PEARSON EDEXCEL GCSE CHEMISTRY · 1CH0

CHEMISTRY



MARK SCHEME

TOPIC 5: SEPARATE CHEMISTRY 1 (PACK 3)

SCORE	PERCENTAGE
/142	%

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Q3.

Question (iii) was well attempted with many candidates scoring. The most common mark awarded was two, this was often scored for showing the understanding that equilibrium yield would increase and that the equilibrium would shift to the right. Only the best candidates were able to explain that the rate of attainment of equilibrium increases and that there is a decrease in number of molecules to score full marks.

Q4. No Examiner's Report available for this question

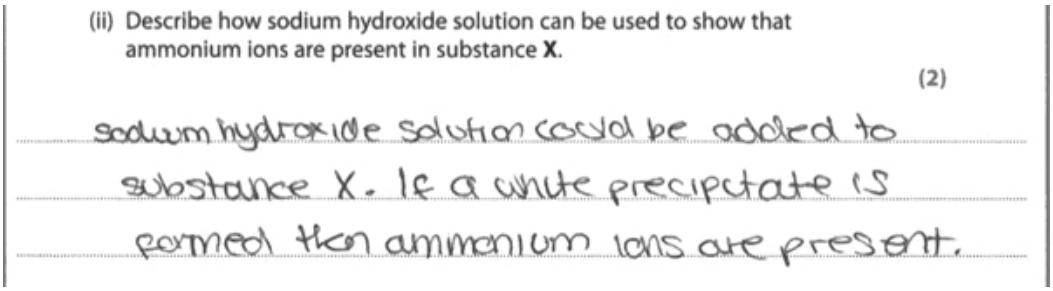
Q5. No Examiner's Report available for this question

Q6. No Examiner's Report available for this question

Q7.

(a) (ii)

Although many candidates did know how to test for ammonia, there were many poor descriptions. A significant number omitted to heat the mixture. A surprising number thought that ammonia would turn blue litmus red or even bleach it. A common error was to place red litmus in the solution with sodium hydroxide rather than in the gas.



(ii) Describe how sodium hydroxide solution can be used to show that ammonium ions are present in substance **X**.

(2)

Sodium hydroxide solution could be added to substance X. If a white precipitate is formed then ammonium ions are present.

Results Plus: Examiner Comments

This candidate has not learnt the test for ammonium ions so has not scored a mark.

Results Plus: Examiner Tip

Learn all the tests for the ions that are listed in the specification.

(ii) Describe how sodium hydroxide solution can be used to show that ammonium ions are present in substance **X**.

(2)

Add a few drops of sodium hydroxide solution to substance X and, if aluminium ions are present, a white precipitate should form. To make sure they are aluminium ions and not calcium ions, add more sodium hydroxide solution. The precipitate should redissolve leaving a colourless solution.

Results Plus: Examiner Comments

This candidate has described the test for aluminium ions and has not scored any marks as the question asks for ammonium ions.

Results Plus: Examiner Tip

Read the questions carefully.

(ii) Describe how sodium hydroxide solution can be used to show that ammonium ions are present in substance **X**.

(2)

Sodium hydroxide solution can be added to substance X, as precipitate will form but it heated, will give off ammonia, this can be tested by the smell and ~~red litmus~~ blue litmus paper as it will turn red.

Results Plus: Examiner Comments

This candidate knows that the mixture should be heated and has remembered that litmus is used to test for ammonia. However, ammonia is an alkaline gas so the colour change in this description is wrong and the answer scored 1 mark.

Results Plus: Examiner Tip

Learn the colour changes for litmus in acidic and alkaline substances.

(ii) Describe how sodium hydroxide solution can be used to show that ammonium ions are present in substance **X**.

(2)

Add sodium hydroxide solution to the substance and boil. A smell of ammonia would be produced and damp red litmus paper would turn blue.

Results Plus: Examiner Comments

This is a very good answer, scoring both marks.

