PEARSON EDEXCEL GCSE CHEMISTRY · 1CH0

CHEMISTRY



MARK SCHEME

TOPIC 3: CHEMICAL CHANGES (PACK 2)

SCORE	PERCENTAGE
/115	%

STEMUP

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Q3.

Part (i) was less well answered with few candidates being able to explain why a new mixture was evaporated rather than the original mixture from the titration. In part (ii) the majority were able to correctly calculate the percentage yield of potassium chloride to gain both mark points, although only the best candidates were able to suggest a reason why the actual yield was greater than the theoretical yield, with many just giving the opposite of why the yield can be lower rather than thinking through the question and scenarios that might lead to the yield being higher. A good proportion were able to calculate the atom economy in the last part of question 4 to gain the full four marks available. In some cases, candidates scored just 3 marks as they had a misconception of the meaning of decimal place and gave an answer of 80 rather than 80.5.

Q4.

Less than half of the candidates scored any marks on this question. Very few seemed to understand the idea that zinc chloride is soluble and zinc carbonate is not, but some scored this mark.

Q5.

Half the candidates wrote a correct balanced half equation which was pleasing to see, as in the past this has normally the preserve of the top students. The main errors seen were where the equation was reversed or not balanced.

When sodium sulfate solution is electrolysed, using inert electrodes, hydrogen is formed at the cathode.

Write the half equation for the formation of hydrogen gas, H_2, from hydrogen ions, H^+.

(2)

$H_2 \rightarrow 2H^+ + 2e^-$

Results Plus: Examiner Comments

This half equation contained the correct species but in the wrong places - the equation is back to front. The first point was not scored and there was no mark for balancing an incorrect equation.

When sodium sulfate solution is electrolysed, using inert electrodes, hydrogen is formed at the cathode.

Write the half equation for the formation of hydrogen gas, H_2, from hydrogen ions, H^+.

(2)

$H^+ - 2e^- \rightarrow H_2$

Results Plus: Examiner Comments

The mark scheme has the first point the correct species in their place and the second point is for the balancing of those species. Unfortunately this candidate had chosen to use '-2 e-' on the left hand side instead of '+ 2e-' which meant the first mark could not be awarded. Had the left side contained '+2 e-', the second point could have been awarded as the half equation was not balanced.

Results Plus: Examiner Tip

In half equations, balancing of the charges is also needed.

Q6.

aii

Candidates performed well in this question, with many giving good descriptions of more than one process which have caused the percentage of carbon dioxide to decrease. Many stating dissolution of carbon dioxide into the oceans and the increase of plants which removed carbon dioxide.

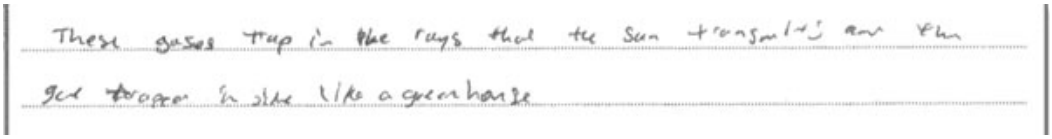
When oceans formed carbon dioxide was absorbed into the oceans. Also marine organisms took in CO_2 ~~for respiration~~ and green plants formed and converted CO_2 into O_2

Results Plus: Examiner Comments

A very good answer, which explains more than one process that has caused the percentage of carbon dioxide to decrease.

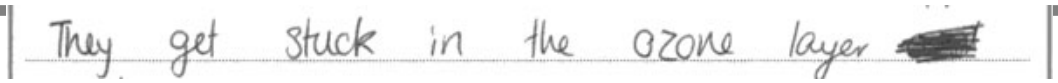
aiii

Candidates did not perform so well in this question, many gave quite vague answers and a large proportion were confused between processes and stated that these gases were involved in the ozone layer.



Results Plus: Examiner Comments

The question asks about how the gases keep the Earth warm, this answer does not relate to the heat provided by the sun, just rays which is insufficient to get the mark.

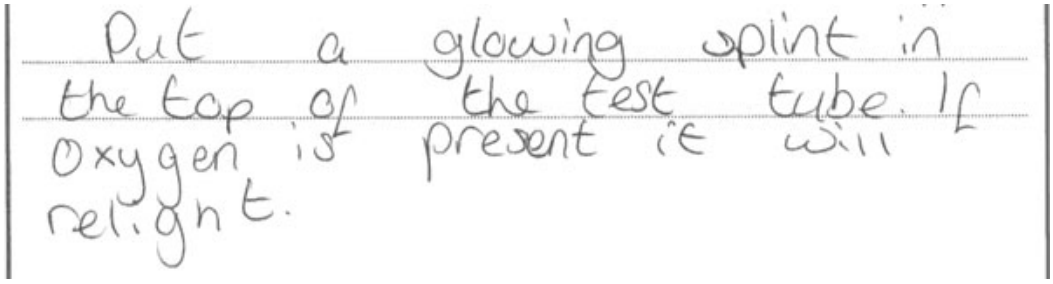


Results Plus: Examiner Comments

Many candidates incorrectly referred to the ozone layer and scored no marks.

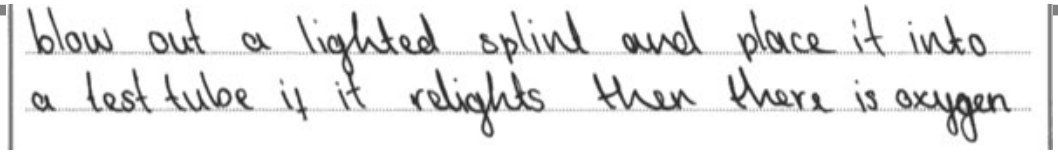
b

In general candidates performed well in this question. However many lost marks as they referred to a blown out splint instead of a glowing splint. A 'blown out' splint would not relight.



Results Plus: Examiner Comments

A good answer.



Results Plus: Examiner Comments

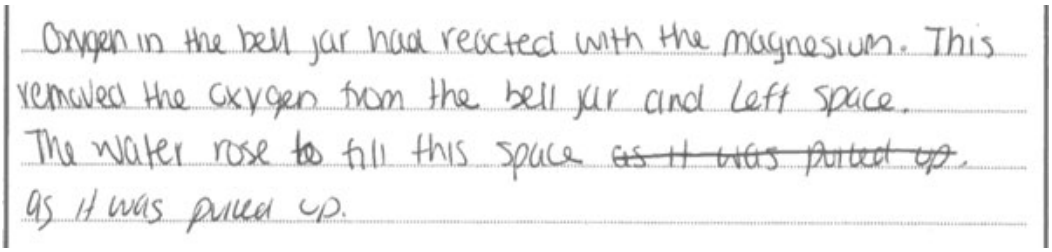
This is an example of a very common mistake, the candidate has stated that the splint has been blown out, if the splint has been blown out, it will not relight if it was placed in a test tube of oxygen and so the whole response gains no credit.

Results Plus: Examiner Tip

Scientific terms are important, ensure the correct terms are used as using less scientific terms can lead to answers that are inadequate as the science behind them would no longer be correct.

ci

Candidates did not perform well in this question, many just re-stated the question. They simply stated that the magnesium reacts with oxygen to form magnesium oxide. There was also evidence of some fundamental misunderstandings such as the magnesium oxide condensing or water vapour being produced, condensed and therefore increasing the water level.

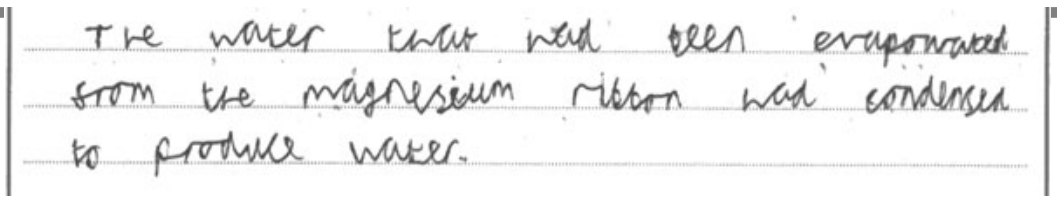

Oxygen in the bell jar had reacted with the magnesium. This removed the oxygen from the bell jar and left space. The water rose to fill this space ~~as it was pulled up.~~ as it was pulled up.

Results Plus: Examiner Comments

A rare correct answer, although the first part restates some of the question, it goes on to gain both marks for the removal of oxygen and the water rising to fill the space.

Results Plus: Examiner Tip

Ensure that when answering the question, the answer does not just restate information that is given in the question, as anything given in the question will not be given credit in the answer.

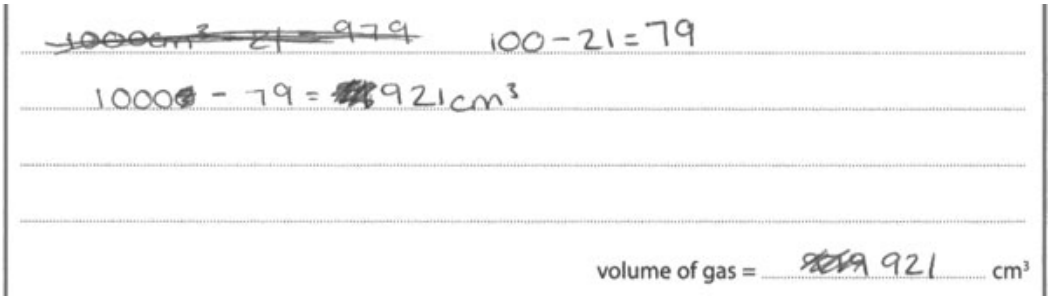

The water that had been evaporated from the magnesium ribbon had condensed to produce water.

Results Plus: Examiner Comments

Many candidates thought that water was produced from the reaction and so the water level rose as there was more water present in the bell jar.

cii

This question was generally well answered.



Results Plus: Examiner Comments

This candidate has correctly calculated the remaining gases present, but then could not complete the next step so just scored the first marking point.

Results Plus: Examiner Tip

Ensure that when answering calculation questions all your working is given.

Marks are awarded for chemistry not for using the calculator so if the working is correct but it written down incorrectly by mistake then credit can still be awarded.

d

This question was generally well answered, with many candidates being able to give the name of the salt formed as magnesium sulphate.

Q7. No Examiner's Report available for this question

Q8.

Part (i) proved quite difficult with many thinking that litmus paper could be used to measure pH. Part (ii) was better attempted with many candidates scoring. Many knew that the pH would increase until the pH was above 7, some showed the understanding that the hydroxide ions react with the hydrogen ions, but only the best scored the fourth marking point showing an understanding that the concentration of hydrogen ions was reduced. Where candidates lost marks it was often that they thought that the pH decreased. Many candidates copied that the magnesium hydroxide was in excess from the stem of the question, this gained no credit.

Q9. No Examiner's Report available for this question

Q10.

(i)

This question was well answered on the whole with most responses scoring the 1 mark available.

The majority of responses correctly gave the correct number of ions in the formula Al_2O_3, namely five.

In many incorrect responses, 2 was the given number, suggesting that candidates were giving the number of different elements in the formula rather than number of ions.

In a few cases, candidates had misinterpreted the question and had correctly calculated the formula mass for aluminium oxide.

(ii)

This question was well answered on the whole with most responses scoring at least 1 of the 2 marks available.

Many candidates gave both correct balancing numbers, 4 and 3 respectively, in the spaces of the balanced equation provided. This is an equation commonly seen in this area of the specification and appeared to be well understood by candidates.

Q11. No Examiner's Report available for this question

Q12. No Examiner's Report available for this question

Q13.

ai

Candidates seem to have a good understanding of what is meant by electrolysis. The majority of candidates knew that it is a process that requires electricity and some knew that a d.c. supply was used. However many candidates are still stating that it is the process of separating compounds, which is not sufficient as a response and does not score the second marking point.

Electrolysis is the decomposition of a compound into its constituent element using direct current electricity

Results Plus: Examiner Comments

A perfect answer including the decomposition of a compound and using direct current.

The Seperating of a Compound using electricity

Results Plus: Examiner Comments

Many candidates are still stating that it is the process of separating compounds, which is not sufficient as a response and does not score the first marking point.

Results Plus: Examiner Tip

When thinking about electrolysis remember

electro– electricity

lysis– splitting.

aii

This question was answered well by the majority of candidates with most being able to state that litmus paper bleaches. Although many candidates are not stating that the litmus is blue and that it is best when damp, marks were not lost for omitting these details.

It will turn damp litmus paper red, then bleech white. (2)

Results Plus: Examiner Comments

Whilst this candidate has not stated to use blue litmus the first marking point is still scored for litmus, they then state that the litmus turns red and is then bleached, so is awarded full marks overall.

If damp blue litmus paper turns red and then bleaches white it shows chlorine is present.

Results Plus: Examiner Comments

A perfect answer, fully describing how damp blue litmus paper turns red then is bleached white.

using a damp litmus paper should change colour

Results Plus: Examiner Comments

This candidate knows that damp litmus should be used so gains the first marking point. However, they have then not given sufficient detail of the colour change to be able to gain the second marking point.

Results Plus: Examiner Tip

If a colour change is occurring that you need to describe, always give the starting colour and the end colour of whatever substance is used.

aiii

Candidates found this question very difficult and only the best candidates scored the mark here.

Chlorine

Results Plus: Examiner Comments

This candidate has not given the complete name of the compound, just the name of one of the atoms that is present.

polyethene

Results Plus: Examiner Comments

This candidate has recognised that a polymer is present but has not given the correct name of the compound.

Results Plus: Examiner Tip

When naming a compound ensure that all parts of the structure are accounted for

poly– to show that it is a polymer

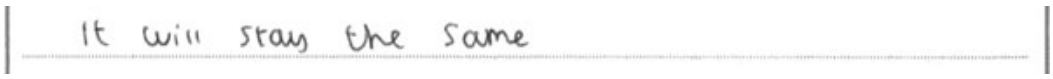
chloro– it contains chlorine

eth– from ethane

ene– as it formed a polymer from its double bond.

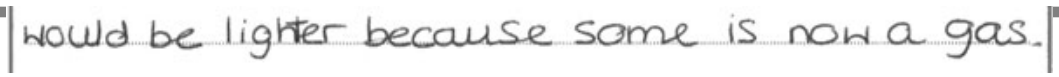
bii

Many candidates did not score here. Candidates that did not get the mark, did so as they thought that a gas was produced and so the mass decreased. They did not read the question fully and did not take on board that no gases were produced in the reaction and that a bung was in the top of the apparatus. There was also evidence of some fundamental misunderstandings such as the magnesium oxide condensing or water vapour being produced, condensed and therefore increasing the water level.



Results Plus: Examiner Comments

Fine, scores one mark.



Results Plus: Examiner Comments

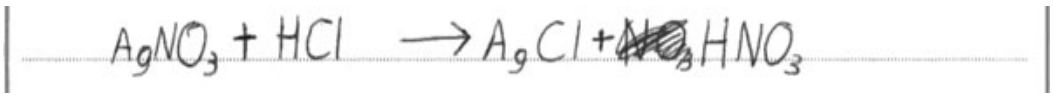
The candidate has not read the question and realised that no gas has been made or seen that there was a bung on top of the conical flask.

Results Plus: Examiner Tip

Check that you read the question fully. When practicals are being discussed ensure that you are clear as to what the reactants and the products are.

biii

Candidates showed that they could write equations and many scored here. However candidates that had not learnt the formulae of the common laboratory acids did not score here.



Results Plus: Examiner Comments

Fine, 2 marks awarded.



Results Plus: Examiner Comments

Whilst the reactants side of the equation was correct for one mark, this candidate could not recall the formulae of nitric acid, the only other product in the reaction.

Results Plus: Examiner Tip

It is important that candidates can recall the formulae of common laboratory compounds used in the specification such as hydrochloric acid and nitric acid.

Q14.

Many candidates recognised that the pH should rise or increase when the concentration decreased but did not say by how much.

Q15.

(ii) Not well answered overall, with some candidates discussing ideas of reactivity to explain why hydrogen forms rather than sodium at the cathode – not answering what had been asked in the question.

Q16. No Examiner's Report available for this question

Q17. No Examiner's Report available for this question

Q18. No Examiner's Report available for this question

Q19. No Examiner's Report available for this question

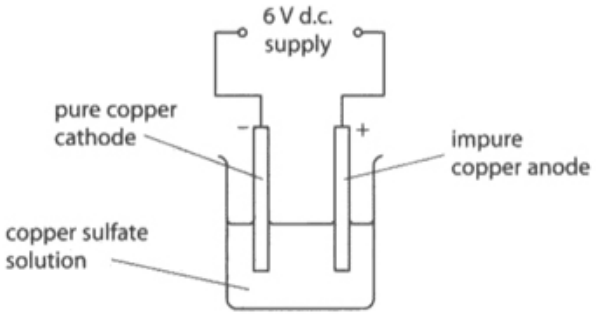
Q20. No Examiner's Report available for this question

Q21.

This was a poorly answered question overall. Most candidates failed to give any creditworthy points. Of the correct responses seen, most gained just 2 marks, Level 1, often by a simple description of the deposition of copper at the cathode and a decrease in size of the anode. Few candidates could add further description for Level 2, let alone explain the redox processes, necessary for Level 3.

*(d) Impure copper can be purified using electrolysis.

The impure copper is used as the anode.
A pure copper cathode is used.
The electrodes are placed in copper sulfate solution.
A direct electric current is passed through the solution.



Describe and explain what is seen when this apparatus is used to purify a piece of impure copper.

(6)

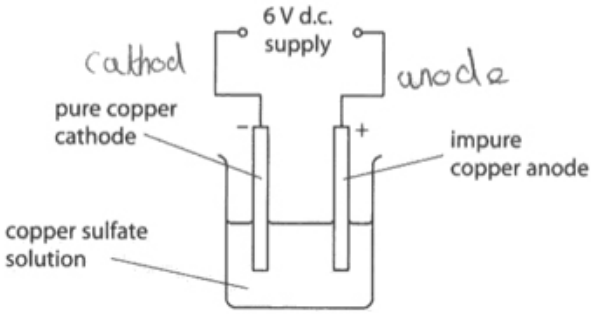
The copper ions from the impure copper anode are released into the copper sulfate solution. The impurities deposit and form sludge at the bottom of the beaker. The pure copper ions attract to the cathode as the pure copper ions are positively charged. The impure copper anode will decrease in mass as oxidation (loss of electrons) occurs and the cathode of pure copper will increase in mass as reduction occurs (gain of electrons). This will leave a pure copper cathode.

Results Plus: Examiner Comments

A typical good quality Level 3 answer. There is a detailed description (3 clear points) and an explanation (3 clear points). This was awarded 6 marks.

*(d) Impure copper can be purified using electrolysis.

The impure copper is used as the anode.
A pure copper cathode is used.
The electrodes are placed in copper sulfate solution.
A direct electric current is passed through the solution.



Describe and explain what is seen when this apparatus is used to purify a piece of impure copper.

