AQA GCSE CHEMISTRY (HIGHER) · 8462

CHEMISTRY



MARK SCHEME

4.4.2 REACTIONS OF ACIDS (PACK 2)

SCORE	PERCENTAGE
/276	%

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Q1.

(a) (i) burette

1

(ii) indicator

1

(iii) colour change

1

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

- volume of (hydrochloric) acid
  allow amount of (hydrochloric) acid
- concentration of (hydrochloric) acid
- concentration of (sodium) hydroxide
  allow concentration of alkali

1

(ii) 22.3(0)

1

[5]

Q2.

(a) four

1

covalent

1

(b) because it has a high melting point

accept it won't melt
accept it won't decompose or react
allow withstand high temperatures
ignore boiling point

1

(c) thin

1

[4]

Q3.

(a) (i) sulfuric

1

(ii) 1

1

(iii) to speed up the reaction

1

(b) because copper oxide in excess

allow copper oxide unreacted

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or

because acid all used up / neutralised

1

(c) evaporation

allow heating
allow cooling
allow leave (to evaporate)
*do **not** accept freezing*

or

crystallisation

1

(d) Some copper sulfate may have been lost during the experiment

1

[6]

Q4.

(a) (i) because they are positively charged

accept they are positive / H^+
*accept oppositely charged **or** opposites attract*

ignore they are attracted

1

(ii) gains one / an electron

accept $H^+ + e^- \rightarrow H$ or multiples
allow gains electrons

1

(b) 3 bonding pairs

1

1 lone pair

accept 2 non-bonding electrons on outer shell of nitrogen

1

(c) (i) hydroxide / OH^-

*do **not** accept sodium hydroxide*

1

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

ignore state symbols
ignore word equation

1

(d) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information in the Reference material.

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0 marks
No relevant content.

Level 1 (1-2 marks)
There are basic descriptions of advantages or disadvantages of the electrolysis cells.

Level 2 (3-4 marks)
There are clear descriptions of environmental or economic advantages or disadvantages of the electrolysis cells. Comparisons may be implied.

Level 3 (5-6 marks)
There are detailed descriptions of environmental and economic advantages and disadvantages, comparing the electrolysis cells.

Examples of chemistry points made in the response:

Accept converse where appropriate.

- mercury cell is more expensive to construct
- mercury is recycled but membranes must be replaced
- mercury is toxic but membrane / polymer is not
- removing traces of mercury from waste is expensive
- mercury cell uses more electricity
- mercury cell produces chlorine that is purer
- mercury cell produces higher concentration / better quality of sodium hydroxide (solution)

6

[12]

Q5.

(a) (i) to increase the rate of reaction

1

(ii) H_2SO_4 on the left hand side

1

H_2O on right hand side

1

(iii) filtration

*allow centrifuging **or** decanting*
ignore evaporation if after filtration

1

(iv) crystallisation

ignore reference to filtration
unless given as an alternative

or

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evaporation / heating / boiling / cooling

1

(v) any **one** from:

- because of an incomplete reaction
  accept not all acid reacted
  accept impure reactants
  accept unexpected reaction
  ignore reversible reaction
- because some (copper sulfate) lost on filtering **or** when poured into evaporating basin **or** boiled over **or** left in apparatus
  must specify when lost
  *accept some (copper sulfate **or** acid) spilt*
- weighing error (of copper sulfate)

1

(b) (i) reversible (reaction)

1

(ii) 300(J)
allow the same

1

(energy) given out / released
accept exothermic / –
*ignore increasing **or** decreasing energy*

1

(c)

$\frac{3.81}{63.5}$ $\frac{0.28}{14}$

***1** mark for dividing mass by A_r (max **2** if A_r divided by mass)*

1

= 0.06 = 0.02

***1** mark for correct proportions*

1

3 1

***1** mark for correct whole number ratio (allow multiples). Can be awarded from formula*

1

Cu_3N

ecf** allowed from **step 2 to step 3** and **step 3 to step 4** if sensible attempt at step **1
*correct formula gains **1** mark*

1

[13]

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Q6.

(a) fertilisers

1

(b) air

1

(c) speeds up the reaction

accept lowers the activation energy

ignore makes the reaction work

1

(d) reversible reaction

1

(e) (i) 10

1

(ii) water

accept H_2O / hydrogen oxide

1

[6]

Q7.