Results Plus: Examiner Tip

When you are asked to describe a test, always describe how you would carry out the test and the observation that would be made.

(b)

A surprising number of candidates were unable to give the correct formula for the hydroxide ion and an even smaller number were able to work out the formula for aluminium hydroxide. However, a significant number of candidates did score 3 marks for this question.

(ii) Describe how sodium hydroxide solution can be used to show that ammonium ions are present in substance **X**.

(b) Aluminium ions, Al^{3+}, react with hydroxide ions in solution to give a white precipitate of aluminium hydroxide.

Write the ionic equation for this reaction.

(3)

$Al^{3+} + 3OH^- \rightarrow AlOH_3$

Results Plus: Examiner Comments

This candidate has written the correct formula for hydroxide ions so has scored 1 mark. If this candidate had drawn brackets around the OH in the formula for aluminium hydroxide, they would have scored 3 marks.

Results Plus: Examiner Tip

Learn how to write formulae for ionic compounds.

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(b) Aluminium ions, Al^{3+}, react with hydroxide ions in solution to give a white precipitate of aluminium hydroxide.

Write the ionic equation for this reaction.

(3)

$Al^{3+}_{(aq)} + 3OH^-_{(aq)} \rightarrow Al(OH)_{3(s)}$

Results Plus: Examiner Comments

This is an excellent answer, scoring 3 marks. The state symbols were not necessary in this question.

(b) Aluminium ions, Al^{3+}, react with hydroxide ions in solution to give a white precipitate of aluminium hydroxide.

Write the ionic equation for this reaction.

(3)

$Al^{3+} + OH^- \rightarrow Al(OH)_3$

$Al^{3+} + OH^- \rightarrow AL(OH)_3$

Results Plus: Examiner Comments

This candidate has written all the correct formulae so has scored 2 marks. If they had balanced the equation, they would have scored an extra mark.

Results Plus: Examiner Tip

Remember to balance all equations.

(c)

Candidates who had learnt the tests for sodium, potassium, iodide and sulfate ions carefully were able to score full marks for this question. Only a few candidates did not know the correct flame test colours for the cations. More candidates did not know the tests for the anions and made errors such as using dilute hydrochloric acid to acidify the silver nitrate solution to test for iodide ions or stated that a yellow solution would be formed rather than a yellow precipitate.

Explain how, using chemical tests, the technician could find out if the substance left in the beaker was potassium sulfate, potassium iodide, sodium sulfate or sodium iodide.

You may include equations in your answer.

(6)

She would divide the crystals up into four groups for the four different tests she would need to preform. she would need to preform the flame test, silver nitrate test, adding sodium hydroxide solution and the bromide test. The result of these reactions, what precipitates formed, the colours the crystals turned and the ordour they gave of can be used to determine what substance was left in the beaker.

Results Plus: Examiner Comments

This candidate has given a number of tests that could be carried out, but has not given the results that would be observed from these four salts. This answer was given 1 mark for carrying out a flame test.

Results Plus: Examiner Tip

When you are asked for tests to identify substances, describe how you would carry out the test and what you would expect to see.

Explain how, using chemical tests, the technician could find out if the substance left in the beaker was potassium sulfate, potassium iodide, sodium sulfate or sodium iodide.

You may include equations in your answer.

(6)

Firstly, the technician could do a flame test. A flame test would involve ~~heating~~ a ~~sp~~ a heating up the substance. A flame test would be able to show if the substance had potassium or sodium in it. The substance would glow lilac if potassium was present.

Add dilute hydrochloric acid followed by some silver nitrate. ~~Then~~ This test should show the difference between the sulfate and the iodide.

Results Plus: Examiner Comments

This is an example of a level 1 answer, scoring 2 marks. The flame test for potassium is correct. However, if you use dilute hydrochloric acid with silver nitrate solution, you will obtaing a precipitate of silver chloride.

Results Plus: Examiner Tip

Use dilute nitric acid with silver nitrate solution to test for halides.