(6)

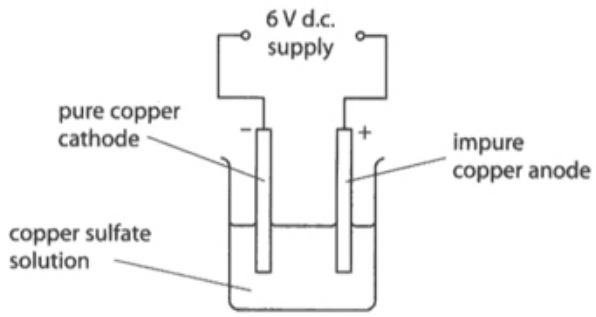
Copper is ~~negatively~~ positively charged so is attracted to the negatively charged cathode. At the cathode a copper coating begings to form, the size of the cathode increases through out the purification. At the anode, since copper atoms are being lost, the size of the anode decreases and impurities form below the anode. ~~Sulfate~~ Sulfur gas is given off also at the anode since ~~it has~~ sulfur is negatively charged. ~~The~~ At the beging of the electrolysis the solution was blue but at the end the blue fades

Results Plus: Examiner Comments

A typical Level 2 response. There is sufficient description of processes occurring at the cathode and anode and of the impurities, so this was awarded 4 marks. There is insufficient explanation to award Level 3.

*(d) Impure copper can be purified using electrolysis.

The impure copper is used as the anode.
A pure copper cathode is used.
The electrodes are placed in copper sulfate solution.
A direct electric current is passed through the solution.



Describe and explain what is seen when this apparatus is used to purify a piece of impure copper.

(6)

The copper sulfate solution will start to fizz as the electrons move to the anode and cathode through the solution. The pure copper will start to build up around the cathode and a sludge will start to form in the solution.

Results Plus: Examiner Comments

A typical Level 1 response. Only two valid descriptions have been made, namely the build up of copper on the cathode and the formation of sludge, ignoring the first few lines in the response. This was awarded 2 marks only.

Q22.

(i)

Most candidates correctly identified electrolysis.

(i) Give the name of this process in which substances, such as hydrochloric acid, are decomposed by a direct electric current.

(1)

decomposition

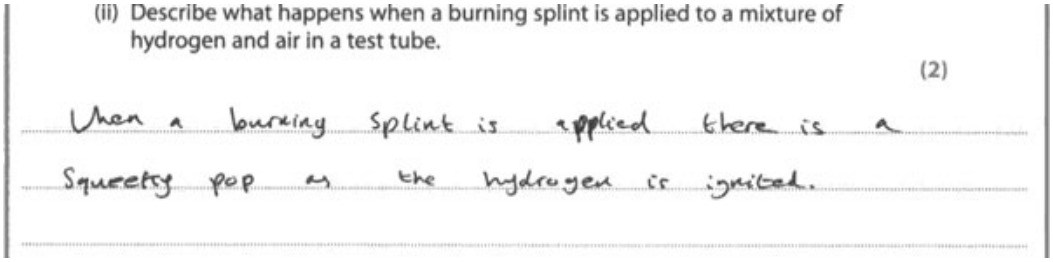
Results Plus: Examiner Comments

A rephrasing of the question is not creditworthy.

(ii)

This question asked for this well known test in a slightly different way. It was well answered, with "squeaky pop" a frequent response. Some candidates just stated "squeaky pop test", which is rather lacking in detail as a description (but was credited). Some answers just mentioned "pop"; the fact that the question was worth 2 marks should indicate that this answer is insufficient. The alternatives of the hydrogen burning or water being formed (allowed in this case due to the way the question was phrased) were rarely seen.

Where the answer was incorrect there was confusion particularly with the test for oxygen - "splint relights" - or just stating that the "splint goes out".


(ii) Describe what happens when a burning splint is applied to a mixture of hydrogen and air in a test tube.

(2)

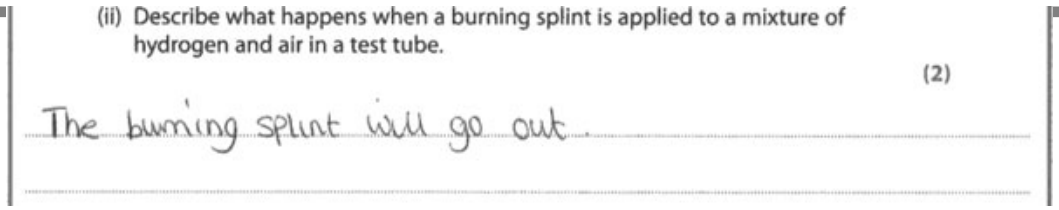
When a burning splint is applied there is a squeeky pop as the hydrogen is ignited.

Results Plus: Examiner Comments

A good, clearly written answer that even explains why a squeaky pop occurs.

Results Plus: Examiner Tip

Try to spell words correctly!


(ii) Describe what happens when a burning splint is applied to a mixture of hydrogen and air in a test tube.

(2)

The burning splint will go out.

Results Plus: Examiner Comments

The candidate has not learnt the gas tests.

Results Plus: Examiner Tip

Tests are an important part of Chemistry and often feature in exam papers.

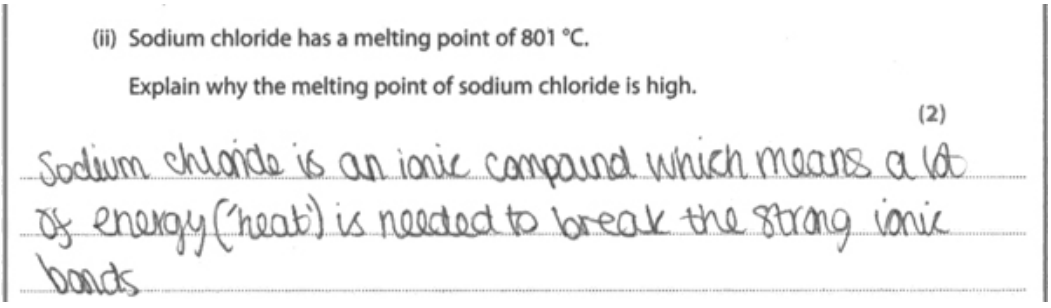
Q23.

This was well answered on the whole, with most candidates able to correctly identify the two cations, Mg^{2+} and Na^{+}, for the 1 mark available. Occasionally, candidates simply listed all the ions and consequently did not score.

Q24.

(a) (ii)

The high melting point of sodium chloride was well explained by large numbers of candidates with many scoring full marks. The majority of incorrect answers were in terms of molecules, or intermolecular forces. Marks were usually achieved by reference to strong (ionic) bonds and a lot of energy being needed to break them. However even strong candidates rarely mentioned the attraction between oppositely charged ions.



(ii) Sodium chloride has a melting point of 801 °C.

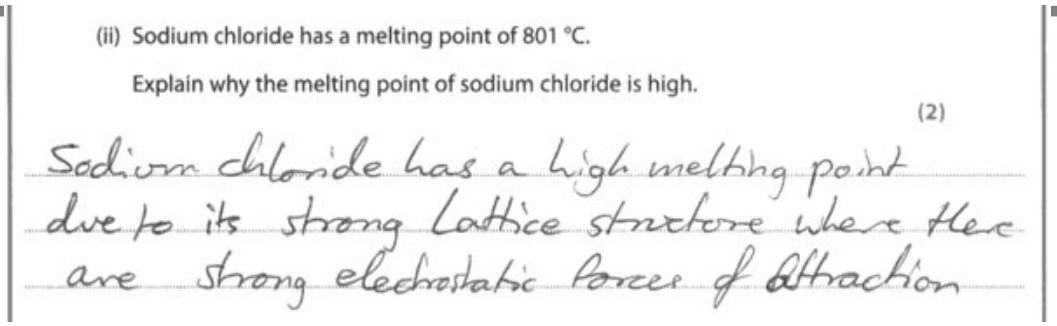
Explain why the melting point of sodium chloride is high.

(2)

Sodium chloride is an ionic compound which means a lot of energy ('heat') is needed to break the strong ionic bonds

Results Plus: Examiner Comments

A typical way in which both marks were gained.



(ii) Sodium chloride has a melting point of 801 °C.

Explain why the melting point of sodium chloride is high.

(2)

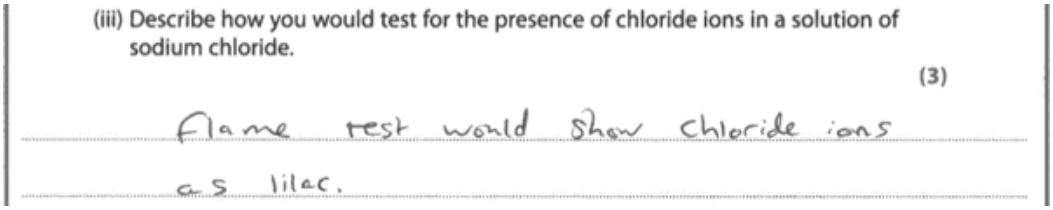
Sodium chloride has a high melting point due to its strong Lattice structure where there are strong electrostatic forces of attraction

Results Plus: Examiner Comments

Candidate gains one mark for correctly mentioning the strong electrostatic forces of attraction but like many others did not refer to them being between oppositely charged ions and so did not gain the second mark.

(a) (iii)

Strong candidates knew this test and gave a perfect answer. A few lost the first mark for failing to add nitric acid or adding hydrochloric acid instead. Some added the nitric acid and failed to mention silver nitrate so also lost out on the precipitate mark. Some candidates attempted an alternative method of determining if a chloride was present. Of these some gained a mark for mentioning electrolysis but then took it no further. Surprisingly, many candidates thought you could test for chloride ions using a flame test.



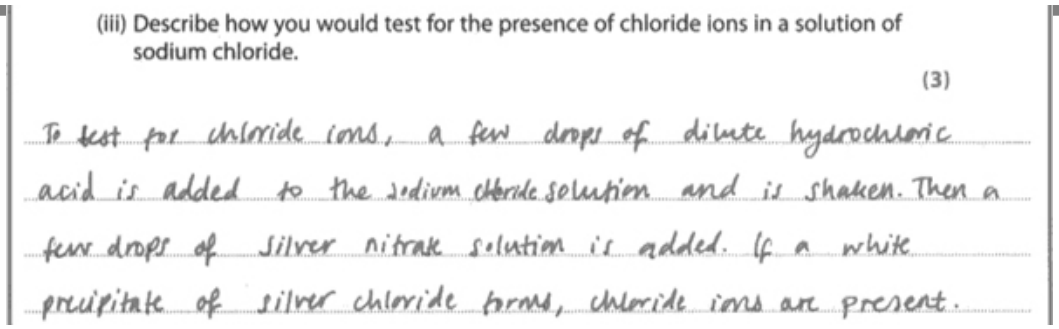
(iii) Describe how you would test for the presence of chloride ions in a solution of sodium chloride.

(3)

flame test would show chloride ions as lilac.

Results Plus: Examiner Comments

This sort of answer was surprisingly seen quite often.



(iii) Describe how you would test for the presence of chloride ions in a solution of sodium chloride.

(3)

To test for chloride ions, a few drops of dilute hydrochloric acid is added to the sodium chloride solution and is shaken. Then a few drops of silver nitrate solution is added. If a white precipitate of silver chloride forms, chloride ions are present.

Results Plus: Examiner Comments

Like quite a few others, this candidate incorrectly used hydrochloric acid (others simply said use an acid) but was able to score the other marks available.

(b)

It was pleasing to see good attempts being made in this free response question with over half of the candidates producing an answer worthy of level 2 or 3. A good understanding of the formation of magnesium oxide was demonstrated by many candidates with the transfer of electrons from magnesium to oxygen being well described, though fewer candidates could provide the correct formulae of the two ions formed. Surprisingly, significant numbers tried to

explain the formation of magnesium oxide in terms of covalent bonding even though they were told in the question that magnesium oxide was an ionic compound. The structure of solid magnesium oxide often received scant treatment, and this was the major reason for not achieving level 3. Some candidates did refer to a lattice structure but often did not mention electrostatic attraction between the oppositely charged ions. Some candidates correctly described properties of magnesium oxide but such answers were not answering the question and so did not gain credit.

*(b) Magnesium has an electronic configuration of 2.8.2.
Oxygen has an electronic configuration of 2.6.

Explain, in terms of their electronic configurations, how magnesium and oxygen atoms react to form the ionic compound magnesium oxide, MgO, and include a description of the structure of solid magnesium oxide.

(6)

Magnesium has 3 shells of electrons with ~~two~~ electrons on the outer most shell. Oxygen has 2 shells of electrons and has ~~6 electrons~~ six electrons on the outer most shell. To make each element stable there needs to be a complete shell of eight electrons on the outer most shell. So magnesium gives out two electrons while oxygen gains two electrons. The two free electrons on the outer most shell of magnesium breaks away and joins the oxygen atom. So now ~~both~~ both elements ~~are~~ have complete outer shells of eight and are combined together creating a solid compound of Magnesium Oxide. Magnesium has an ionic charge of +2 as it gives out electrons and oxygen has an ionic charge of -2 as it takes electrons.

$Mg + O \longrightarrow MgO_{(s)}$

$Mg^{2+} + O^{2-} \longrightarrow MgO_{(s)}$

Results Plus: Examiner Comments

A decent description of the formation of the ions and the charges on them are shown but no reference to the structure of magnesium oxide so this was a level 2 answer and given four marks.

*(b) Magnesium has an electronic configuration of 2.8.2.
Oxygen has an electronic configuration of 2.6.

Explain, in terms of their electronic configurations, how magnesium and oxygen atoms react to form the ionic compound magnesium oxide, MgO, and include a description of the structure of solid magnesium oxide.

(6)

Magnesium ~~has~~ has an atomic mass of 24 and an atomic number of 12. This means that the electronic configeration for this is 2, 8, 2. This also means that it has 12 ~~protons~~ electrons ~~and~~, protons and neutrons. Oxygen has the atomic mass of 16 and the atomic number for it is 8. This means that the electronic configeration for it is 2, 6 and it has 8 electrons, 8 protons and 8 neutrons. These two react to form the ionic compound magnesium oxide. The structure of this simple molecular covalent. ~~It has a low melting and boiling~~ It has a low melting and boiling point and the electrons ~~are~~ are, quite far away from eachother and has weak forces of attraction between them.

Results Plus: Examiner Comments

Regrettably even though the candidate has written quite a lot they have not described the ion formation and despite saying it is an ionic compound have then contradicted themself by saying the structure is simple molecular covalent. Hence there is nothing creditworthy here.

Q25.

(b) (ii)

The majority of candidates did not appreciate that carbon dioxide is produced when dilute hydrochloric acid is added to potassium carbonate. Most students therefore described the test for hydrogen and occasionally the test for oxygen.

Of those who did identify the gas as being carbon dioxide a significant number described a lit splint being extinguished as a viable test for carbon dioxide.

(ii) When dilute hydrochloric acid is added to potassium carbonate, a gas is evolved.

Describe the test for this gas.

(2)

You can use a lit splint and put it into the gas and it should make a popping sound.

Results Plus: Examiner Comments

An all too common answer suggesting a test for hydrogen.

(ii) When dilute hydrochloric acid is added to potassium carbonate, a gas is evolved.

Describe the test for this gas.

(2)

Add the potassium carbonate to acid and let the CO_2 molecule go through the delivery tube to lime water and if carbonate is present, lime water will turn cloudy/milky.

Results Plus: Examiner Comments

An example of a very good response.

Q26.

Most candidates could recall 'hydrogen', as being the correct gas from the 'pop' test, to score the 1 mark available.

Q27.

Most candidates were able to score at least 1 of the 2 available marks, typically for stating the correct formulae of the reactants in this balanced equation as given in the stem of the question.

(b) Magnesium carbonate, $MgCO_3$, can be reacted with dilute sulfuric acid, H_2SO_4, to form magnesium sulfate, water and carbon dioxide.

Write the balanced equation for this reaction.

(2)

$MgCO_3 + H_2SO_4 \rightarrow MgSO_4 + H_2O + CO_2$

Mg 1 - 1
C 1
O 3 - 4
H 2
S 1 - 1

Results Plus: Examiner Comments

A typical example of a fully correct answer for 2 marks. Although, not necessary, this candidate has clearly checked the balancing beneath.

(b) Magnesium carbonate, $MgCO_3$, can be reacted with dilute sulfuric acid, H_2SO_4, to form magnesium sulfate, water and carbon dioxide.

Write the balanced equation for this reaction.

(2)

$2MgCO_3 + 2H_2SO_4 \rightarrow$ ~~Magnesium sulfate~~ $2MgSO_4 + H_2O + CO_2$

Results Plus: Examiner Comments

Although the correct formulae of the reactants reactants and products have been shown, the incorrect attempt at balancing, limited the score to 1 mark only.

Q28.

(b)

This question was very poorly answered. Most candidates struggled with writing the ionic equation for neutralisation. It was apparent that very few candidates knew what is meant by an ionic equation, let alone how to write one.

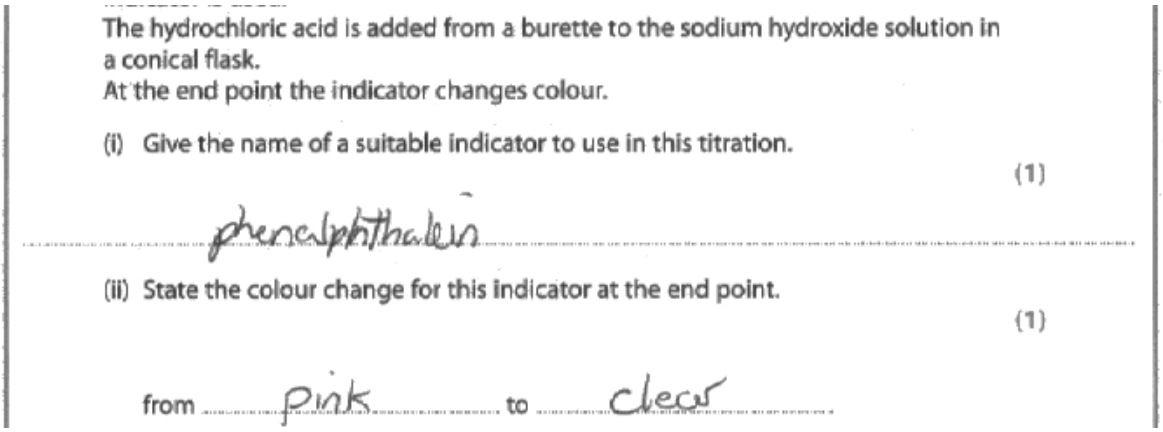
Many wrote the full symbol equation, and in few cases, word equation. Some candidates were able to score 1 mark for the inclusion of the spectator ions, sodium and chloride ions, on both sides of the equation.

(c)

Although there were many correct responses seen by examiners, typically for 'phenolphthalein'

or 'methyl orange' coupled with their correct colour changes, many candidates incorrectly suggested indicator paper or 'universal indicator' as a suitable indicator. Centres need to stress to candidates that universal indicator solution is not acceptable for titrations.

Common errors were noted by examiners: extremely poor spelling, particularly for phenolphthalein, such that it was not phonetic and could not score. Occasionally, where a correct indicator had gained credit, the mark for the colour change was not scored, since the change was the incorrect way round or 'clear' was incorrectly used instead of 'colourless' when referring to phenolphthalein.



The hydrochloric acid is added from a burette to the sodium hydroxide solution in a conical flask.
At the end point the indicator changes colour.

(i) Give the name of a suitable indicator to use in this titration.

(1)

phenolphthalein

(ii) State the colour change for this indicator at the end point.