(a) he made urea / organic compound / he made another organic compound

ignore he made it unless qualified eg accept he made it from non-living material / not made from animals / plants

1

(b) any **one** from:

sensible ideas eg

- famous scientists / eminent scientists / high status scientists accepted the life-force theory
- sensible references to lack of status of Wöhler
- was not in line with accepted ideas of time / religious beliefs etc

  eg it was a new idea
- other sensible answers eg fake / anomalous results

  or lack of evidence / proof

  accept only made 1 compound
  ignore no evidence

  or not reliable / reproduced

  or not repeated

1

(c) sensible ideas such as:

accept 'other scientists repeated his experiment / made other organic compounds'

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Wöhler made another organic compound **or** more evidence **or** repeated it

allow more proof

ignore he proved it

1

(d) (i) nitric (acid)

spelling must be correct

accept HNO_3 correctly written

ignore hydrogen nitrate

1

(ii) evaporate

allow heat / boil / cool

or

allow to crystallise

do not allow freeze

ignore filtration unless as an alternative

ignore distillation

ignore solidify

1

[5]

Q8.

(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

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

1

[8]

Q9.

(a) (s) (aq) (aq) (g)
must be in this order
***2** marks if all four correct*
***1** mark if 2 or 3 correct*

2

(b) (i) 55
ignore units

1

(ii) 54
*allow ecf from **(b)(i)***

1

(iii) 0.92
*correct answer with or without working gains **2** marks*
*ecf from volume in **(b)(i)***
accept 2 d.p. up to calculator value
*if answer incorrect, allow rate = (b)(i) / 60 for **1** mark*

2

(c) (i) circle round point at (48,22)

1

(ii) problem (1) and explanation (1)
*explanation **must** give lower volume of gas or slower reaction*
ignore human error unless qualified

problem with bung

e.g. bung not placed in firmly / quickly enough

so gas lost

or

problem with reagent

e.g. acid was diluted **or** acid not replaced

so reaction slower

or

problem with temperature

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e.g. temperature was lower than recorded temperature

so reaction slower

or

problem with measurement

e.g. length of magnesium less than 8 cm **or** timed for less than a minute

so less gas produced

2

(d) repeat the experiment (several times)

1

because anomalous results could be excluded

1

and then the mean can be determined / calculated

*accept suggestion of alteration to method, which is explained as to why it would reduce the error, for **3** marks (e.g. place the magnesium in a container within the flask (1) so it can be tipped into the acid once the bung is in place (1). This will prevent anomalous results or gas loss (1))*

ignore idea of more accurate gas syringe
ignore shorter time intervals

1

(e) (i) use clean magnesium **or** use magnesium without oxide coating

1

compare results

1

(ii) **either**

measure the temperature of the acid before (adding magnesium)

1

and after adding magnesium

or

place the conical flask in a water bath (at 40 °C) (1)

compare results (1)

1

[16]

Q10.

(a) (i) red

ignore pink

1

(ii) add silver nitrate (solution)

1

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white precipitate

dependent on addition of silver nitrate

ignore addition of another acid

*if hydrochloric acid added max **1** mark*

1

(b) suitable named alkali / sodium hydroxide solution in burette

1

add alkali solution until (indicator) becomes pink / red

1

*if acid to acid titration described, first two marking points **not** available*

any **two** from:

- wash / rinse equipment
- add dropwise or slowly (near end point)
- swirl / mix
- read (meniscus) at eye level
- white background
- read start and final burette levels / calculate the volume needed
- repeat

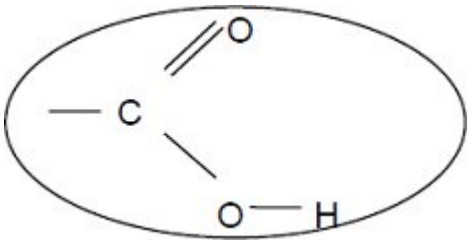
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(c) does not ionise / dissociate completely

allow <u>for acids of the same concentration</u>, weak acids have a higher pH or fewer hydrogen ions

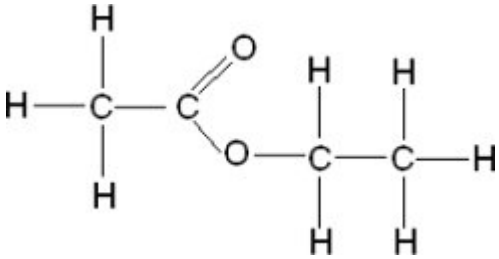
1

(d) (i) ring round COOH

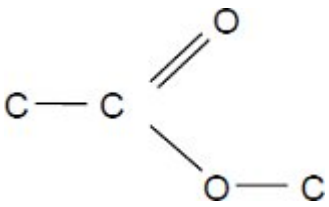


1

(ii)



*if not fully correct, allow **1** mark for correct ester group − minimum*



2

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[11]

Q11.

