2$ )

*for 1 mark*

1

(ii) sodium nitrate (accept correct formula)

*for 1 mark*

1

[2]

56

- correct use of react/reaction/reactants NOT mixed added to join/combine/displace  
NOT equals
- correct use of produce/products/gives/forms/makes/creates
- reactants correctly identified
- products correctly identified

*(copper oxide reacts with sulphuric acid to produce copper sulphate and water, will be awarded all 4 marks)*

*for 1 mark each*

Reactants must be correctly identified for 'react' mark to be given. Similarly for products

[4]

57

(a) acidic }  
neutral }  
alkaline }

*in this order*

*all correct 2 marks*

*one correct 1 mark*

2

(b) *ideas that*

- nothing happens at first (to pH) / pH stays the same
- then (rapidly) changes / increases
- then stays at same (higher) level

5

**[7]**