(1)

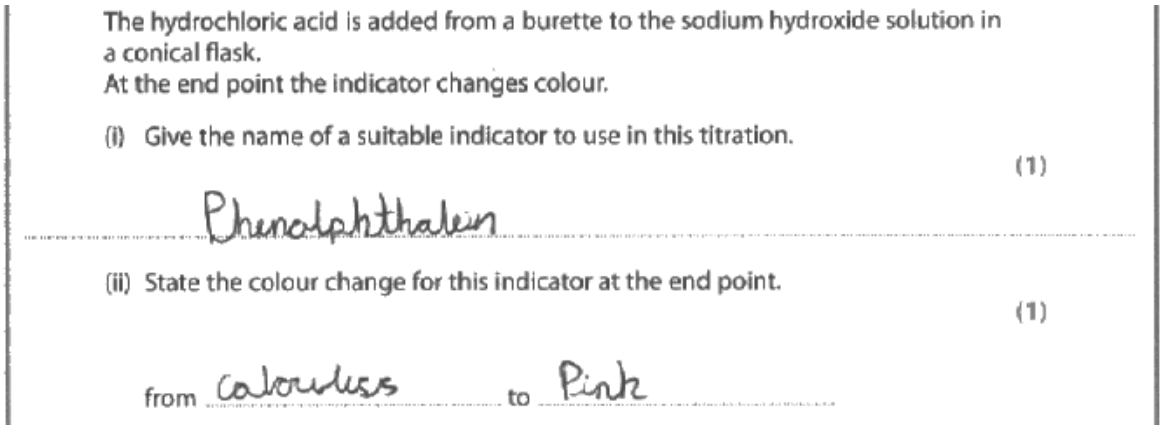
from pink to clear

Results Plus: Examiner Comments

This response mentions 'phenolphthalein' which scored 1 mark for part (i). Unfortunately, the second marking point (pink to colourless) for part (ii) was not awarded, since 'clear' is not equivalent to colourless.

Results Plus: Examiner Tip

This is a commonly asked question. It is worthwhile learning key indicators and their correct corresponding colour changes. Remember, universal indicator solution should never be used as an indicator for titration experiments.



The hydrochloric acid is added from a burette to the sodium hydroxide solution in a conical flask.
At the end point the indicator changes colour.

(i) Give the name of a suitable indicator to use in this titration.

(1)

Phenolphthalein

(ii) State the colour change for this indicator at the end point.

(1)

from colourless to Pink

Results Plus: Examiner Comments

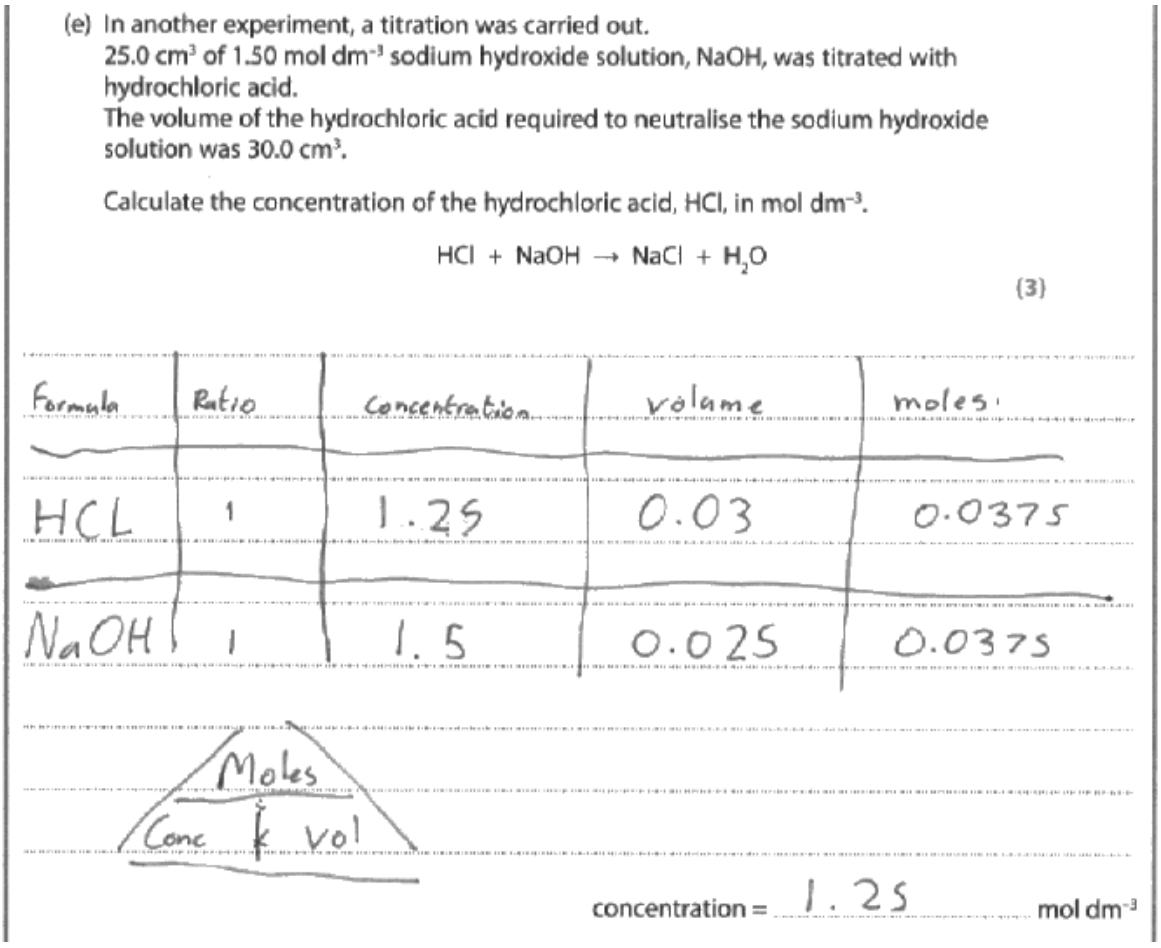
This response scored 1 mark only for correct indicator (and spelled correctly) in part (i), but the colour change is the wrong way round, so the second marking point was not scored.

(d)

The majority of candidates correctly calculated the correct concentration for the 2 marks available, or at least 1 mark for correctly calculating the Relative Formula Mass for sodium hydroxide. Commonly seen errors included: dividing the Relative Formula Mass (40 g) by the mass (20 g), namely 40/20, as opposed to the other way round, 20/40. Some calculated the mass concentration, 20 g dm^{-3}, which gained 1 mark only.

(e)

Examiners were impressed by the high quality of responses seen, many scoring the full 3 marks available. It was evident that many candidates were able to use the formulae for calculating moles and concentrations competently. Occasionally, candidates inverted arithmetic or lost marks with powers of ten errors, so were limited to 1 or 2 marks. A few answers gained credit for clearly stating that the reactants were in a ratio 1:1.



(e) In another experiment, a titration was carried out.
25.0 cm^3 of 1.50 mol dm^{-3} sodium hydroxide solution, NaOH, was titrated with hydrochloric acid.
The volume of the hydrochloric acid required to neutralise the sodium hydroxide solution was 30.0 cm^3.

Calculate the concentration of the hydrochloric acid, HCl, in mol dm^{-3}.

$$HCl + NaOH \rightarrow NaCl + H_2O$$

(3)

Formula	Ratio	Concentration	volume	moles
HCL	1	1.25	0.03	0.0375
NaOH	1	1.5	0.025	0.0375

Moles
Conc x vol

concentration = 1.25 mol dm^{-3}

Results Plus: Examiner Comments

A typical example of a fully correct response, 3 marks. This candidate has used the correct formula triangle and shown all the quantities in a table (correctly calculated the number of moles of sodium hydroxide, and recognised that the reaction is in a 1:1 ratio, and has then calculated the concentration of the hydrochloric acid).

Q29.

(ii)

Candidates found it quite hard to name barium sulfate as the precipitate formed.

(ii) Give the name of the white precipitate formed by the reaction of barium chloride solution with dilute sulfuric acid.

(1)

barium sulphate precipitate

Results Plus: Examiner Comments

The correct answer that scored the mark.

(ii) Give the name of the white precipitate formed by the reaction of barium chloride solution with dilute sulfuric acid.

(1)

barium

Results Plus: Examiner Comments

A common error seen was to simply state barium as the white precipitate formed.

(ii) Give the name of the white precipitate formed by the reaction of barium chloride solution with dilute sulfuric acid.

(1)

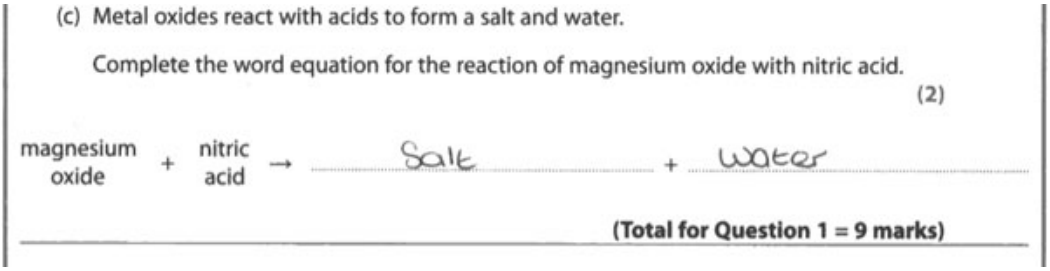
Barium Sulfide

Results Plus: Examiner Comments

In some cases candidates gave 'barium sulfide' or were too vague with their answer and just stated salt.

Q30.

Many answers scored one mark for water which just needed to be transposed (although a significant minority did not include water as a product). Most candidates did not recognise that nitrates are formed from nitric acid, so naming the salt was a good discriminator. A very large number just gave "salt". Other incorrect responses included magnesium nitric, magnesium acid, nitrogen oxide, hydrogen or oxygen. Some answers gave too many products, when the answer space clearly indicated the correct number.



(c) Metal oxides react with acids to form a salt and water.

Complete the word equation for the reaction of magnesium oxide with nitric acid.

(2)

magnesium oxide + nitric acid → Salt + water

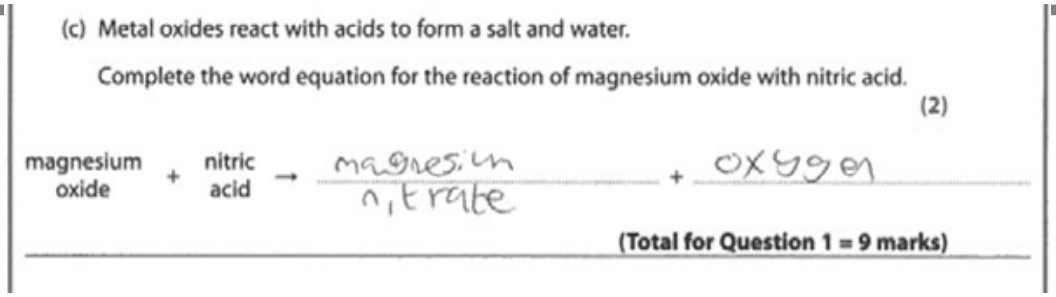
(Total for Question 1 = 9 marks)

Results Plus: Examiner Comments

The most common answer to this question.

Results Plus: Examiner Tip

Remember that the salt formed depends on the acid used.



(c) Metal oxides react with acids to form a salt and water.

Complete the word equation for the reaction of magnesium oxide with nitric acid.

(2)

magnesium oxide + nitric acid → magnesium nitrate + oxygen

(Total for Question 1 = 9 marks)

Results Plus: Examiner Comments

There were examples of correctly identified salts.

Results Plus: Examiner Tip

It's a pity that the candidate has completed the hard task of identifying the salt but has not read the question where water was given as the other product. The examiners give lots of clues in the questions.

Q31. No Examiner's Report available for this question

Q32.

(a)

Many candidates were able to state that another effect of hydrochloric acid in the stomach was to kill bacteria. However many candidates did not read the question correctly and just repeated the stem in their answer.

3 Hydrochloric acid is present in the stomach to help digestion.

(a) State another effect hydrochloric acid has in the stomach.

(1)

To kill any bacteria in the stomach.

Results Plus: Examiner Comments

A correct answer for 1 mark.

3 Hydrochloric acid is present in the stomach to help digestion.

(a) State another effect hydrochloric acid has in the stomach.

(1)

to ~~brea~~ help break up food in the digested system.

Results Plus: Examiner Comments

The question stem states that hydrochloric acid is present in the stomach to help digestion. This learner has then simply repeated the stem of the question and so cannot gain any credit.

STEMUP.CO.UK

Results Plus: Examiner Tip

When you have written your answer it is good practice to re-read the question along with your answer to check that you have answered the question that has been posed and that you have not repeated the stem of the question.

Q33.

Many candidates were able to score some credit on this question, however few could give a complete description of this basic practical to gain all three of the available marks.

Excess solid nickel carbonate is added to dilute sulfuric acid in a beaker.

nickel carbonate + sulfuric acid → nickel sulfate + carbon dioxide + water

Nickel sulfate is formed in solution.

Describe how a sample of pure, dry nickel sulfate crystals can be obtained from the mixture of nickel sulfate solution and excess solid nickel carbonate in the beaker.

(3)

nickel sulfate crystals can be obtained from the mixture using ~~any~~ filtration. A funnel is added to the top of a beaker and filter paper added, with the cloth. the mixture is poured into the funnel, where the filter paper allows the small solution liquid molecules ~~to~~ through, which are the collected in the beaker. ↑ but the nickel of nickel sulfate and nickel carbonate. sulfate crystals are too large to go through the filter paper so collect in the funnel, ready to be collected/obtained.

Results Plus: Examiner Comments

Many answers had no filtration at all. Others filtered but thought that this would filter out nickel sulfate crystals. In this example, although filtering is mentioned, because nickel sulfate is the residue this cannot score. They are filtering the crystals from a solution which is incorrect and so

scored no marks.

Excess solid nickel carbonate is added to dilute sulfuric acid in a beaker.

nickel carbonate + sulfuric acid → nickel sulfate + carbon dioxide + water

Nickel sulfate is formed in solution.

Describe how a sample of pure, dry nickel sulfate crystals can be obtained from the mixture of nickel sulfate solution and excess solid nickel carbonate in the beaker.

(3)

burn off the excess sulfuric acid and water from the nickel mixture. Titration is needed and once titration has happened, repeat it without the acid, and then leave it in a warm place for the dry nickel sulfate crystals to form.

Results Plus: Examiner Comments

In some cases, candidates started by describing an alternative method of making the nickel sulfate solution and therefore scored a maximum of 1 mark. In this example, the candidate scored 1 mark for showing an understanding that the solution should be left in a warm place for the crystals to form.

Excess solid nickel carbonate is added to dilute sulfuric acid in a beaker.

nickel carbonate + sulfuric acid → nickel sulfate + carbon dioxide + water

Nickel sulfate is formed in solution.

Describe how a sample of pure, dry nickel sulfate crystals can be obtained from the mixture of nickel sulfate solution and excess solid nickel carbonate in the beaker.

(3)

Filtration + crystallisation. Filter the mixture of nickel sulfate solution + excess solid nickel carbonate into a beaker. The insoluble nickel carbonate (excess) will stay in the filter paper. Then ~~use~~ heat ~~on~~ slowly until bubbling occurs, then take off heat + leave to stand and crystals appear of pure nickel sulfate.
larger crystals will form if cooled slowly/evaporation takes longer

Results Plus: Examiner Comments

A good answer that scored all three marks.

Q34.

This was generally well-answered, but the lack of filtration as the first step restricted many candidates to two marks. Most went on to heat the solution, but often there was detail missing as to how dry crystals would be obtained.Some thought that after filtration, the nickel sulfate would be found on the filter and so described how that should be dried. The weaker students tended to describe the addition of the nickel carbonate to the sulfuric acid before a mention of crystallisation. A few answers included fractional distillation as the first step.

Excess solid nickel carbonate is added to dilute sulfuric acid in a beaker.

$$\text{nickel carbonate} + \text{sulfuric acid} \rightarrow \text{nickel sulfate} + \text{carbon dioxide} + \text{water}$$

Nickel sulfate is formed in solution.

Describe how a sample of pure, dry nickel sulfate crystals can be obtained from the mixture of nickel sulfate solution and excess solid nickel carbonate in the beaker.

(3)

* Next Firstly you would filter the solution heat the solution using a bunsen burner to allow any water to evaporate from the solution.

* Firstly, you would filter away the excess solid nickel carbonate.

Leave the rest of the solution in a drying cupboard.

Results Plus: Examiner Comments

By carefully wording the answer the candidate did score the 1st mark for 'Firstly you would filter ....'. 'Next you would heat the solution ...' scored the 2nd mark. The final line scored the 3rd mark for leaving it in a warm place - the drying cupboard.

3 marks overall

Excess solid nickel carbonate is added to dilute sulfuric acid in a beaker.

$$\text{nickel carbonate} + \text{sulfuric acid} \rightarrow \text{nickel sulfate} + \text{carbon dioxide} + \text{water}$$

Nickel sulfate is formed in solution.

Describe how a sample of pure, dry nickel sulfate crystals can be obtained from the mixture of nickel sulfate solution and excess solid nickel carbonate in the beaker.

(3)

First, you put the solution over a heat source (bunsen burner) to evaporate all of the water. Next you would make a cone with filter paper and put it in a beaker. You would then pour the solution into the filter paper, this will seperate the nikel Sulfate and the nikel carbonate. you will then dispose of the nikel carbonate and be left with the pure, dry nikel Sulfate crystals.

Results Plus: Examiner Comments

The filtering and heating steps are the wrong way around so 1 mark only was scored.

Results Plus: Examiner Tip

Practice answering questions that involve practical work. Organise your thoughts into a logical order before starting to write your answer.

Q35.

(b)

This question had a good response, with many candidates able to state the name of a suitable indicator for the first marking point, typically for 'universal indicator', 'phenolphthalein', 'methyl orange' or '(red/blue) litmus'. The second marking point, for the correct colour in acid, was less frequently scored.

Common errors were noted by examiners: poor spelling, particularly for phenolphthalein, such as it was often not phonetically spelt and could not score. Occasionally, where a correct indicator gained credit, the mark for the colour in acid was not scored, since candidates incorrectly gave the colour for the indicator in an alkaline or neutral solution.
Also, when 'phenolphthalein' was given as a correct indicator, 'clear' was incorrectly referred to instead of 'colourless' as the colour in acid.

(b) An indicator can be used to show that ethanoic acid is acidic.

Give the name of an indicator that can be used and state its colour in the acid.

(2)

indicator phenophthalein

colour in acid Colourless

Results Plus: Examiner Comments

In this response, a correct indicator, namely 'phenolphthalein' and the correct colour in acid, namely 'colourless' have been given, so it scored 2 marks. The misspelling of phenolphthalein is a minor error, since it is still easily recognisable.

(b) An indicator can be used to show that ethanoic acid is acidic.

Give the name of an indicator that can be used and state its colour in the acid.

(2)

indicator Universal indicator

colour in acid purple

Results Plus: Examiner Comments

This response scored 1 mark only for stating a correct indicator, namely 'Universal Indicator'. The colour given for Universal Indicator in acid, 'purple' is incorrect, so the second mark was not scored.

Results Plus: Examiner Tip

This is a commonly asked question. It is worthwhile learning commonly used indicators and their corresponding colour changes in preparation for the examination.