(a) any **two** from:

- effervescence / bubbles / fizzing
  allow gas / hydrogen is given off
  allow volume of gas
  allow magnesium floats

- magnesium disappears / dissolves
  allow change in mass of magnesium

- heat given off / exothermic
  allow temperature change
  *do **not** accept temperature decreases*

- change in pH
  *do **not** accept pH decreases*

2

(b) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information in the Marking guidance.

0 marks
No relevant content.

Level 1 (1-2 marks)
A simple plan without reference to changing any variable but should include an attempt at measuring rate **or** an attempt at fair testing

Level 2 (3-4 marks)
A plan including change of concentration / 'volume' of acid **and** should include an attempt at measuring rate **and / or** an attempt at fair testing

Level 3 (5-6 marks)
A workable plan including change of concentration **and** measurement of rate **and** fair testing

Examples of chemistry points made in the response could include:

Plan:

- add magnesium to acid
- time reaction / 'count bubbles' / measure volume of gas
- change concentration / 'volume' of acid

Control Variables:

- amount / mass / length / same 'size' of magnesium
- volume / amount of acid

6

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[8]

Q12.

(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_2 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]

Q13.

(a) (i) 10

1

(ii) OH^-

1

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(b) (i) air

1

(ii) particles move faster

1

particles collide more often

1

(iii) catalyst(s)

1

(c) liquid

1

[7]

Q14.

(a) *ignore any attempts to change the charge on chloride ion*

2.8.2 (drawn as dots or crosses on the circles)

accept e instead of dots or crosses

1

2.8.8 (drawn as dots or crosses on the circles)

1

(b) (i) filtration

accept decanting or centrifugation

*do **not** accept evaporation*

1

(ii) hydrochloric

accept HCl

1

(c) (i) so that ions / particles can move (in electrolyte)

allow so it can conduct electricity / carry charge / carry current

ignore reference to electrons moving in the external circuit

*any unqualified reference to electrons moving / carrying charge / carrying current = **0** marks*

1

(ii) electrons are lost

ignore numbers

1

(iii) + $2e^-$ on left hand side of equation

must be correct with no other additions

accept correct multiples

1

[7]

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Q15.

(a) sodium has a lower density

1

sodium is more reactive

1

(b) hydrogen

1

(c) $OH^-(aq)$

1

[4]

Q16.

(a) it / brown colour has a high(er) boiling point

allow it / brown colour is a solid

1

(b) (i) partially

1

(ii) for ethanoic acid –

accept converse points for hydrochloric acid

fewer bubbles **or** gas produced at a slower rate

1

more magnesium remains **or**
magnesium disappears more slowly

accept less temperature rise or less energy released for ethanoic acid

1

(c) (i) pipette

1

conical flask

1

burette

answers must be in the order shown

1

(ii) indicator

1

colour changes

if indicator named then any stated colours must be correct

1

(d) (i) 23.5 is anomalous / rough titration / overshot

1

the mean of the other 3 is 20.0

1

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(ii) (no)

it only contained 4.8g of ethanoic acid in $100cm^3$

1

[12]

Q17.

(a) (i) react

allow neutralise

allow bubbles / fizzes

accept produces gas / CO_2F

ignore rises

1

(ii) stop reacting / producing

stops on its own is insufficient allow stop working / bubbling / fizzing

1

the (hydrochloric) acid / (calcium) carbonate is used up

accept because the (calcium) carbonate has neutralised the (hydrochloric) acid

OR

have been used up (1)

the graph line becomes horizontal / levels out (1)

OR

stays the same / no change (1)

ignore reference to graph line

no further reaction (1)

1

(iii) bubble the gas through limewater / calcium hydroxide solution

allow (add) limewater

test must be correct to gain result mark

1

(the solution) goes cloudy

allow milky

1

(b) advantage > Quarrying limestone provides building materials, employment and new road links

1

disadvantage > Quarrying limestone releases dust, and lorries release carbon dioxide from burning diesel fuel

1

[7]

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Q18.