(c) (i)

Most candidates were able to identify 'oxygen' as the correct gas.

(c) (ii)

Most candidates were able to identify 'hydrogen' as the correct gas, from result of the pop test given in the question. Occasionally, the gas was confused with carbon dioxide.

(c) (iii)

Most candidates were able to identify 'carbon dioxide' as the correct gas formed between an acid and a carbonate.

(d)

Many candidates were able to score at least 1 of the 2 marks available, mainly for writing out the correct reactants on the Left Hand Side. Despite having been given so much information in the stem of the question, namely all the names of the reactants and products, many candidates either omitted one of the products or commonly added 'ester' to the products side, not recognising the fact that 'ethyl ethanoate' is the ester. Some candidates misread the question and attempted to give a balanced equation, but frequently could only recall the formula for water.

(d) Ethanoic acid is reacted with ethanol to produce an ester, ethyl ethanoate, and water.

Write the word equation for this reaction.

(2)

Ethanoic acid + ethanol → ester + ethyl ethanoate + water

Results Plus: Examiner Comments

This was a commonly seen response and scored 1 mark only for correctly showing the reactants. On the products side, the word 'ester' has been included, so the mark for the correct products

has not been scored.

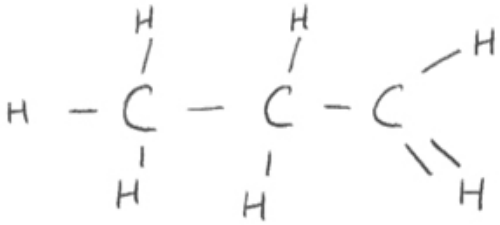
Q36.

(a) (ii)

Many candidates knew that oxidation is loss of electrons. Some candidates were confused between chloride ions and chlorine and it was not unusual to see that some candidates read the half-equation in reverse and they wrote about chlorine gaining electrons. Some candidates wrote that the chloride ions lost their negative charge but this did not score any marks as they needed to refer to electron loss.

(ii) Draw the structure of a molecule of propene, showing all covalent bonds.

(2)



Results Plus: Examiner Comments

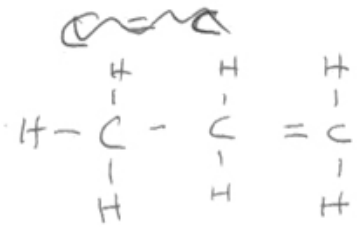
This candidate knew that propene has three carbon atoms and a double dond, but they have shown the double bond between a carbon atom and a hydrogen atom so did not score a mark.

Results Plus: Examiner Tip

Remember that hydrogen atoms only form 1 bond.

(ii) Draw the structure of a molecule of propene, showing all covalent bonds.

(2)



Results Plus: Examiner Comments

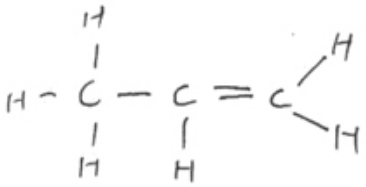
This candidate knew that there should be three carbon atoms and one double bond, so scored 1 mark. However, there are too many hydrogen atoms on the central carbon atom.

Results Plus: Examiner Tip

Remember that carbon atoms only form 4 bonds.

(ii) Draw the structure of a molecule of propene, showing all covalent bonds.

(2)



Results Plus: Examiner Comments

This was a clear, correct answer scoring two marks.

Results Plus: Examiner Tip

Learn that all alkenes contain a double bond between two carbon atoms.

Learn that the prefixes of the names give the number of carbon atoms in the molecules.
meth- shows 1 carbon atom.
eth- shows 2 carbon atoms.
prop- shows 3 carbon atoms.
but- shows 4 carbon atoms.

(c) (i)

Many candidates were able to describe one observation for the reaction between sodium carbonate and dilute ethanoic acid, but far fewer could describe two observations. Some candidates stated that carbon dioxide is produced but did not state what they would **see** as a gas is formed.

(c) (i) Describe what you would **see** when solid sodium carbonate is added to dilute ethanoic acid.

(2)

a gas is formed and the Mixture will turn cloudy.

Results Plus: Examiner Comments

This candidate knows that a gas is formed but has not stated what they would **see**during the reaction.

Results Plus: Examiner Tip

When a gas is formed from a reaction involving a solid and a solution, you will always see the gas as fizzing or effervescence.

(c) (i) Describe what you would **see** when solid sodium carbonate is added to dilute ethanoic acid.

(2)

A reaction taking place and bubbles coming off the Sodium carbonate

Results Plus: Examiner Comments

This candidate scored 1 mark for knowing that bubbles would be seen.

Results Plus: Examiner Tip

When you see 2 marks for a question, try to include more detail in your answer.

(c) (i) Describe what you would **see** when solid sodium carbonate is added to dilute ethanoic acid.

(2)

There would be fizzing or bubbling as carbon dioxide is produced. The solid ~~of~~ sodium carbonate would dissolve into solution

Results Plus: Examiner Comments

This is an excellent answer scoring both marks.

(c) (ii)

Although there were some excellent answers to this question, many candidates struggled to write the correct formula for an ester and it was not uncommon to see COO or COOH at the end of the formula. Many candidates did realise that water is formed and gained 1 mark for the formula but some candidates thought that carbon dioxide is produced when a carboxylic acid reacts with an alcohol.

(ii) When ethanoic acid reacts with ethanol, one of the products is the ester, ethyl ethanoate.

Complete the balanced equation for this reaction.

(2)

$CH_3COOH + C_2H_5OH \rightarrow$ C_2H_8OH + CO_2

(Total for Question 2 = 8 marks)

Results Plus: Examiner Comments

This candidate has been unable to work out the formula for the ester and has carbon dioxide as the other product, which is incorrect. This answer did not score any marks.

Results Plus: Examiner Tip

Remember that a carboxylic acid reacts with an alcohol to produce and ester and water.

(ii) When ethanoic acid reacts with ethanol, one of the products is the ester, ethyl ethanoate.

Complete the balanced equation for this reaction.

(2)

$CH_3COOH + C_2H_5OH \rightarrow$ C_4H_7OOH + H_2O

Results Plus: Examiner Comments

This candidate did not know the formula for the ester, but they did know that water is also formed, so scored 1 mark.

Results Plus: Examiner Tip

Learn how to write the formula for an ester.

(ii) When ethanoic acid reacts with ethanol, one of the products is the ester, ethyl ethanoate.

Complete the balanced equation for this reaction.

(2)

$CH_3COOH + C_2H_5OH \rightarrow CH_3COOC_2H_5 + H_2O$

Results Plus: Examiner Comments

This is an example of a perfect answer, scoring both marks.

Results Plus: Examiner Tip

Notice how this candidate has crossed through the end H in the ethanoic acid and the OH in the ethanol. They know that water is formed so were able to combine the remaining parts of the molecules to write the correct formula for the ester.

Q37.

(i)

The majority were able to identify an indicator. Most gave phenolphthalein or methyl orange, some gave litmus which was accepted.

Universal indicator solution is not a suitable indicator for an acid-alkali titration.

(i) Give the name of an indicator that is suitable for use in the titration of sodium hydroxide solution with hydrochloric acid.

(1)

methyl orange

Results Plus: Examiner Comments

A correct answer that scored the mark. In some cases, candidates wrote methane orange rather than methyl orange and were not awarded credit.

Universal indicator solution is not a suitable indicator for an acid-alkali titration.

(i) Give the name of an indicator that is suitable for use in the titration of sodium hydroxide solution with hydrochloric acid.

(1)

~~Universal indicator~~ Litmus paper

Results Plus: Examiner Comments

Litmus alone was allowed. However, those who gave litmus paper did not gain credit. Other incorrect answers seen were benedicts solution and iodine.

Universal indicator solution is not a suitable indicator for an acid-alkali titration.

(i) Give the name of an indicator that is suitable for use in the titration of sodium hydroxide solution with hydrochloric acid.

(1)

phenolthalein solution

Results Plus: Examiner Comments

Candidates found it hard to recall the spelling for phenolphthalein but phonetic spellings were accepted.

(ii)

Candidates found this question very hard. Few understood the need for a definite end point when using an indicator for titrations.

(ii) Universal indicator goes through a series of gradual colour changes as the pH changes in a solution.

Give a reason why universal indicator is not a suitable indicator to use in an acid-alkali titration.

(1)

The colour change is too gradual, this would cause confusion

Results Plus: Examiner Comments

Many answers repeated the stem of the question which gained no credit.

Results Plus: Examiner Tip

Candidates should be taught not to repeat the stem of the question as no credit will be awarded for this.

(ii) Universal indicator goes through a series of gradual colour changes as the pH changes in a solution.

Give a reason why universal indicator is not a suitable indicator to use in an acid-alkali titration.

(1)

No specific end point can be identified.

Results Plus: Examiner Comments

A good answer that scored the mark.

Q38. No Examiner's Report available for this question

Q39.

It was pleasing to see some candidates score all three marks, often with quite a short, succinct answer.

However many other candidates failed to appreciate the nature of the mixture and often thought that simply heating the mixture would yield the pure barium sulfate. Some failed to score the first mark due to inadequate descriptions of filtering - the use of filter paper and a (filter) funnel was required. A significant number suggested the use of a separating funnel and others suggested distillation.

Candidates quite often managed to score two marks but missed the third either by forgetting to wash the sample or just stating 'dry it' without suggesting how.

(c) Barium nitrate solution is added to potassium sulfate solution in a beaker.
A white precipitate of barium sulfate forms in a mixture with potassium nitrate solution.

Describe how you would obtain a pure, dry sample of barium sulfate from the mixture in the beaker.

(3)

Mix the two soluble ~~salts to~~ solutions together. filter the solution. The insoluble salt should stick to the filter paper. clean the salt with pure water. Dry the salt by leaving it on the filter paper or put in oven to dry.

Results Plus: Examiner Comments

This is an example of an answer awarded all three marks.

Q40.

This was very poorly answered on the whole. Most candidates failed to score or had no idea what was required for the 2 marks available. Many simply repeated the stem of the question or confused the reaction for a precipitation reaction and incorrectly suggested filtering the product. The reaction of acids and bases is clearly covered in the specification. However, from the vast majority of responses seen, it was clear that candidates from most centres may neither have carried out this particular practical nor that of the preparation of a similar soluble salt.

Aqueous Solutions

6 (a) Magnesium sulfate solution can be made by reacting magnesium oxide with dilute sulfuric acid.

The word equation for the reaction is

magnesium oxide + sulfuric acid → magnesium sulfate + water

Describe how solid magnesium oxide and dilute sulfuric acid are used to prepare a sample of pure magnesium sulfate solution.

(2)

magnesium sulfate solution can be made by reacting magnesium oxide with dilute sulfric acid

Results Plus: Examiner Comments

A typical incorrect response, where the stem of the question has simply been repeated, so this did not score.

Aqueous Solutions

6 (a) Magnesium sulfate solution can be made by reacting magnesium oxide with dilute sulfuric acid.

The word equation for the reaction is

magnesium oxide + sulfuric acid → magnesium sulfate + water

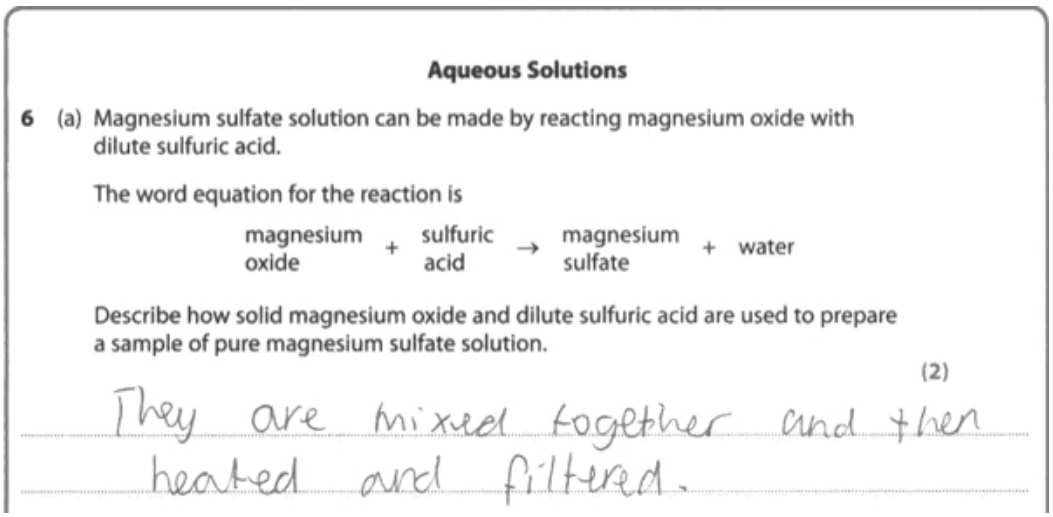
Describe how solid magnesium oxide and dilute sulfuric acid are used to prepare a sample of pure magnesium sulfate solution.

(2)

The magnesium Oxide is mixed with the Sulfuric acid, ace mixed you filter out the excess water and are left with Pure magnesium Sulfate

Results Plus: Examiner Comments

Although filtering is suggested, this did not score since it is clearly implied that the solid, namely magnesium sulfate, is a precipitate and that this is being filtered, as opposed to excess solid reactant, magnesium oxide.



Aqueous Solutions

6 (a) Magnesium sulfate solution can be made by reacting magnesium oxide with dilute sulfuric acid.

The word equation for the reaction is

magnesium oxide + sulfuric acid → magnesium sulfate + water

Describe how solid magnesium oxide and dilute sulfuric acid are used to prepare a sample of pure magnesium sulfate solution.

(2)

They are mixed together and then heated and filtered.

Results Plus: Examiner Comments

A rarely seen response, in which the 'filtered' could be credited, so this scored 1 mark.

Q41.

The responses were variable in terms of the quality of descriptions of the stages for the preparation of dry crystals of a soluble salt, namely ammonium sulfate. Most of the marks gained were from detailed descriptions from Stage 2. Only a minority of those responses scoring Level 2 or above made reference to Stage 3. Examiners noted that a surprisingly large number of candidates did not know what either a pipette or a burette was and following on from that a larger number confused a pipette and a burette, and few seemed to realise that a conical flask is a reaction vessel. In many responses which failed to gain credit, candidates simply repeated statements from the Stages in stem of the question.

*(c) A student is told to prepare pure, dry crystals of ammonium sulfate.

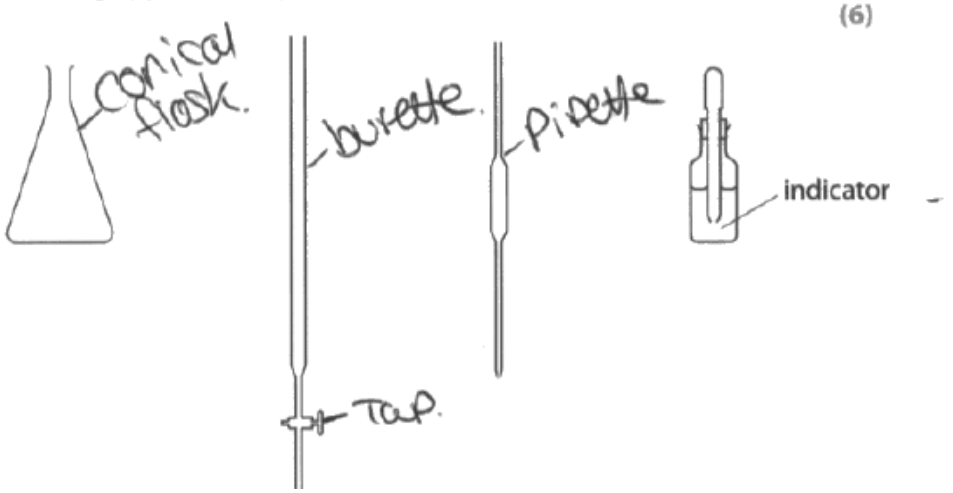
The student is told to carry out the experiment in four stages.

Stage 1: take 25.0 cm^3 of ammonia solution
Stage 2: find the volume of sulfuric acid that is needed to neutralise the ammonia solution
Stage 3: use this result to prepare an ammonium sulfate solution
Stage 4: prepare pure, dry crystals of ammonium sulfate from this solution

Describe how the student should carry out this experiment.

Some of the following apparatus may be used in the experiment.

(6)



First you use a pipette to ~~[illegible]~~ put the 25.0cm^3 of the alkali, ammonia solution, along with a few drops of ~~[illegible]~~ the indicator into the conical flask. Funnel the acid into the burette making sure the tap is closed. Slowly letting the tap open and allowing acid to flow out into the ammonia fully neutralised it should go colourless, producing ~~salt~~ salt + water. ~~[illegible]~~ heat the salt and waters allowing the water to evaporate and ~~[illegible]~~ crystallise the salt. Make sure you do a test run first then carry it out two more times, if the result are very similar then you know this test is reliable.

(Total for Question 5 = 12 marks)

14

Results Plus: Examiner Comments

This response scored a **Level 3**, 6 marks. Three stages have been described with at least five descriptive points.

Stage 1: use of a pipette to put 25.0 cm^3 of ammonia solution into conical flask (2 creditworthy points).

Stage 2: a few drops of indicator added, sulfuric acid in burette, add acid from burette slowly to ammonia solution, repeat two more times until results are similar (at least 4 creditworthy points).

Stage 3: no detail given.

Stage 4: heat ...to evaporate (until crystals formed) (another descriptive point).

All the pieces of equipment have been identified/labelled in the diagram.

*(c) A student is told to prepare pure, dry crystals of ammonium sulfate.

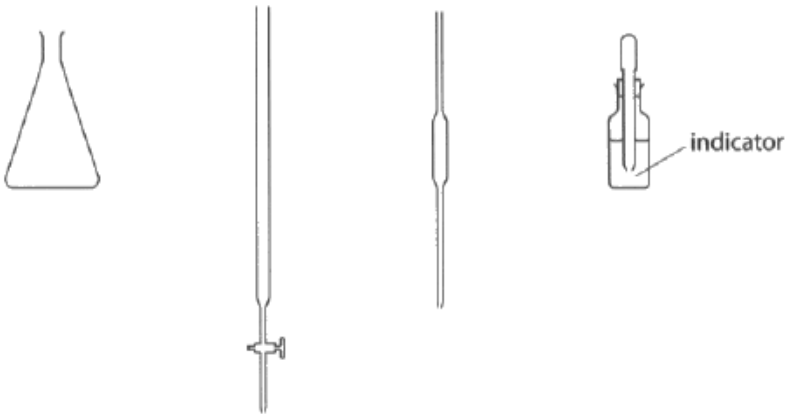
The student is told to carry out the experiment in four stages.

Stage 1: take 25.0 cm^3 of ammonia solution
Stage 2: find the volume of sulfuric acid that is needed to neutralise the ammonia solution
Stage 3: use this result to prepare an ammonium sulfate solution
Stage 4: prepare pure, dry crystals of ammonium sulfate from this solution

Describe how the student should carry out this experiment.

Some of the following apparatus may be used in the experiment.

(6)



He needs to use the pippette and measuring cylinder to measure 25cm³ of ammonia solution. He then needs to put the amount of sulfuric acid and also put this into the glass cylinder. He then needs to use the metal rod to create crystals. A bunsen burner is used to heat it up. Once heated, the solution needs to be crystalised.