(a) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also apply a "best-fit" approach to the marking.

0 marks

No relevant content.

Level 1 (1-2 marks)
There is a simple description of a laboratory procedure for obtaining potassium chloride.

Level 2 (3-4 marks)
There is a clear description of a laboratory procedure for obtaining potassium chloride from potassium hydroxide solution and hydrochloric acid that does not necessarily allow the procedure to be completed successfully by another person. The answer must include the use of an indicator or a method of obtaining crystals.

Level 3 (5-6 marks)
There is a detailed description of a laboratory procedure for obtaining potassium chloride from potassium hydroxide solution and hydrochloric acid that can be followed by another person. The answer must include the use of an indicator and a method of obtaining crystals.

examples of the chemistry/social points made in the response:

- One reagent in beaker (or similar)
- Add (any named) indicator
- Add other reagent
- Swirl or mix
- Add dropwise near end point
- Stop addition at change of indicator colour
- Note volume of reagent added
- Repeat without indicator, adding same volume of reagent **or** remove indicator using charcoal
- Pour solution into basin / dish
- Heat (using Bunsen burner)
- Leave to crystallise / leave for water to evaporate / boil off water

Accept any answers based on titration

6

(b) nitric (acid)

allow HNO_3

ignore incorrect formula

1

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(c) (i) because it is a fertiliser / helps plants grow

allow plant food

*do **not** accept pesticide / herbicide / neutralising soil*

1

(ii) tick by: 'Should farmers stop using ammonium nitrate on their land?'

1

any **two** from:

- cannot be done by experiment

  accept difficult to get / not enough evidence

- based on opinion / view

  allow must be done by survey

- ethical **or** economic issue

  *if top box ticked allow **1** mark for drinking water varies from place to place*

2

[11]

Q19.

(a) (i) hydrochloric

1

(ii) insoluble

1

filtration

1

(iii) crystallisation

1

(b) any **four** from:

any reference to incorrect bonding = max 3

- calcium atom reacts with **<u>2 chlorine atoms</u>**
- calcium atoms <u>lose</u> electrons

  accept calcium ion is formed

- lose **<u>two</u>** electrons

  accept calcium has a 2+ charge / calcium ion has a 2+ charge

  allow Ca^{2+}

- chlorine atoms **gain** electrons

  accept chloride ion formed

- gain <u>one</u> electron

  accept chlorine / chloride has a negative charge / is a negative ion/ is a negative particle

  allow Cl^-

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*if no other marks awarded allow ionic bonding **or** complete outer shell for **1** mark*

4

[8]

Q20.

(a) any **one** from:

- they are negative / anions
  allow Cl^-
  ignore atoms / chlorine
  *do **not** accept chloride ions are negative electrodes*
- they are attracted
- they are oppositely charged

1

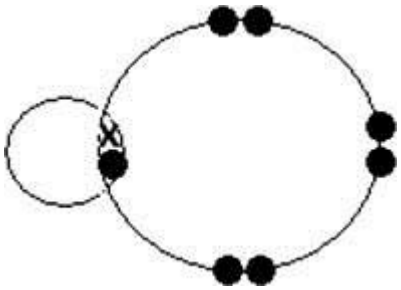
(b) hydrogen is less reactive than sodium

1

(c) hydroxide (ions) / OH^-
ignore OH
*do **not** accept NaOH / sodium hydroxide*

1

(d) (i)



allow any combination of dots or crosses
ignore chemical symbols

1

(ii) covalent
allow close spelling errors
apply list principle

1

(iii) hydrogen (ion) / H^+
ignore (aq) / H
do not accept hydrochloric acid / HCl
apply list principle

1

[6]

Q21.

(a) (i) hydrochloric (acid) / HCl

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allow phonetic spelling
ignore incorrect formula
ignore state symbols

1

(ii) idea of a solid / insoluble substance being formed (from solutions)
accept solid / insoluble product
ignore cloudy
*do **not** accept evaporation*

1

(iii) filtration / filter
accept decanting / centrifugation
ignore evaporate if after filtering

1

(iv) idea of making safe (to eat)
*allow remove harmful substances / organisms **or** sterilisation*

or
idea of purification
or
idea of neutralisation

1

(v) crystallisation
accept evaporation / heating / boiling
allow cooling
*do **not** allow freezing / solidifying*

1

(b) (i) $2e^-$
accept $e^- + e^-$
ignore working out

1

(ii) electron(s) are lost (from calcium atoms)
ignore numbers if given
*do **not** accept any reference to oxygen*

1

[7]

Q22.