Results Plus: Examiner Comments

This response scored a **Level 1**, 2 marks. Even though two stages of the preparation have been discussed, there is only one descriptive point.

Stage 1: the use of a pipette / measuring cylinder for the ammonia solution (a creditworthy descriptive point).

Stage 2: there is no mention of a burette for acid and the response incorrectly refers to a 'glass cylinder'.

Stage 3: no detail has been given.

Stage 4: 'heat with Bunsen burner .. to crystallize' has been mentioned - but it is not clear as to which solution is being heated.

*(c) A student is told to prepare pure, dry crystals of ammonium sulfate.

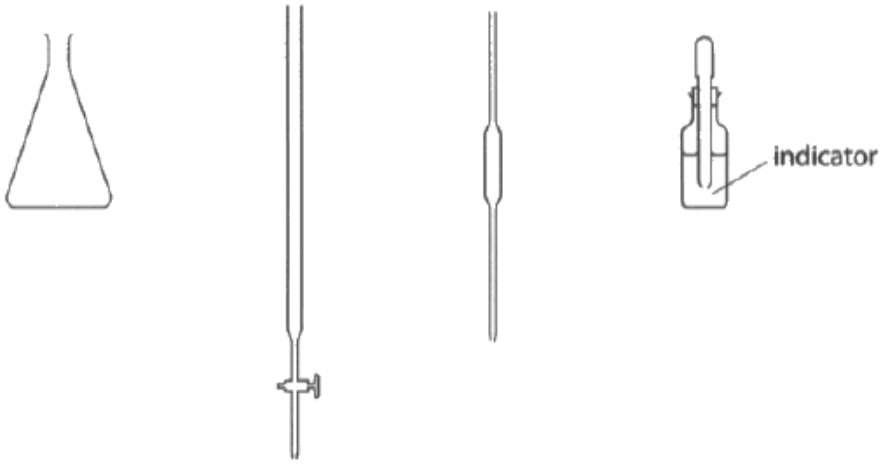
The student is told to carry out the experiment in four stages.

Stage 1: take 25.0 cm^3 of ammonia solution
Stage 2: find the volume of sulfuric acid that is needed to neutralise the ammonia solution
Stage 3: use this result to prepare an ammonium sulfate solution
Stage 4: prepare pure, dry crystals of ammonium sulfate from this solution

Describe how the student should carry out this experiment.

Some of the following apparatus may be used in the experiment.

(6)



The student should carry this out by doing the following. Firstly he should gather the equipment what he needs. Then set it all up ready for the experiment. He then should take 25.0 cm^3 of ammonia solution he find the volume of Sulfuric acid that is needed to neutralise the ammonia solution. Thirdly use the result of this to prepare an ammonium sulfate solution then finally the student can prepare pure, dry crystals of ammonium sulfate from this solution. After these steps you should have the crystals produced at the end.

Results Plus: Examiner Comments

This response scored a **Level 0**. There are no creditworthy descriptive points made, since this is simply a repetition of the stages given in the stem of the question.

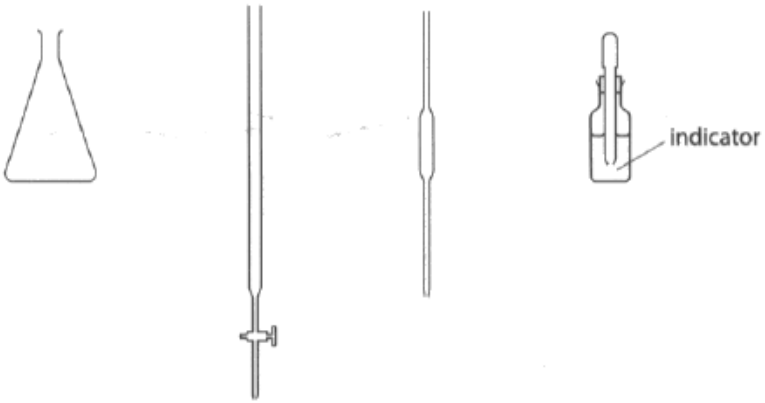
The student is told to carry out the experiment in four stages.

Stage 1: take 25.0 cm^3 of ammonia solution
Stage 2: find the volume of sulfuric acid that is needed to neutralise the ammonia solution
Stage 3: use this result to prepare an ammonium sulfate solution
Stage 4: prepare pure, dry crystals of ammonium sulfate from this solution

Describe how the student should carry out this experiment.

Some of the following apparatus may be used in the experiment.

(6)



1. With a pipette, take 25.0cm³ of ammonia solution. This will go into the conical flask.
2. Do a ~~rough test~~ titration to find the volume of sulfuric acid that is needed to neutralise the ammonia solution by using a burette. Sulfuric acid goes into burette. Indicator goes in conical flask with ammonia solution.
3. Use results to prepare ammonium sulfate solution.
4. With this solution, allow it to dry over a period of time to create pure, dry crystals of ammonium sulfate.

Results Plus: Examiner Comments

This response scored a **Level 2**, 4 marks. Two stages are described correctly, namely Stages 1 and 2, with four creditworthy descriptive points.

Stage 1: use of a pipette for ammonia solution which goes into the conical flask (2 creditworthy points).

Stage 2: putting sulfuric acid into a burette and indicator into the conical flask containing the ammonia (2 creditworthy points).

Stage 3: no detail has been given.

Stage 4: insufficient detail has been given.

Q42.

(i)

Very few candidates could write a correct formula for sulphuric acid. SO4 was often seen even though hydrogen still appeared on the right-hand side of the equation. More candidates gained the mark for correct products as the formula for zinc sulphate was given but some even lost this mark as they wrote hydrogen as H.

6 (a) A student investigated the rate of a reaction.
The student investigated the reaction between zinc and dilute sulfuric acid.
The products are zinc sulfate, $ZnSO_4$, and hydrogen.

(i) Write the balanced equation for this reaction.

(2)

Zn + SO4 = ZnSO4

Results Plus: Examiner Comments

A common incorrect attempt for the formula of sulfuric acid.

(ii)

This proved to be a very accessible and hence well answered question, with the large majority of candidates producing a level 2 or 3 answer. Most candidates demonstrated a good understanding of the collision theory. The effect of the changed conditions was often well described, with the best answers containing separate considerations of the effect of concentration and temperature. However many candidates did not distinguish between their explanations for temperature and concentration and gave a combined answer rather than explaining each factor in turn. As a result these candidates often referred to an increase in concentration making the particles move faster or having more energy. Sometimes candidates lost marks because they only referred to concentration effects or temperature effects, rather than both. Many candidates omitted the need for successful collisions, simply stating that collision frequency would be increased.

Evaluate these results, explaining the reasons why the rate of reaction in experiment 2 is faster than the rate of reaction in experiment 1.
In your answer you should refer to the frequency and energy of collisions between particles.

(6)

The rate of reaction is higer in experiment 2 because the temprature is higer. This is because higher temprature give the particles more energy, this means the particles will be moving at a greater speed. If they are moving at a greater speed it increases the chance of a sucsessful collision. If their are more sucsessful collishions happening at a faster rate this means the reaction will happen quicker.

Results Plus: Examiner Comments

This answer contains a good description of the effect of increasing temperature but does not mention concentration and so is unable to access level 3.

Evaluate these results, explaining the reasons why the rate of reaction in experiment 2 is faster than the rate of reaction in experiment 1.
In your answer you should refer to the frequency and energy of collisions between particles.

(6)

The rate of reaction was alot faster due to the difference between the tempurature that was use in experiment 1+2. In experiment 1 the temp was 20 and 2 the temp was 40. this proves that the higher the temp the quicker the reaction is. Also using different amounts of concentrated Sulfuric acid helps to increase the rate of reaction. This is because the peiece of zinc would have more to react with making the reation stronger.

Results Plus: Examiner Comments

This answer just gives a limited description and so is a level 1 response.

Evaluate these results, explaining the reasons why the rate of reaction in experiment 2 is faster than the rate of reaction in experiment 1.
In your answer you should refer to the frequency and energy of collisions between particles.

(6)

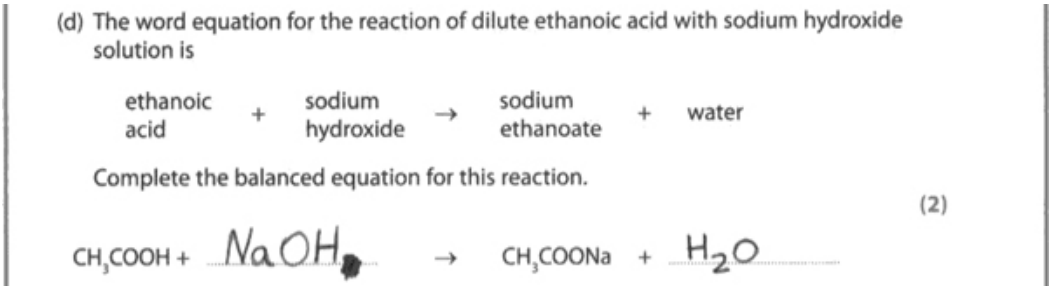
As the concentration of sulfuric acid and the temperature increases, the rate of the reaction also increases. When the concentration increases, there are more particles per cm^3 which means there are more frequent collisions between the particles. More frequent collisions means more successful collisions. When the temperature is increased, the particles move a lot faster. When the particles move faster, they move with a lot more energy which means there are more frequent collisions. The more frequent the collisions are, the more successful the collisions are and therefore the rate of the reaction increases.

Results Plus: Examiner Comments

A detailed description of the effect of increasing the concentration and temperature and worthy of six marks.

Q43.

Most candidates scored at least 1 mark of the 2 marks available, either for showing the correct reactant or product formula. A few candidates thought that the formula for the reactant was NaH_2, or carelessly, showed the second letter in the symbol for sodium using an upper case 'A', namely NAOH.



(d) The word equation for the reaction of dilute ethanoic acid with sodium hydroxide solution is

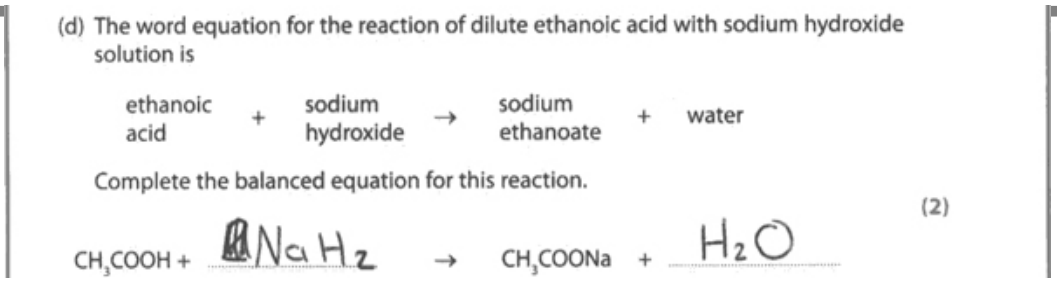
ethanoic acid + sodium hydroxide → sodium ethanoate + water

Complete the balanced equation for this reaction. (2)

CH_3COOH + NaOH → CH_3COONa + H_2O

Results Plus: Examiner Comments

The most commonly seen fully correct response, with both the correct reactant and product formulae shown, so this scored 2 marks.



(d) The word equation for the reaction of dilute ethanoic acid with sodium hydroxide solution is

ethanoic acid + sodium hydroxide → sodium ethanoate + water

Complete the balanced equation for this reaction. (2)

CH_3COOH + NaH_2 → CH_3COONa + H_2O

Results Plus: Examiner Comments

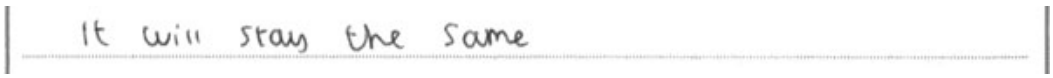
A commonly seen error, showing the reactant formula, NaH_2, but giving the correct formula for water, so this response clearly scored 1 mark only.

Q44. No Examiner's Report available for this question

Q45.

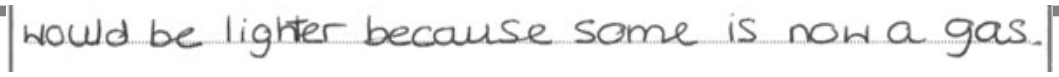
ii

Many candidates did not score here. Candidates that did not get the mark, did so as they thought that a gas was produced and so the mass decreased. They did not read the question fully and did not take on board that no gases were produced in the reaction and that a bung was in the top of the apparatus. There was also evidence of some fundamental misunderstandings such as the magnesium oxide condensing or water vapour being produced, condensed and therefore increasing the water level.



Results Plus: Examiner Comments

Fine, scores one mark.



Results Plus: Examiner Comments

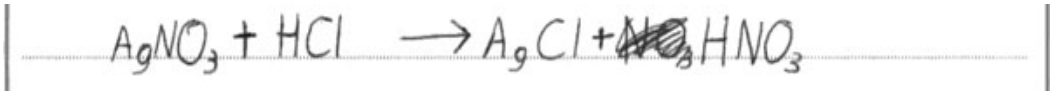
The candidate has not read the question and realised that no gas has been made or seen that there was a bung on top of the conical flask.

Results Plus: Examiner Tip

Check that you read the question fully. When practicals are being discussed ensure that you are clear as to what the reactants and the products are.

iii

Candidates showed that they could write equations and many scored here. However candidates that had not learnt the formulae of the common laboratory acids did not score here.



Results Plus: Examiner Comments

Fine, 2 marks awarded.



Results Plus: Examiner Comments

Whilst the reactants side of the equation was correct for one mark, this candidate could not recall the formulae of nitric acid, the only other product in the reaction.

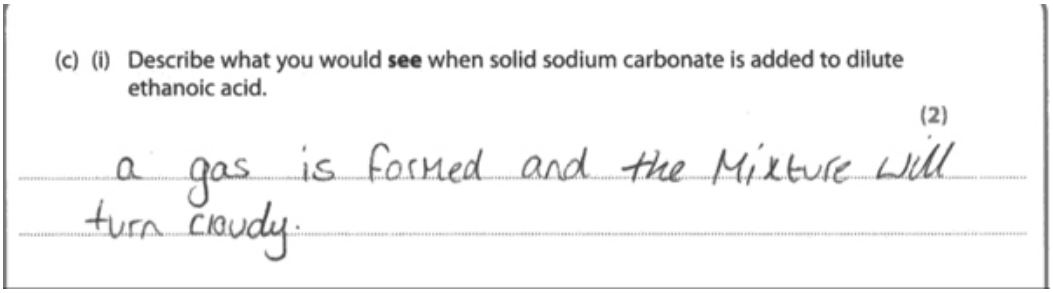
Results Plus: Examiner Tip

It is important that candidates can recall the formulae of common laboratory compounds used in the specification such as hydrochloric acid and nitric acid.

Q46.

(i)

Many candidates were able to describe one observation for the reaction between sodium carbonate and dilute ethanoic acid, but far fewer could describe two observations. Some candidates stated that carbon dioxide is produced but did not state what they would **see**as a gas is formed.


(c) (i) Describe what you would **see** when solid sodium carbonate is added to dilute ethanoic acid.

(2)

a gas is formed and the Mixture will turn cloudy.

Results Plus: Examiner Comments

This candidate knows that a gas is formed but has not stated what they would **see**during the reaction.

Results Plus: Examiner Tip

When a gas is formed from a reaction involving a solid and a solution, you will always see the gas as fizzing or effervescence.

(c) (i) Describe what you would **see** when solid sodium carbonate is added to dilute ethanoic acid.

(2)

A reaction taking place and bubbles coming off the Sodium carbonate

Results Plus: Examiner Comments

This candidate scored 1 mark for knowing that bubbles would be seen.

Results Plus: Examiner Tip

When you see 2 marks for a question, try to include more detail in your answer.

(c) (i) Describe what you would **see** when solid sodium carbonate is added to dilute ethanoic acid.

(2)

There would be fizzing or bubbling as carbon dioxide is produced. The solid ~~e~~ sodium carbonate would dissolve into solution

Results Plus: Examiner Comments

This is an excellent answer scoring both marks.

(ii)

Although there were some excellent answers to this question, many candidates struggled to write the correct formula for an ester and it was not uncommon to see COO or COOH at the end of the formula. Many candidates did realise that water is formed and gained 1 mark for the formula but some candidates thought that carbon dioxide is produced when a carboxylic acid reacts with an alcohol.

(ii) When ethanoic acid reacts with ethanol, one of the products is the ester, ethyl ethanoate.

Complete the balanced equation for this reaction.

(2)

$CH_3COOH + C_2H_5OH \rightarrow$ C_2H_8OH + CO_2

(Total for Question 2 = 8 marks)

Results Plus: Examiner Comments

This candidate has been unable to work out the formula for the ester and has carbon dioxide as the other product, which is incorrect. This answer did not score any marks.

Results Plus: Examiner Tip

Remember that a carboxylic acid reacts with an alcohol to produce and ester and water.

(ii) When ethanoic acid reacts with ethanol, one of the products is the ester, ethyl ethanoate.

Complete the balanced equation for this reaction.

(2)

$CH_3COOH + C_2H_5OH \rightarrow$ C_4H_7OOH + H_2O

Results Plus: Examiner Comments

This candidate did not know the formula for the ester, but they did know that water is also formed, so scored 1 mark.

Results Plus: Examiner Tip

Learn how to write the formula for an ester.

(ii) When ethanoic acid reacts with ethanol, one of the products is the ester, ethyl ethanoate.

Complete the balanced equation for this reaction.

(2)

$CH_3COOH + C_2H_5OH \rightarrow$ $CH_3COOC_2H_5$ + H_2O

Results Plus: Examiner Comments

This is an example of a perfect answer, scoring both marks.

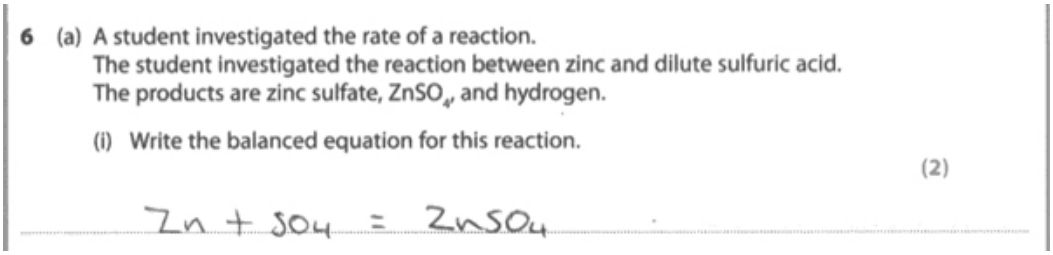
Results Plus: Examiner Tip

Notice how this candidate has crossed through the end H in the ethanoic acid and the OH in the ethanol. They know that water is formed so were able to combine the remaining parts of the molecules to write the correct formula for the ester.

Q47.

(a) (i)

Very few candidates could write a correct formula for sulphuric acid. SO4 was often seen even though hydrogen still appeared on the right-hand side of the equation. More candidates gained the mark for correct products as the formula for zinc sulphate was given but some even lost this mark as they wrote hydrogen as H.



6 (a) A student investigated the rate of a reaction.
The student investigated the reaction between zinc and dilute sulfuric acid.
The products are zinc sulfate, $ZnSO_4$, and hydrogen.

(i) Write the balanced equation for this reaction.

(2)

Zn + SO4 = ZnSO4

Results Plus: Examiner Comments

A common incorrect attempt for the formula of sulfuric acid.

(a) (ii)

This proved to be a very accessible and hence well answered question, with the large majority of candidates producing a level 2 or 3 answer. Most candidates demonstrated a good understanding of the collision theory. The effect of the changed conditions was often well described, with the best answers containing separate considerations of the effect of concentration and temperature. However many candidates did not distinguish between their explanations for temperature and concentration and gave a combined answer rather than explaining each factor in turn. As a result these candidates often referred to an increase in concentration making the particles move faster or having more energy. Sometimes candidates lost marks because they only referred to concentration effects or temperature effects, rather than both. Many candidates omitted the need for successful collisions, simply stating that collision frequency would be increased.

Evaluate these results, explaining the reasons why the rate of reaction in experiment 2 is faster than the rate of reaction in experiment 1.
In your answer you should refer to the frequency and energy of collisions between particles.

(6)

The rate of reaction is higer in experiment 2 because the temprature is higer. This is because higher tempratures give the particles more energy, this means the particles will be moving at a greater speed. If they are moving at a greater speed it increases the chance of a sucsessful collishion. If their are more sucsessful collishions happening at a fuster rate this means the reaction will happen quicker.

Results Plus: Examiner Comments

This answer contains a good description of the effect of increasing temperature but does not mention concentration and so is unable to access level 3.

Evaluate these results, explaining the reasons why the rate of reaction in experiment 2 is faster than the rate of reaction in experiment 1.
In your answer you should refer to the frequency and energy of collisions between particles.

(6)

The rate of reaction was alot faster due to the difference between the tempurature that was use in experiment 1+2. In experiment 1 the temp was 20 and 2 the temp was 40. this praves that the higher the temp the quicker the reaction is. Also using different amounts of concentrated Sulfuric acid helps to increase the rate of reaction. This is because the peiece of zinc would have more to react with making the reaction stronger.

Results Plus: Examiner Comments

This answer just gives a limited description and so is a level 1 response.

Evaluate these results, explaining the reasons why the rate of reaction in experiment 2 is faster than the rate of reaction in experiment 1.
In your answer you should refer to the frequency and energy of collisions between particles.

(6)

As the concentration of sulfuric acid and the temperature also increases, the rate of the reaction ~~increases~~. When the concentration increases, there are more particles per cm^3 which means there are more frequent collisions between the particles. More frequent collisions means more successful collisions. When the temperature is increased, the particles move a lot faster. When the particles move faster, they move with a lot more energy which means there are more frequent collisions. The more frequent the collisions are, the more successful the collisions are and therefore the [redacted] rate of the reaction increases.

Results Plus: Examiner Comments

A detailed description of the effect of increasing the concentration and temperature and worthy of six marks.

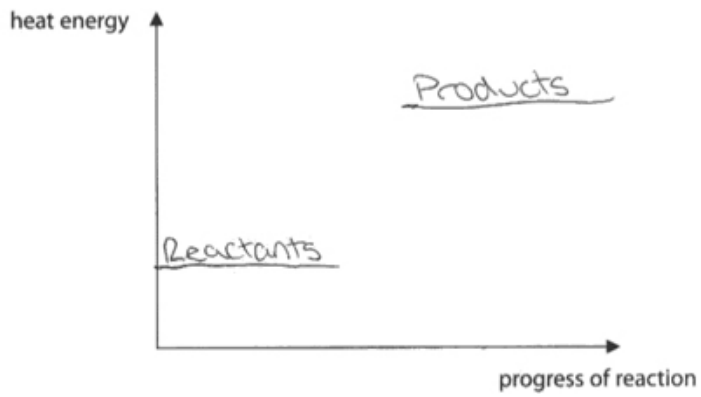
(b) (ii)

Many candidates scored both marks but some lost a mark by either labelling the lines incorrectly or not labelling them at all. Many candidates drew a reaction profile diagram and put in the activation energy "hump" which was obviously acceptable. Some thought the products would be at a higher level than the reactants but others did not draw any horizontal lines and seemingly tried to plot some sort of graph.

(ii) This reaction is exothermic.

On the diagram below draw labelled lines to show the relative energies of the reactants and products in this reaction.

(2)



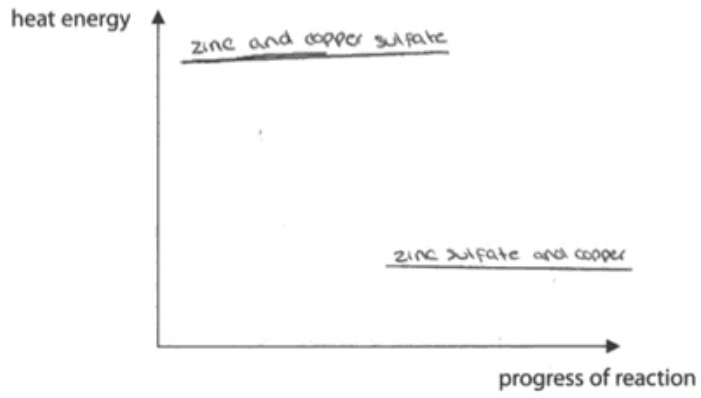
Results Plus: Examiner Comments

This is worth one mark as the products line is to the right of the reactants but does not gain the second mark as it shows an endothermic reaction.

(ii) This reaction is exothermic.

On the diagram below draw labelled lines to show the relative energies of the reactants and products in this reaction.

(2)



Results Plus: Examiner Comments

A good answer giving the names of the reactants and products (although just "reactants" and "products" was also acceptable) in their correct relative positions.

Q48.

The majority of responses did not score any of the 2 marks available, since few candidates were able to recall the definition for reduction, namely 'gain of electrons'. Occasionally, a few responses gained just 1 mark for 'the cathode gains electrons'.

(b) During electrolysis, reduction takes place at the cathode.

Explain, in terms of electrons, what is meant by reduction.

(2)

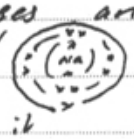
Reduction is the gain of electrons during a reaction.

Results Plus: Examiner Comments

A good example of a correct, albeit rarely seen, response. This was awarded the 2 marks

available.

(2)

A reduction is when it loses an electron. So for example sodium has () an extra one on its last shell. So it loses it to make itself stable.

Results Plus: Examiner Comments

Oxidation has been confused with reduction - a typical error. This was awarded 0 marks.

(2)

Reduction is loss of oxygen and the gain of electrons.

Results Plus: Examiner Comments

A good 2 marks answer. The first statement alone, referring to 'loss of oxygen', would have secured 1 mark.

Q49.

(b)

The question told the candidates that the compound was ionic so if they mentioned molecular, intermolecular or covalent in their explanations they did not score any marks. Many identified "strong bonds" which gained a mark, but then followed this by referring to high temperature being needed to melt the compound or that the bonds would be hard to break, instead of the required reference to a lot of energy being required.

(b) Barium chloride is an ionic compound and has a high melting point.

Explain why barium chloride has a high melting point.

(2)

Barium chloride has a high melting point because it's particles are held together by strong bonds in a lattice structure.

Results Plus: Examiner Comments

This was awarded one mark for the mention of strong bonds.

(b) Barium chloride is an ionic compound and has a high melting point.

Explain why barium chloride has a high melting point.

(2)

Barium chloride has a high melting point because it is an ionic substance, meaning that it has strong bonds which need a lot of energy to break and a strong lattice structure.

Results Plus: Examiner Comments

This was worth two marks for referring to strong bonds and a lot of energy needed to break them.

(b) Barium chloride is an ionic compound and has a high melting point.

Explain why barium chloride has a high melting point.

(2)

barium chloride has high melting point because its an ionic compound and it has a strong electrostatic force of attraction between the oppositely charged ions in the lattice this requires high energy to break the bonds

Results Plus: Examiner Comments

This is an example of a very good answer giving a full explanation of the high melting point of an ionic compound.

(c)(i)

It was disappointing to find that there was an almost exactly even split between correct and incorrect answers.

Some candidates, unfortunately, simply answered "white" and so did not gain the mark because

they did not add precipitate or solid. It appeared that others simply guessed or got confused with other tests and so there were wide ranging suggestions including yellow precipitate, orange solid, brown liquid/precipitate.

(c) Barium chloride solution is used to test for the presence of sulfate ions in a solution.

When sulfate ions are present, insoluble barium sulfate is formed.

(i) Describe the appearance of barium sulfate.

(1)

A precipitate

Results Plus: Examiner Comments

No mention of white so no mark awarded.

(c)(ii)

It is very disappointing to report that only about a quarter of candidates gained any credit here, especially given that they already had the left hand side of the equation.
Most incorrect answers seemed to include K_2Cl_2.

(ii) Complete the balanced equation for the reaction between barium chloride and potassium sulfate.

(2)

$BaCl_2 + K_2SO_4 \rightarrow$ BaSO4 + KCl

Results Plus: Examiner Comments

This was worth one mark for correct formulae but it had not been balanced.

(ii) Complete the balanced equation for the reaction between barium chloride and potassium sulfate.

(2)

$BaCl_2 + K_2SO_4 \rightarrow$ Ba SO4 + k2 Cl2

Results Plus: Examiner Comments

Answers like this were the most common of all.

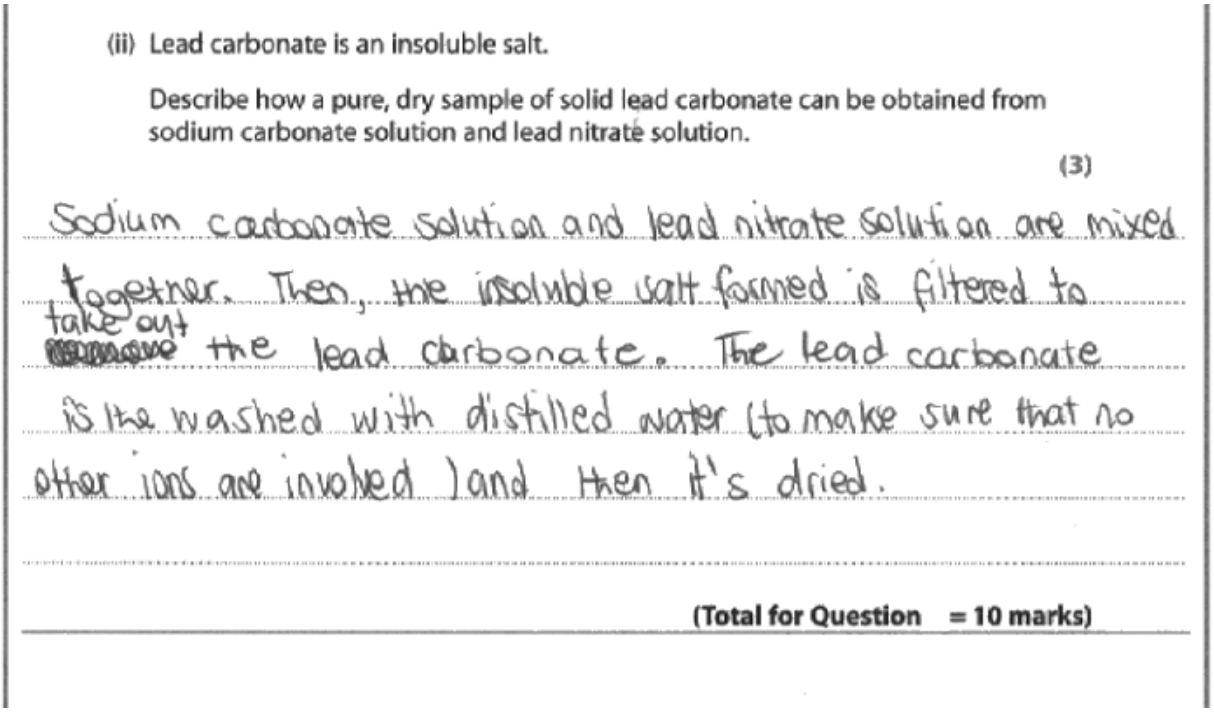
(d)(ii)

There were some very good answers describing how to prepare a sample of lead carbonate with many scoring full marks.

However others failed to say that the two salt solutions should be mixed/reacted and others gave an incorrect sequence of steps.

It was quite common for candidates to suggest the use of heat or the addition of another reagent, usually an acid.

The use of a separating funnel was sometimes given as a method of separation with fractional distillation also being suggested.



(ii) Lead carbonate is an insoluble salt.

Describe how a pure, dry sample of solid lead carbonate can be obtained from sodium carbonate solution and lead nitrate solution.

(3)

Sodium carbonate solution and lead nitrate solution are mixed together. Then, the insoluble salt formed is filtered to take out the lead carbonate. The lead carbonate is the washed with distilled water (to make sure that no other ions are invoked) and then it's dried.

(Total for Question = 10 marks)

Results Plus: Examiner Comments

A response worth all three marks.

Q50.

(a)

As usual, the sight of a calculation threw some candidates into panic mode, and they either made no attempt or wrote figures all over the place with no indication as to what they were.

Most candidates who made an attempt got 1 mark for showing 18.50 - 18.20 = 0.30 (even though some came out with wrong answer, due to the fact that they omitted the decimal point).

After that, very few correctly divided by 0.5, with most candidates multiplying the two figures.

5 (a) A mass of magnesium sulfate was taken.

mass of watch glass + magnesium sulfate = 18.50 g

mass of watch glass = 18.20 g

The solid was dissolved in water to make 500 cm^3 solution.

Calculate the concentration of the magnesium sulfate solution in g dm^{-3}.

(1000 cm^3 = 1 dm^3)

(2)

18.50 - 18.20 = 0.3g (500cm³ = 0.5dm³)

0.5 x 0.3 = 0.15g dm^{-3}

concentration = 0.15gm g dm^{-3}

Results Plus: Examiner Comments

This answer scored 1 and does have the merit of being clearly set out.
It was the most common error where full marks were not scored.

(b)(i)

Some nice answers were given with pipette and pipette/safety filler (filler was not required).

(b)(ii)

This question was very poorly answered. It was expected that most candidates could describe the Universal Indicator (or even Litmus) results effectively, but this was not so, and the examiners were surprised by this. A large proportion gave no indicator or an irrelevant substance that was not an indicator. Some did give Universal Indicator or Litmus but could not give correct colours. A fair minority did (try to) give phenolphthalein or methyl orange (and some leeway was given here with spelling). It is perhaps notable that those using phenolphthalein were much more likely to get the correct colours.

(c)

There was a lot of confusion in this question, either because the candidates did not grasp at all the idea of salt preparation, or because they apparently did not read the information provided. Hence, although candidates were told a soluble salt is formed, they proceeded to describe precipitate collection, filtering the mixture to collect the residue which was washed and dried.

Others mixed up the correct answer with a titration method. The most common answer was to react the substances and then evaporate water with no filtration stage. Having said this, there were some excellent answers scoring 6 marks.

*(c) Copper sulfate is a soluble salt.
Copper sulfate can be prepared by reacting copper oxide with dilute sulfuric acid.
Copper oxide is an insoluble solid.

Describe how you would prepare some pure, dry crystals of copper sulfate by reacting excess copper oxide with dilute sulfuric acid.

(6)

The copper oxide and the dilute Sulfuric acid will be mixed until a product, begins to form at the bottom of the flask, once this occures then the solution will be filtered So there is only the solution containing the salt and water. This solution should the be boiled leaving behind a pure sample of the salt. The water level should be continuesly checked to make sure it is all evaporated before re weighing the salt crystals left behind.

Results Plus: Examiner Comments

This answer is not fully correct but is clearly set out and the basic principles are understood.

Results Plus: Examiner Tip

-Try to remember how you did these experiments in class (usually, the reaction mixture is heated)
-Use the information given (copper oxide is insoluble so the excess would be filtered out – this should be explained in the answer)
-Remember how crystallization occurs – not all of the water is evaporated

*(c) Copper sulfate is a soluble salt.
Copper sulfate can be prepared by reacting copper oxide with dilute sulfuric acid.
Copper oxide is an insoluble solid.

Describe how you would prepare some pure, dry crystals of copper sulfate by reacting excess copper oxide with dilute sulfuric acid.

(6)

- add the dilute sulfuric acid with the copper oxide.
- wait till the solution is equal and filter any undissolved copper oxide.
- Evaporate all the solution on a bunsen burner in a beaker until the solution has crystalised.
- Then you have pure, dry crystals of copper oxide.

Results Plus: Examiner Comments

A reasonable answer, with the use of a bullet point style being helpful. This might be a useful answer to ask a class to rewrite to make it even better.

Results Plus: Examiner Tip

The use of bullet points can be helpful in extended writing.

Q51.

This question was generally well answered, with many candidates being able to give the name of the salt formed as magnesium sulphate.

Q52.

(b)

A significant number of candidates were unable to use the information about solubility to work out the correct state symbols for copper carbonate and sodium nitrate. It was not unusual to see (g) given as a state symbol.

(c)

Many candidates were able to work out the correct formula for copper carbonate. Some candidates wrote the formula as $Cu^{2+} + CO_3^{2-}$ and they did not score a mark as this just shows the symbols of the two separate ions.



Results Plus: Examiner Comments

This candidate has written the symbols of the ions with a '+' sign in the middle and does not score a mark.

Results Plus: Examiner Tip

Practise working out formulae of compounds from the symbols of their ions.



Results Plus: Examiner Comments

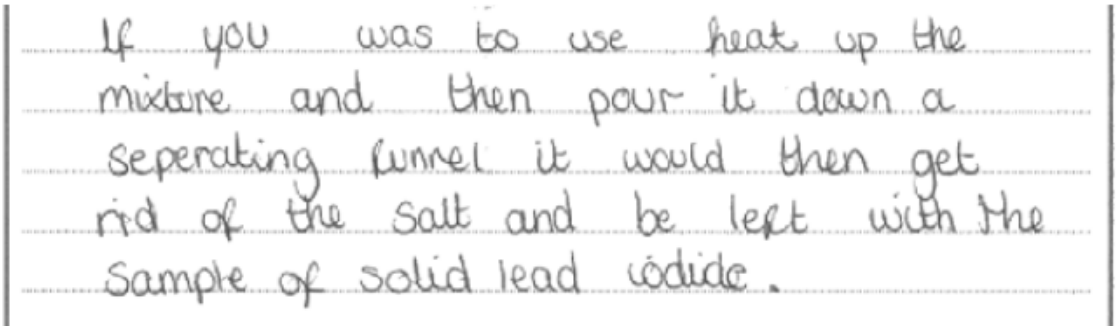
This is an example of a correct answer, scoring 1 mark.

(d)

It was disappointing to see that many candidates were not familiar with this practical procedure.

Some candidates started by describing how to make the mixture but this was not necessary.

Some candidates started by heating to evaporate the water and did not realise that the other salt would be left with the lead iodide. Some realised that filtering is necessary to separate a solid from a solution, but a significant number described the use of a separating funnel instead of a funnel and filter paper. Many also just mentioned using filter paper without a funnel or used a funnel without filter paper. It was often unclear about where the lead iodide was after filtering. Very few candidates described washing the solid in the filter paper to purify it. Many candidates did not describe a method of drying the solid.


If you was to use heat up the mixture and then pour it down a seperating funnel it would then get rid of the salt and be left with the sample of solid lead iodide.