(a) (i) hydrogen ions

1

(ii) partially ionised

1

(b) (i) burette

1

(ii) indicator

1

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(iii) colour change or turns pink

1

(c) 20.4(0)

*correct answer with or without working gains **2** marks*
if answer incorrect allow
$\frac{20.30 + 20.50 + 20.40}{3}$
*20.80 **or***
*for **1** mark*

2

(d) 50 (g)

*correct answer with or without working gains **2** marks*
*if answer incorrect allow evidence of 1.25 × 40 for **1** mark*

2

[9]

Q23.

(a) Hydrogen / H^+

ignore state symbols
ignore proton / H

1

(b) *it = weak acid*

pH of weak acid is higher than the pH of a strong acid

allow converse for strong acids
allow correct numerical comparison

1

any **one** from:

allow converse for strong acids

- only partially dissociated (to form ions)
  allow ionises less
- not as many hydrogen ions (in the solution)
  allow fewer H^+ released

1

(c) (i) (titration of) weak acid and strong base

1

(ii) 0.61

*correct answer with or without working gains **2** marks*
if the answer is incorrect:
moles of sodium hydroxide = (30.5 × 0.5)/1000 = 0.01525 moles
or
*(0.5 × 30.5/25) gains **1** mark*

2

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(d) 12

*correct answer with or without working gains **2** marks or even with incorrect working.*

if the answer is incorrect:

0.8 × 60 = 48g

or

evidence of dividing 48g (or ecf) by 4

or

$\frac{0.8 \times 250}{1000} = \frac{0.8}{4} =$ *0.8 × 0.25 = 0.2 mol*

or

evidence of multiplying 0.2mol (or ecf) by 60

*would gain **1** mark*

2

[8]

Q24.

(a) diagram **A**

1

(b) the atoms can slide over each other.

1

the atoms are in layers

1

(c) (i) sulfuric

1

(ii) bubbles are produced

1

the magnesium disappears

1

(iii) crystallisation

1

[7]

Q25.

(a) the ions can <u>move</u> / <u>travel</u> / <u>flow</u> /are <u>free</u>

accept particles / they for ions

allow delocalised ions

or

ignore delocalised / free electrons

ignore references to collisions

accept converse with reference to solid

the ions <u>carry</u> the charge / current

ignore ions carry electricity

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1

(b) any **one** from:

- because they are negative / anion
  allow Cl^-
  ignore chlorine
- opposite charges / attract

1

(c) 13

1

(d) (i) reasonable attempt at straight line which misses the anomalous point
must touch all five crosses
*do **not** allow multiple lines*

1

(ii) 40
ignore 2.2

1

(iii) any **two** sensible errors from:
ignore systematic / human / apparatus / zero /experimental / random / measurement / reading errors unless qualified

- gas escapes
- weighing error
  allow NaCl not measured correctly
- error in measuring (volume / amount) of hydrogen
- error in measuring (volume / amount) of water
  *allow error in measuring volume / scale for **1** mark if neither hydrogen or water mentioned*
- incorrect concentration
  *allow NaCl not fully dissolved **or** spilled **or** impure*
- timing error
- change in voltage / current
  allow faulty power supply
- change in temperature
- recording / plotting error

2

(iv) any **one** from:
ignore 'do more tests'

- repeat the experiment

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- results compared with results from /other students / other groups / other laboratories / internet / literature.

- results compared with another method

1

(v) increases owtte

allow directly proportional or positive correlation

allow rate / it is faster / quicker

1

[9]

Q26.

(a) • made of layers / rows (atoms / ions / particles)

ignore free / delocalised electrons

1

• which can slide / slip (over each other)

*reference to incorrect particles / covalency / intermolecular forces = max **1***

or

particles / ions / atoms can slide over each other

ignore malleable / ductile / weak bonds

1

(b) (i) sulfuric

accept sulphuric

ignore formula

ignore hydrogen sulfate

1

(ii) any **two** from:

list principle applies for incorrect observations

- (hydrogen) gas produced (or any indication of a gas such as bubbles etc.)

  ignore just hydrogen produced

  ignore cloudiness / colour changes

- magnesium / solid disappears / goes into solution

  accept magnesium / magnesium sulfate / solid / it dissolves

  accept forms a liquid / solution

- gets hot

  allow exothermic

  ignore floats

2

(iii) crystallisation

accept detailed answers such as: evaporate to half volume and then allow the solution to crystallise.

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or

evaporation / heating / boiling / cooling
ignore any references to filter

1

[6]

Q27.

(a) (i) nitrogen - air
accept atmosphere

1

hydrogen - north sea gas / natural gas / methane / CH_4
accept water / (crude) oil / coal / hydrocarbons / brine

1

(ii) *allow converse throughout*

- high temperature gives a low yield

1

- because reaction is exothermic
must be linked to first bullet point

1

- but at low temperatures the rate is (too) slow
if no other marks awarded accept 450°C is a compromise between yield and rate
or
*450°C gives a reasonable yield in a reasonable time for **1** mark*

1

(iii) nitric (acid)
accept HNO_3

1

(b) Ammonia / Haber process can be used to make fertiliser

1

with a specified economical reason
eg raw materials for Haber process readily available
eg transport costs are lower or no need to import
eg Haber process is a continuous process
ignore employment / labour costs

1

[8]

Q28.

(a) (i) sodium hydroxide solution

1

blue

1

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(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
ignore clear / discoloured

1

(ii) 13.9

or

(titration) 2

1

(iii) 13.2
ecf from (d)(ii)

1

[10]

Q29.

(a) (i) *incorrect test or no test = **0** mark*
*testing the solution **or** using blue litmus = **0** mark*

(test ammonia / gas with red) litmus
accept any acid-base indicator with correct result

1

(goes) blue

OR

(conc.) HCl (1)

white fumes / smoke / solid (1)
allow white gas / vapour

OR

(test ammonia / gas with) Universal Indicator (1)

blue / purple (1)

1

(ii) *incorrect test or no test = **0** marks*

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add barium chloride / $BaCl_2$ (solution)

*do **not** accept H_2SO_4 added*

or add barium nitrate / $Ba(NO_3)_2$ (solution)

allow Ba^{2+} solution / aqueous added

1

white precipitate / solid (formed)

allow white barium sulfate / $BaSO_4$

ignore barium sulfate / $BaSO_4$ alone

1

(b) (i) fully / completely ionised / dissociated
or hydrogen ions fully dissociated

accept has more ions than weaker acid / alkali of same concentration

ignore strongly ionised

*do **not** accept ions are fully ionised*

*ignore concentrated **or** reference to concentrations of ions*

1

(ii) methyl orange

accept correct spelling only

accept any strong acid-weak base indicator

*do **not** allow phenolphthalein / litmus / universal indicator*

1

(iii) 32 × 0.05/1000 **or** 0.0016 (mole H_2SO_4)

*accept (0.05 x 32) = (V x 25) **or** 0.05 x 32 / 25*

1

(reacts with) 2 × 0.0016 **or** 0.0032 (mole NH_3 in 25 cm^3)

*accept dividing rhs by 2 **or** multiplying lhs by 2*

1

(0.0032 × 1000/25 =) 0.128

allow ecf from previous stage

*correct answer 0.128 **or** 0.13 with or without working gains all **3** marks*

1

(iv) 2.176 **or** 2.18

correct answer with or without working

or ecf from candidate's answer to (b)(iii)

or 2.55 if 0.15 moles used

if answer incorrect or no answer

*0.128 × 17 **or** 0.13 x 17*

***or** their (b)(iii) × 17*

***or** 0.15 × 17 gains **1** mark*

2

[11]

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Q30.

(a) (i) mix (owtte)

accept to allow more collisions / helps particles to collide (owtte)
idea of more efficient heat transfer
*do **not** allow heat is a catalyst*

1

(ii) higher **and** more

1

powder **and** big

1

concentrated **and** more

1

(b) electrons

1

(c) H^+

1

[6]

Q31.