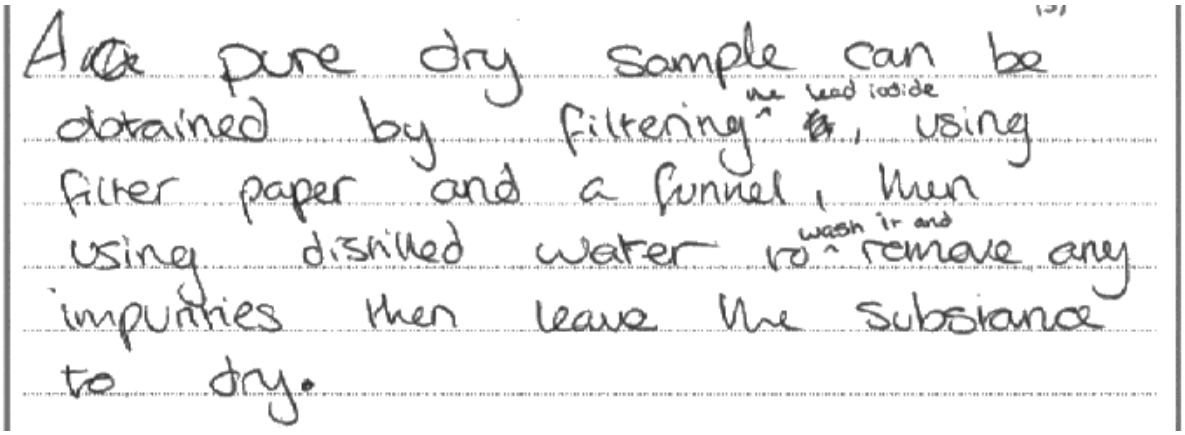
Results Plus: Examiner Comments

Separating funnels were seen quite frequently in answers to this question. This did not score a mark.

Results Plus: Examiner Tip

Use a separating funnel to separate a mixture of immiscible liquids.

Use a funnel and filter paper to separate a solid from a solution.


A pure dry sample can be obtained by filtering the lead iodide, using filter paper and a funnel, then using distilled water to wash it and remove any impurities then leave the substance to dry.

Results Plus: Examiner Comments

This is an example of a good answer and it scored 3 marks.

(e)(i)

Some candidates were able to identify potassium ions from the lilac colour of the flame.

Candidates should learn the flame test colours in the specification.

(e)(ii)

It was disappointing to see that only a small minority of candidates were able to identify chloride ions in the salt from the description of the test and the result. A few candidates gave the name of the salt instead of the ion. Many candidates just selected a random element to fill the space, with the majority of answers being metals. Candidates should carry out the tests for ions in the specification and learn the tests and results.



Results Plus: Examiner Comments

This candidate did not score a mark for potassium chloride as the question asked for the identity of the **ion** in the salt that produced the white solid. Only the chloride ions react with silver nitrate to produce a white solid.



Results Plus: Examiner Comments

This is an example of a correct answer that scored 1 mark.

Results Plus: Examiner Tip

Learn the tests for the ions in the specification.

Q53. No Examiner's Report available for this question

Mark Scheme

Q1.

Question number	Answer	Additional guidance	Mark
(i)	An explanation linking • pure water contains {only water (molecules)/ only one substance} / impure water contains more than one substances (1) • identification from label of impurity: dissolved solids/ calcium (ions) / sodium (ions) / hydrogencarbonate (ion) / ions	ignore all references to pH	(2) AO3

Question number	Answer	Mark
(ii)	pH (=7)	(1) AO2

Question number	Answer	Mark
(iii)	15 mg with or without working scores 2 • 250/1000 (1) (=0.250) • 60 x 250/1000 (1) (=15) OR • 1000/250 (1) = 4 • 60/4 (1) (=15)	(2) AO2

Q2.

Question number	Answer	Additional guidance	Mark
(i)	An explanation linking • solution from titration contains an indicator (1) • therefore second solution used with no indicator / indicator would contaminate salt (1)	MP2 dependent on MP1 allow original mixture was contaminated by indicator so doesn't form a pure salt (2)	(2)

Question number	Answer	Additional guidance	Mark
(ii)	final answer of 120% with or without working (2) OR $\frac{0.84}{0.70}$ (=1.2) (1) $\frac{0.84}{0.70}$ x 100 (=120(%)) (1)	allow any fraction x100 (1)	(2)

Question number	Answer	Additional guidance	Mark
(iii)	{the salt/solid/potassium chloride} was still wet/ not all of the water had been evaporated off		(1)

Question number	Answer	Additional guidance	Mark
(iv)	final answer of 80.5 with or without working (4) OR total mass: 56 + 36.5 (=92.5) / 74.5 + 18 (=92.5) (1) $\frac{74.5}{92.5}$ (= 0.8054) (1) $\frac{74.5}{92.5}$ x 100 (=80.540) (1) = 80.5 (1)	allow ECF throughout 92.5 seen (1) incorrect answer with working to 1 decimal place (1) 50.0/100.0 does not score MP4	(4)

Q3.

Question number	Answer	Additional guidance	Mark
(i)	An explanation linking • solution from titration contains an indicator (1) • therefore second solution used with no indicator / indicator would contaminate salt (1)	MP2 dependant on MP1 allow original mixture was contaminated by indicator so doesn't form a pure salt (2)	(2)

Question number	Answer	Additional guidance	Mark
(ii)	final answer of 120% with or without working (2) OR $\frac{0.84}{0.70}$ (=1.2) (1) $\frac{0.84}{0.70}$ x 100 (=120(%)) (1)	allow any fraction x100 (1)	(2)

Question number	Answer	Additional guidance	Mark
(iii)	{the salt/solid/potassium chloride} was still wet/ not all of the water had been evaporated off		(1)

Question number	Answer	Additional guidance	Mark
(iv)	final answer of 80.5 with or without working (4) OR total mass: 56 + 36.5 (=92.5) / 74.5 + 18 (=92.5) (1) $\frac{74.5}{92.5}$ (= 0.8054) (1) $\frac{74.5}{92.5}$ x 100 (=80.540) (1) = 80.5 (1)	allow ECF throughout 92.5 seen (1) incorrect answer with working to 1 decimal place (1) 50.0/100.0 does not score MP4	**(4)**

Q4.

Question number	Answer	Additional guidance	Mark
	An explanation linking • zinc chloride soluble and zinc carbonate insoluble (1) • so ions free to move only in zinc chloride solution / comparison with zinc carbonate (1)		**(2)** **AO1**

Q5.

Question Number	Answer	Additional guidance	Mark
	$2H^+ + 2e^{(-)} \rightarrow H_2$ / $2H^+ \rightarrow H_2 - 2e^{(-)}$ (2) species in correct place as shown above (1) balancing of correct species in correct place (1)	allow use of = or ⇌ in place of → allow multiples reject h2 / h_2 / H2 / H^2	**(2)** AO 1 1

Q6.

	Answer	Acceptable answers	Mark
(a)(i)	**D** less than 0.5%		(1)
(a)(ii)	A explanation linking any **two** of • dissolves /is absorbed (1) • in the oceans (1) • incorporated into marine organisms (1) • formed carbonate rocks (1) • increase in (green) plants/plants start growing • photosynthesis /plants remove carbon dioxide	reject references to plants respiring/breathing	(2)
(a)(iii)	traps <u>heat</u>	reflects <u>heat back to Earth</u> reject references to the ozone layer	(1)
(b)	A description to include • glowing splint (1) M1 • relights (1) M2	smouldering splint reject unlit splint ignore blown out splint M2 dependent on M1 but lighted splint burns brighter (2)	(2)
(c)(i)	An explanation linking • volume of gas in bell jar decreases/water rises to fill the space (1) • oxygen is removed from the	{volume/amount} of air decreases accept oxygen is used up	(2)

	air (1)		
(c)(ii)	(amount of gases remaining) 79% (1) (volume remaining) = $\frac{1000 \times 79}{100}$ (1) = 790 (cm^3)	ecf for incorrect percentage of volume of gases remaining in M1 correct answer or valid calculation alone scores (2)	(2)
(d)	magnesium sulphate	accept magnesium sulphate	(1)

Q7.

Question number	Answer	Mark
(i)	wear safety goggles/ gloves	(1) AO3

Question number	Answer	Additional guidance	Mark
(ii)	Measure mass of solid/ use a specified mass of solid	ignore changes to stirring ignore use a full spatula	(1) AO3

Question number	Answer	Mark
(iii)	**B** from 1 to 12 is the only correct answer. **A** and **C** are incorrect because the mixture does not start or end neutral **D** is incorrect because the pH is changing in the reverse direction	(1) AO2

Question number	Answer	Additional guidance	Mark
(iv)	start: red/pink (1) end: yellow (1)	allow (1) if colours reversed	(2) AO1

Q8.

Question number	Answer	Additional guidance	Mark
(i)	pH meter/ pH probe	ignore data logger alone reject litmus / phenolphthalein / universal indicator solution / pH paper	(1)

Question number	Answer	Additional guidance	Mark
(ii)	• increases pH (1) • until pH above 7 (1) and an explanation linking REACTION • {magnesium hydroxide / base / alkali / OH^- ions} {reacts with / neutralises} {the acid / the H^+ ions} IONS REMAINING • so the hydrogen ions concentration is reduced / **all** hydrogen ions reacted / there is an excess of hydroxide ions (1)	allow until pH = 7 ignore until neutral ignore there is an excess of magnesium hydroxide	(4)

Q9.

Question number	Answer	Mark
(i)	test tube/ boiling tube	(1) AO1

Question number	Answer	Mark
(ii)	**A** electrode is the only correct answer. **B**, **C** and **D** are incorrect because they are not electrodes.	(1) AO2

Question number	Answer	Additional guidance	Mark
(iii)	it conducts (electricity)/ is inert	ignore high melting point	(1) AO1

Question number	Answer	Mark
(iv)	$2\ HCl \rightarrow H_2 + Cl_2$	(1) AO2

Q10.

Question number	Answer	Additional guidance	Mark
(i)	five / 5 (ions)	allow 2 + 3	(1)

Question number	Answer	Mark
(ii)	$2Al_2O_3 \rightarrow 4\ Al + 3\ O_2$	(2)

Q11.

Question Number	Answer	Mark
	$2H^+ + 2e \rightarrow H_2$ (2) correct species (1) balancing of correct species (1)	(2)

Q12.

Question Number	Answer	Mark
	(place) ammeter / lamp (in circuit) (1)	(1)

Q13.

	Answer	Acceptable answers	Mark
(a)(i)	an explanation linking the following • decomposition (of compound/substance /electrolyte)(1)	splitting up/breaking down/breaking up ignore separating	(2)

	• using (direct) current (1)	reject splitting of atoms/elements/molecules for M1 using {electrical energy /electricity} reject alternating current/ac	
(a)(ii)	• (damp blue) litmus (paper) (1) • (turns red then) {bleaches / goes white} (1)	allow bleaches indicator for 1 mark ignore indicator goes lighter ignore smells of chlorine/swimming pools ignore any incorrect middle colour mentioned use of suitable named indicator with correct result e.g. (damp) universal indicator paper (1) (turns red then) bleaches (1) starch-iodide paper(1) turns blue-black(1)	(2)
(a) (iii)	poly(chloroethene)	PVC/polyvinylchloride/ polychloroethene/poly(chlorethene)	(1)
(b)(i)	D AgCl(s)		(1)
(b)(ii)	same/no change		(1)
(b)(iii)	$HCl + AgNO_3 \rightarrow AgCl + HNO_3$ • reactant formulae (1) • product formulae (1)	$Ag^+ + Cl^- \rightarrow AgCl$ max 1 if any incorrect attempt to balance reject incorrect use of cases and non-subscripts	(2)

Q14.

Question Number	Answer	Additional guidance	Mark
	pH {increases / goes up} by <u>one</u> / moves <u>1</u> closer to neutral	ignore {increases / goes up} alone	**(1)** AO 1 1

Q15.

Question number	Answer	Mark
(i)	hydrogen / H_2	(1) AO3

Question number	Answer	Additional guidance	Mark
(ii)	An explanation linking • hydrogen ions attracted to cathode/negatively charged electrode (1) • (two) hydrogen ions {gain (two) electrons /are reduced / form hydrogen molecules} / correct half equation ($2H^+ + 2e^{(-)} \rightarrow H_2$) (1)	allow positively charged ions attracted to cathode ignore references to sodium ions	(2) AO1

Q16.

Question number	Answer	Mark
	<table><tr><th>salt</th><th>soluble</th><th>insoluble</th></tr><tr><td>ammonium chloride</td><td>✓</td><td></td></tr><tr><td>lithium sulfate</td><td>✓</td><td></td></tr><tr><td>magnesium carbonate</td><td></td><td>✓</td></tr></table> • All three correct (2) • Any two correct (1)	(2)

Q17.

Question number	Answer	Mark
(i)	C	(1)

Question number	Answer	Mark
(ii)	C	(1)

Q18.

Question number	Answer	Mark
	<table><tr><th>salt</th><th>soluble</th><th>insoluble</th></tr><tr><td>ammonium chloride</td><td>✓</td><td></td></tr><tr><td>lithium sulfate</td><td>✓</td><td></td></tr><tr><td>magnesium carbonate</td><td></td><td>✓</td></tr></table> • All three correct (2) • Any two correct (1)	(2)

Q19.

Question number	Answer	Mark
	C dissolving **A, B, D** – these answers are about different processes	**(1)**

Q20.

Question Number	Answer	Mark
	D calcium carbonate (1)	**(1)**

Q21.

		Indicative Content	
QWC	*	A description / explanation including some of the follo anode	

		• the anode decreases in mass / size • copper atoms form ions by losing electrons • copper ions pass into electrolyte • oxidation takes place at the anode • (anode) sludge forms as • impurities {are left behind / fall to the bottom} electrode) cathode • the cathode increases in mass / size • copper ions gain electrons to form copper • pure copper deposits on the cathode • reduction takes place at the cathode electrolyte • copper sulfate solution does not change in colo • no change in concentration of copper ions • copper ions in the electrolyte move toward the	

Level	**0**	No rewardable content
1	**1 - 2**	• a limited description e.g. copper leaves the anode and deposits on the cathode. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy
2	**3 - 4**	• a simple description e.g. copper leaves the anode and deposits on the cathode and impurities fall to the bottom of the beaker. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	**5 - 6**	• a detailed description and explanation e.g. copper atoms from the anode lose electrons to form copper ions; copper ions are attracted to the cathode where they gain electrons to form pure copper. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Q22.

	Answer	**Acceptable answers**	**Mark**
(i)	electrolysis	Allow any phonetically correct spelling	**(1)**
(ii)	A description including **two** of the following • Burns/ ignites (1) • Squeaky (1) • pop/explodes (1) • water formed (1)	Ignore references to splint	**(2)**

Q23.

	Answer	Acceptable answers	Mark
	Na^+ **and** Mg^{2+}	reject if any other ions are given allow names	**(1)**

Q24.

	Answer	Acceptable answers	Mark
(a)(i)	B lead chloride		**(1)**
(a)(ii)	An explanation linking two of • strong (electrostatic) forces of attraction • between oppositely charged ions • so requires lot of heat/energy to overcome forces/break bonds	Any reference to molecules/molecular/intermolecular/covalent scores 0 marks strong (ionic) bonds positive and negative ions reject charged atoms for this mark ignore hard to melt/high temperature needed	**(2)**
(a)(iii)	A description including • M1 add (dilute) nitric acid • M2 add silver nitrate (solution) • M3 forms white ppt/solid	Accept correct formulae If use any other acid can score M2 and M3 dependent on use of silver nitrate Alternative method: Electrolyse (1) Chlorine formed (1) Bleaches litmus/pH paper (1) Ignore smell	**(3)**

	Indicative Content	

QWC	***(b)**	A description including some of the following points **ion formation** • magnesium atoms lose electrons • each magnesium atom loses two electrons • to acquire full outer shell • magnesium (configuration) becomes 2.8 • forms Mg^{2+} ion • electrons transferred to oxygen atoms • oxygen atoms gain electrons • each oxygen atom gains two electrons • oxygen (configuration) becomes 2.8 • to acquire full outer shell • forms O^{2-} ion **structure** • magnesium ions attract oxide ions • due to opposite charges • ions pack close together • ratio of ions 1: 1 • ions arranged in lattice • giant (ionic) (structure) diagram can be credited for any points

Level	**0**	No rewardable content
1	**1 - 2**	• a limited description e.g. magnesium atoms lose electrons and oxygen atoms gain electrons e.g. magnesium oxide is a giant structure • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy
2	**3 - 4**	• a simple description e.g. magnesium atoms lose two electrons to form positive ions and oxygen atoms gain two electrons to form negative ions • e.g. magnesium atoms lose electrons and oxygen atoms gain electrons and magnesium oxide is a giant structure • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	**5 - 6**	• a detailed description e.g. each magnesium atom transfers two electrons to an oxygen atom and the opposite charged ions (Mg^{2+} /O^{2-}) formed attract each other to form a giant (ionic) lattice • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Q25.

Question Number	Answer	Acceptable answers	Mark
(a)	B Na^+		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)(i)	C K_2CO_3		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)(ii)	A description linking M1 (bubble gas through) limewater/calcium hydroxide solution (1) M2 turns cloudy/milky/white precipitate (1)	 if limewater added directly to the solution/mixture then only M1 can be awarded .white ppt second mark dependent on use of limewater if mention any gas other than carbon dioxide or make reference to any other gas test/result then max 1	**(2)**

Q26.

	Answer	**Acceptable answers**	**Mark**
	hydrogen	H_2 ignore H	**(1)**

Q27.

	Answer	**Acceptable answers**	**Mark**
	$MgCO_3 + H_2SO_4 \rightarrow MgSO_4 + H_2O + CO_2$ (2) left hand side (1) right hand side (1)	 max 1 if incorrect balancing	**(2)**

Q28.

Question Number	Answer	Acceptable answers	Mark
(a)	**D** aq l		**(1)**

Question Number	Answer	acceptable answers	Mark
(b)	$H^+ + OH^-$ (1) → H_2O (1)	LHS (1) RHS (1) ignore state symbols, even if incorrect. allow inclusion of spectator ions, Na^+ and Cl^-, if shown on both sides for one mark max	**(2)**

Question Number	Answer	Acceptable answers	Mark
(c)(i)	suitable acid-base indicator eg methyl orange, phenolphthalein	litmus reject universal indicator allow recognisable phonetic spelling	**(1)**

Question Number	Answer	Acceptable answers	Mark
(c)(ii)	correct colour change for suitable indicator in 4(c)(i): methyl orange : yellow → orange/pink/red phenolphthalein : magenta/pink → colourless	 litmus : blue → red ignore clear	**(1)**

Question Number	Answer	Acceptable answers	Mark
(d)	rel mass NaOH = 23.0 + 16.0 + 1.00 (1) concentration = $\frac{20.0}{\text{formula mass}}$ x 1 (1)	(= 40.0) (1) 0.5 (mol dm^{-3}) without working (2)	**(2)**

Question Number	Answer	Acceptable answers	Mark
(e)	moles of NaOH = $\frac{25.0 \times 1.50}{1000}$ (1) (= 0.0375 moles) ratio 1 : 1 / moles NaOH = moles HCl (1) conc of HCl = $\frac{0.0375 \times 1000}{30.0}$ (1) (= 1.25 (mol dm^{-3})) OR 25.0 x 1.50 = 30.0 x conc acid (2) conc of HCl = $\frac{25.0 \times 1.50}{30.0}$ (1) (=1.25 (mol dm^{-3}))	 0.0375 (1) – without working shown conc of HCl = 1.25 (mol dm^{-3})(3) without any working shown allow ecf conc = $\frac{30.0 \times 1.50}{25.0}$ = 1.80 (2) (mol dm^{-3}) allow 0.00125 /0.125 / 12.5 max 2	**(3)**

Q29.

Question Number	Answer	Additional guidance	Mark
(i)	25.7 (g)	do not allow 25 answer may be written on the lower diagram	**(1)** AO 2 1

Question Number	Answer	Additional guidance	Mark
(ii)	barium sulfate	do not allow barium sulfide	**(1)** AO 1 2

Q30.

	Answer	Acceptable answers	Mark
	magnesium nitrate / $Mg(NO_3)_2$ (1) water /H_2O (1)	Reject hydrogen oxide	**(2)**

Q31.

Question Number	Answer	Mark
	{sodium/ potassium / ammonium} carbonate (solution) / any soluble sulfate (solution) / sulfuric acid	**(1)**

Q32.

Question Number	Answer	Acceptable answers	Mark
(a)	to kill bacteria (1)	to kill microorganisms /pathogens / maintain the correct acidity / lower pH ignore kills germs ignore acid indigestion	**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)	**B** neutralise the excess acid		**(1)**

Question Number	Answer	Acceptable answers	Mark
(c)	**A** magnesium chloride		**(1)**

Q33.

Question Number	Answer	Additional guidance	Mark
	A description to include • filter (1) and two in a logical order from • **crystallisation** (1) • heat solution (to concentrate) (1) • allow to cool (1) • dry crystals between filter papers (1)	if filtration not first stage, ignore it and give maximum 2 marks allow description of filtration ignore filtration to obtain nickel sulfate (crystals) allow 'leave until water evaporates' / use of water bath / evaporate {water/the solution} allow leave {until crystals form / for a few hours / in a warm place / on a window sill} allow 'dry crystals in (warm) oven' if alternative methods of making nickel sulfate solution described, max 1 mark from last four marking points	**(3)** AO 2 2

Q34.

Question Number	Answer	Additional guidance	Mark
	A description to include • filter (1) and two in a logical order from • **crystallisation** (1) • heat solution (to concentrate) (1) • allow to cool (1) • dry crystals between filter papers (1)	if filtration not first stage, ignore it and give maximum 2 marks allow description of filtration ignore filtration to obtain nickel sulfate (crystals) allow 'leave until water evaporates' / use of water bath / evaporate {water/the solution} allow leave {until crystals form / for a few hours / in a warm place / on a window sill} allow 'dry crystals in (warm) oven' if alternative methods of making nickel sulfate solution described, max 1 mark from last four marking points	**(3)** AO 2 2

Q35.

Question Number	Answer	Acceptable answers	Mark
(a)	**C** preservative		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)	M1 named indicator (1) M2 correct colour (1) M2 dependent on M1	universal Indicator – yellow/orange/red methyl orange – red phenolphthalein – colourless (red/blue) litmus - red	**(2)**

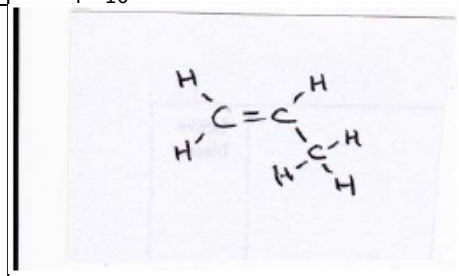
Question Number	Answer	Acceptable answers	Mark
(c) (i)	oxygen (1)	O_2 reject O	**(1)**

Question Number	Answer	Acceptable answers	Mark
(c)(ii)	hydrogen (1)	H_2 reject H	**(1)**

Question Number	Answer	Acceptable answers	Mark
(c)(iii)	carbon dioxide (1)	CO_2	**(1)**

Question Number	Answer	Acceptable answers	Mark
(d)	ethanoic acid + ethanol → ethyl ethanoate + water (2) left hand side (1) right hand side (1)	allow recognisable misspellings allow reactants and products in either order allow = for → allow correct formulae if formulae are used do not allow incorrect use of the subscripts / upper / lower case	**(2)**

Q36.

	Answer	Acceptable answers	Mark
(a)(i)	D C_4H_{10}		**(1)**
(a)(ii)	 **one** C=C in a molecule with three consecutive carbon atoms (1) rest of structure correct, ignore bond angles, conditional on first marking point(1)	allow $-CH_3$ do not allow two C=C in a molecule allow (1) for completely correct dot and cross diagram	**(2)**
(b)	C oxidised		**(1)**
(c)(i)	A description including two from • effervescence / fizzing / bubbles of gas (1) • solid {disappears/clears} /(colourless)solution formed (1)	ignore {cloudy/white ppt} /'gas formed'/colour change /name of gas / changes to a liquid (solid/sodium carbonate/it) dissolves	**(2)**

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		(1)	
(c)(ii)	$CH_3COOC_2H_5$/$CH_3COOCH_2CH_3$/ $CH_3CO_2C_2H_5$ / $CH_3CO_2CH_2CH_3$ / $C_2H_5O_2CCH_3$ / $CH_3CH_2OOCCH_3$(1) H_2O (1)	allow displayed formulae/ $C_4H_8O_2$ do not allow formulae ending in –COOH/-COO or any formula that does not show an ester do not allow H2O / H^2O /lower case h/HOH maximum (1) if additional incorrect balancing ignore state symbols	**(2)**

Q37.

Question Number	Answer	Additional guidance	Mark
(i)	phenolphthalein /methyl orange	allow litmus / screened methyl orange / methyl red ignore litmus paper ignore pH meter/probe	**(1)** AO 2 2

Question Number	Answer	Additional guidance	Mark
(ii)	it does not show sharp colour change at end point / not known which colour change gives correct end point	ignore goes through a series of gradual colour changes allow does not have a definite end point	**(1)** AO 3 1b

Q38.

Question number	Answer	Mark
(i)	magnesium iron silver	**(1)** **AO3**

Question number	Answer	Mark
(ii)	**C** put a lighted splint at the open end of the test tube is the only correct answer **A**, **B** and **D** are incorrect because they would not work	**(1)** **AO2**

Question number	Answer	Additional guidance	Mark
(iii)	(squeaky) pop / flame	ignore references to ignites reject references to relights	**(1)** **AO1**

Q39.

Question Number	Answer	Acceptable answers	Mark
		maximum 2 marks if heat or evaporate or crystallisation method used on mixture or filtrate	**(3)**
	First mark filter (the mixture) **(1)**	description or diagram of filtering ie (filter) funnel **and** filter paper do not allow sieving/sifting/draining /decanting do not allow separating funnel	
	Second and third marks A description including **two** of the following barium sulphate/the solid/the residue/precipitate is left on (filter) paper/in the funnel (1) wash/rinse (the solid/residue/barium sulfate with distilled water) **(1)**	pour water over/through solid (in filter paper) clean solid with water do not allow this mark if washing is done after drying	
	any method of drying **(1)**	eg in an oven /on a windowsill / on a radiator /with filter paper warm it heat it evaporate the water Allow 'leave to dry' Do not allow just "dry it (out/off)" must have filtered and/or washed to score the mark for drying	

Q40.

	Answer	Acceptable answers	Mark
	A description including excess magnesium oxide (1) filter (to remove excess solid / magnesium oxide) (1)		**(2)**

Q41.

Question Number		Indicative Content	Mark
QWC	*	A description including some of the following points **Stage 1** • identifies pipette • pipette / measuring cylinder to measure out the ammonia solution (25 cm^3) • into a suitable container, e.g. conical flask **Stage 2** • add few drops of indicator / suitable named indicator • put flask on a white tile • identifies burette • fill burette with sulfuric acid solution • clamp burette / burette holder/stand • read level of burette • add acid from the burette • swirl flask (gently) • add drop-wise near end-point • until {indicator just changes colour / correct colour change for chosen indicator} • read level on burette • repeat experiment until concordant results owtte **Stage 3** • mix the same volumes of sulfuric acid and ammonia solution (determined from the titration experiment) • but leaving out the indicator **Stage 4** • pour into an evaporating dish • {heat the solution / leave to evaporate} to dryness, until pure salt crystals formed • to point of crystallisation/ concentrate solution • leave to cool • filter off crystals • wash with water • leave to dry	**(6)**

Level	0	No rewardable content
1	1 - 2	• a limited description e.g. limited description of one stage / add one solution to the other • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy
2	3 - 4	• a simple description e.g. one stage in detail / attempt to describe more than one stage • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	5 - 6	• a detailed description e.g. add sulphuric acid to ammonia using indicator appropriately, good detail of equipment and of titration technique and some mention of producing crystals / detail description of producing crystals with some mention of titration • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Q42.

	Answer	Acceptable answers	Mark
(i)	$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$ reactants (1) products (1)	Accept multiples If not correctly balanced max 1 Must be subscripts where relevant	**(2)**

		Indicative Content
QWC	***(ii)**	A description including some of the following points **general points** • reactions occur when particles collide • more frequent collisions cause higher rate of r • mass and size of zinc pieces same so no effect reaction • because same surface area • two factors have been altered in the same exp • cannot be certain of effect of each **concentration** • experiment 2 higher/triple concentration of ac • so more particles (in same volume) • so more frequent collisions between particles • more successful collisions **temperature** • experiment 2 higher temperature

		• particles move faster • particles have more energy • so more frequent collisions between particles (a rate) • more successful collisions • so more energetic collisions between particles • more particles have enough energy to react (a energy) when they collide	
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. temperature is higher and concentration is higher so reaction is faster e.g. temperature is higher so particles move faster so reaction is faster • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	a simple description e.g. temperature is higher so particles move faster and concentration is higher so more particles so reaction is faster eg when concentration is higher there will be more particles so more frequent collisions so faster reaction e.g. when temperature is higher particles move faster so more successful collisions so faster reaction • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description e.g. higher concentration of acid so more particles so more frequent collisions so faster reaction and higher temperature so particles have more energy so more successful collisions so faster reaction • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Q43.

	Answer	**Acceptable answers**	**Mark**
	(CH_3COOH +) NaOH (1) (→ CH_3COONa +) H_2O (1)	NaHO ignore attempts to balance	**(2)**

Q44.

	Answer	Acceptable answers	Mark
	A neutralisation		**(1)**

Q45.

	Answer	Acceptable answers	Mark
	D AgCl(s)		(1)
	same/no change		(1)
	$HCl + AgNO_3 \rightarrow AgCl + HNO_3$ • reactant formulae (1) • product formulae (1)	$Ag^+ + Cl^- \rightarrow AgCl$ max 1 if any incorrect attempt to balance reject incorrect use of cases and non-subscripts	(2)

Q46.

	Answer	Acceptable answers	Mark
(i)	A description including two from • effervescence / fizzing / bubbles of gas (1) • solid {disappears/clears} /(colourless)solution formed (1)	ignore {cloudy/white ppt} /'gas formed'/colour change /name of gas / changes to a liquid (solid/sodium carbonate/it) dissolves (1)	**(2)**
(ii)	$CH_3COOC_2H_5$/$CH_3COOCH_2CH_3$/ $CH_3CO_2C_2H_5$ / $CH_3CO_2CH_2CH_3$ / $C_2H_5O_2CCH_3$ / $CH_3CH_2OOCCH_3$(1) H_2O (1)	allow displayed formulae/ $C_4H_8O_2$ do not allow formulae ending in –COOH/-COO or any formula that does not show an ester do not allow H2O / H^2O /lower case h/HOH maximum (1) if additional incorrect balancing ignore state symbols	**(2)**

Q47.

	Answer	Acceptable answers	Mark
(a)(i)	$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$ reactants (1) products (1)	Accept multiples If not correctly balanced max 1 Must be subscripts where relevant	**(2)**

		Indicative Content	
QWC	***(a)(ii)**	A description including some of the following points **general points** • reactions occur when particles collide • more frequent collisions cause higher rate of r • mass and size of zinc pieces same so no effect reaction • because same surface area • two factors have been altered in the same exp • cannot be certain of effect of each **concentration** • experiment 2 higher/triple concentration of ac • so more particles (in same volume) • so more frequent collisions between particles • more successful collisions **temperature** • experiment 2 higher temperature • particles move faster • particles have more energy • so more frequent collisions between particles rate) • more successful collisions • so more energetic collisions between particles • more particles have enough energy to react (a energy) when they collide	
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. temperature is higher and concentration is higher so reaction is faster e.g. temperature is higher so particles move faster so reaction is faster • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	a simple description	

		e.g. temperature is higher so particles move faster and concentration is higher so more particles so reaction is faster eg when concentration is higher there will be more particles so more frequent collisions so faster reaction e.g. when temperature is higher particles move faster so more successful collisions so faster reaction • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description e.g. higher concentration of acid so more particles so more frequent collisions so faster reaction and higher temperature so particles have more energy so more successful collisions so faster reaction • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

	Answer	**Acceptable answers**	**Mark**
(b)(i)	B displacement		**(1)**
(b)(ii)	Shown on diagram • horizontal reactant line above product line (1) • horizontal product line to right of reactant line (1)	lines must be correctly labelled eg reactants/Zn + $CuSO_4$ and products/ $CuSO_4$ and Cu ignore any extra lines/curves/labels if not drawn lines but just labels in correct relative positions max 1 If two lines drawn in correct positions but no labels max 1	**(2)**

Q48.

	Answer	**Acceptable answers**	**Mark**
	An explanation linking (reduction is) gain of electrons(2)	if cathode gains electrons – 1 mark loss of oxygen – 1 mark	**(2)**

Q49.

Question Number	Answers	Acceptable Answers	Mark
(a)	A aluminium nitrate and lead sulfate		**(1)**

Question Number	Answers	Acceptable Answers	Mark
(b)	An explanation linking two of the following strong (forces of / electrostatic) attraction (1) (between) oppositely charged ions (1) requires lot of heat/energy {to separate ions/overcome forces/break bonds} (1)	Any reference to molecules/molecular/intermolecular/covalent scores 0 marks overall strong bonds ignore "between atoms" for this mark ignore strong lattice / giant structure positive and negative ions reject between bonds reject charged atoms for this mark {high / more} {heat / energy} ignore hard to melt/high temperature needed	**(2)**

Question Number	Answers	Acceptable Answers	Mark
(c)(i)	**white** {precipitate /solid}	**white** powder	**(1)**

Question Number	Answers	Acceptable Answers	Mark
(c)(ii)	$BaSO_4$ + 2KCl (2) OR $BaSO_4$ + KCl (1)	SO_4Ba / ClK Ignore incorrect use of case, or use of superscript or large number 4	**(2)**

Question Number	Answers	Acceptable Answers	Mark
(d)(i)	C K^+		**(1)**

Question Number	Answers	Acceptable Answers	Mark
(d)(ii)	A description linking three of the following (sequence has to be correct for full marks) M1 add/mix/react only sodium carbonate (solution) and lead nitrate (solution) (1) M2 filter (off precipitate) (1) **M3 dep on M2** M3 wash/rinse (solid/residue with distilled water) OR dry using {filter paper/paper towel/in a (warm/drying) oven} (1)	 add/mix/react the (two) solutions/them for M1 ignore warm/heat mixture if any indication of heating to evaporate anywhere only M1 can be scored if any other reagent added eg acid can score max 2 for question decant (off the solution) reject if wash with acid or other reagent leave to dry / in the sun / on a radiator / near a window reject heat/hot oven	**(3)**

Q50.

Question Number	Answer	Acceptable answers	Mark
(a)	mass of magnesium sulfate = 18.50 – 18.20 (1) (= 0.30 (g)) conc = ans to subtraction /0.3 (1) 0.5 (= 0.6 g dm^{-3})	Allow mark if you see 0.3 Give 2 if answer is 0.6.	**(2)**

Question Number	Answer	Acceptable answers	Mark
(b)(i)	pipette allow any recognisable spelling.		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)(ii)	named indicator (1) colour in alkali (1) colour at end point / in acid (1) for example: phenolphthalein (1) pink/ purple (1) colourless (1) methyl orange (1) yellow (1) orange/pink (1)	if no indicator named/ substance named is not an indicator then score 0 for whole part. Indicator spelling has to be recognisable. Litmus (paper/ solution) allowed if universal indicator (allow 'indicator paper') **and** correct colours (allow neutral or acid colour for colour at end) allow 1 mark only.	**(3)**

Question Number		Indicative Content	Mark
QWC	*** (c)**	A description including some of the following points **Salt formation** • measure sulfuric acid into a beaker / suitable vessel • stir • heat / warm beaker and sulfuric acid (over a Bunsen flame) • add copper oxide • until solid remains **Separation** • filter the mixture • to remove excess / unreacted copper oxide **Crystallisation** • collect filtrate / copper sulfate solution in an evaporating basin • heat until concentrated / half evaporated • allow to cool and crystallise • pour off remaining solution to leave crystals • dry crystals eg filter paper/ oven/warm place	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. add copper oxide to sulfuric acid in a beaker and mix/stir • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description e.g. add copper oxide to sulfuric acid in a beaker until no more reacts and filter off the unreacted copper oxide • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description e.g. add copper oxide to sulfuric acid, filter, allow filtrate to crystallise, dry crystals • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Q51.

	Answer	**Acceptable answers**	**Mark**
	magnesium sulphate	accept magnesium sulphate	(1)

Q52.

Question Number	Answer	Acceptable answers	Mark
(a)	C precipitation		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)	copper carbonate (s) (1) sodium nitrate (aq)(1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
(c)	$CuCO_3$ Ignore any 'balancing' number in front of $CuCO_3$ Ignore any working to find the formula	$Cu(CO_3)/Cu^{2+}CO_3^{2-}$ / $(Cu)^{2+}(CO_3)^{2-}$ / $(Cu^{2+})(CO_3^{2-})$ do not allow superscript 3 ie $CuCO^3$ do not allow $Cu(CO)_3$	**(1)**

Question Number	Answer	Acceptable answers	Mark
(d)		Maximum **2** marks if another chemical is added to the original mixture Maximum **2** marks if heat or evaporate is used on the original mixture or the filtrate	
	First mark filter/filtration/filtering (1)	description or diagram of filtering ie funnel **and** filter paper do not allow sieving/ sifting/ draining /decanting do not allow separating funnel	
	Second and third marks A description including **two** of the following		
	wash/rinse (with distilled water) (1)	pour water through solid in filter paper / clean solid with water do not allow this mark if washing is done after drying	
	any method of drying (1)	leave to dry do not allow just 'dry'	
	{lead iodide/the solid/the precipitate/the insoluble salt} is {the residue/left on the paper} (1)	do not allow other {solids/salts} left with the lead iodide	**(3)**

Question Number	Answer	Acceptable answers	Mark
(e)(i)	potassium / K^+	K	**(1)**

Question Number	Answer	Acceptable answers	Mark
(e)(ii)	chloride / Cl^-	chlorine (ion) / Cl do not allow Cl_2	**(1)**

(Total for Question = 9 marks)

Q53.

Question Number	Answer	Mark
	D NaCl H_2O	**(1)**