(a) gas / g

accept low density / low boiling point
or** weak intermolecular forces **or
*small molecules **or** simple molecules*
***or** simple molecular (structure)*
accept volatile or easy to evaporate
ignore very light
ignore incorrect name of gas

1

(b) filter / filtration

accept filter paper
accept decant / centrifuge
ignore filter funnel / sieving / drained off / funnelling
ignore names of compounds
ignore evaporation / heating if after filtration
*do **not** accept crystallisation*

1

(c) evaporation / crystallisation

accept heating / boiling
accept 'leave for a few days' owtte
allow cool
*do **not** allow freeze*
ignore filtration

1

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(d) *candidates can gain marks from any two of the three linked pairs*

hydrogen chloride escaped / released (into atmosphere) **or** (hydrogen chloride) damaged vegetation / harmful

used to make chlorine / bleach

*to get both of these **2** marks hydrogen chloride must be mentioned*

ignore HCl formed / produced / made

ignore sale of hydrogen chloride

1

unpleasant smell (of calcium sulfide)

or
waste of calcium (sulfide)

converted to sulfur

or
used to make sulfuric acid

ignore calcium sulfide alone

allow calcium / calcium sulfate for calcium sulfide

to get both of these 2 marks calcium (sulfide) must be mentioned

ignore sale of calcium sulfide

1

unreacted coal (1)

recycled / burnt / used / sold (1)

must be linked to first coal point

1

[7]

Q32.

(a) burette

1

(b) indicator changed colour

allow any indication of colour change

1

(c) (i) 0.2 **or** 18.3 to 18.5

1

(ii) 18.4

1

(iii) improve reliability

allow improve accuracy

allow to calculate a mean / average

***or** get rid of anomalous result*

ignore fair test / correct results / random results

1

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[5]

Q33.

(a) hydroxide (ion) / OH^- / OH^-(aq)

ignore OH

1

(b) fully / all / completely ionised / dissociated

*ignore strongly ionised **or** more ions **or** concentration*
ignore all 'noise'
*do **not** accept <u>ions</u> are fully ionised / dissociated*

1

(c) *assume it = sodium hydroxide*

any valid test

*incorrect test / titration = **0** marks for question*

1

linked comparison

*correct result / reference to pH with no test = **1** mark*

eg UI **or** full range indicator **or** pH

paper / solution / (pH) meter (1)

NaOH has higher pH **or**

allow converse for weak(er)
pH values must be above 7

correct <u>comparison</u> of colours (1)

NaOH – purple, Ammonia – blue
allow correct comparison of blue or purple

or

conductivity test (1)

NaOH conducts better / more **or** bulb brighter (1)

1

[4]

Q34.

(a) (i) (different) properties

allow ideas of different property / behaviour / element

1

(ii) any **one** from:

they = Crawford + Cruikshank

- they had high status

or

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they were lecturers / doctors / professors / famous scientists

- other scientists repeated experiments
  allow experiment could be repeated
  allow other scientists showed they had different properties
- they had proof

  or

  lots of / strong / conclusive / enough / clear evidence
  ignore evidence unqualified

1

(iii) other scientists obtained similar results / proved it

or

experiments were repeated

1

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

- mass of solid / strontium (chloride) / barium (chloride)
  allow amount / volume
- volume of water
  allow amount / mass
- type of container
  allow initial / starting temperature (of water)
  ignore room temperature / time / concentration
  ignore reference to hydrochloric acid

1

(ii) 2 **and** takes in heat / energy

or

2 **and** temperature goes down (owtte)

1

(iii) temperature increased for one experiment and decreased for the other (owtte)

or

one was exothermic and one was endothermic (owtte)
accept experiment 1 was exothermic

1

(c) any **one** from

- positive / + (charge)
  *do **not** accept incorrect further qualification eg electrons / atoms / electrodes*

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- opposite (charges) attract

1

[7]

Q35.

(a) (i) H^+

1

(ii) OH^-

1

(iii) lower than

1

(b) with HCl:

UI goes red / pink

allow a comparison eg redder than ethanoic acid

1

has a pH 0 ,1 ,2 **or** 3

allow a comparison eg has pH less than ethanoic acid.
*do **not** accept an incorrect pH.*

or

with ethanoic acid:

UI goes orange / yellow (1)

allow a comparison with HCl

has a pH 4 / or above (but less than 7) (1)

allow a comparison with HCl

1

(c) completely

1

(d) (i) conical flask

1

(ii) titration

1

(iii) repeat

allow compare with another students results

or

take average

1

[9]

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