Use dilute hydrochloric acid with barium chloride solution to test for sulfates.

Explain how, using chemical tests, the technician could find out if the substance left in the beaker was potassium sulfate, potassium iodide, sodium sulfate or sodium iodide.

You may include equations in your answer.

(6)

- Add dilute nitric acid to potassium iodide and then a few drops of silver nitrate. Iodide produces a yellow precipitate. In a flame test the potassium will turn the flame lilac.

In a flame test sodium will produce a red flame.

Add dilute nitric acid to sodium sulphate or sodium iodide then add a few drops on nitric acid. A white precipitate will be formed.

Results Plus: Examiner Comments

This is an example of a level 2 answer, scoring 4 marks. The flame test for potassium and the test for iodide are correct. However, sodium does not give a red flame and the test for sulfate is incorrect.

Results Plus: Examiner Tip

Learn the tests for all of the ions in the specification.

Explain how, using chemical tests, the technician could find out if the substance left in the beaker was potassium sulfate, potassium iodide, sodium sulfate or sodium iodide.

You may include equations in your answer.

(6)

To identify potassium ions, you can use a flame test. Add the solution to a lit bunsen burner and if the flame turns ~~purple~~ lilac potassium ions are present. You can also test for sodium ions by a flame test. Again add the solution to a flame and if the flame is yellow/~~orange~~ orange then sodium ions are present. To test for iodide ions, add dilute nitric acid (to get rid of any carbonate ions) and add silver ~~chloride~~ nitrate. If iodine ions are present, a yellow precipitate will form. The equation for this is $Ag^+ + I^- = AgI_{(s)}$. Lastly, to test for sulfate ions, add hydrochloric ~~to~~ acid to the solution followed by barium chloride. If sulfate ions are present, the a precipitate of barium sulfate will form.

Results Plus: Examiner Comments

This is a very good level 3 answer, scoring 6 marks. The candidate has written correct identification test for the ions and has even added a correct ionic equation.

Q8. No Examiner's Report available for this question

Q9.

Few candidates scored well on this question as they did not compare the data from the table but just re-stated it. Those that did score did so for stating that steel had an increased strength in comparison with iron but then did not write anything else for a second mark. Some seemed to misunderstand the data given and thought that steel would rust easier (than iron). Some compared the cost or density which did not score credit.

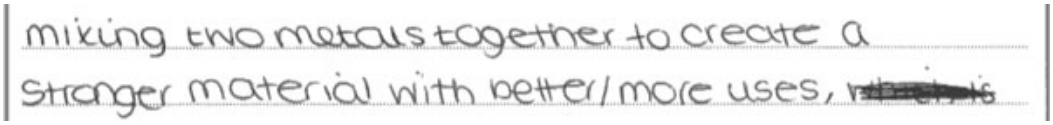
Q10. No Examiner's Report available for this question

Q11. No Examiner's Report available for this question

Q12.

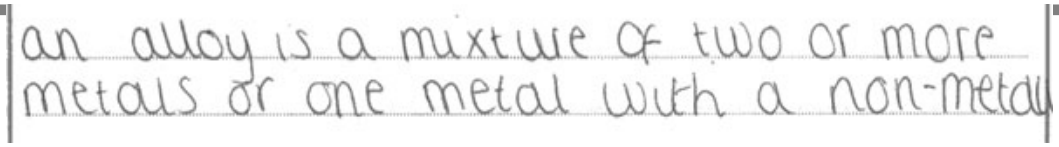
i

Many candidates knew that an alloy should contain a mixture of atoms rather than a compound, however many also stated that the mixture was of a metals and non-metals.



Results Plus: Examiner Comments

This answer gains full credit as they have the idea of mixing metals.



Results Plus: Examiner Comments

If this response had finished after the word metals, it would have scored 2 marks. However, it then goes on to state 'or one metal with a non-metal' which is not creditworthy.

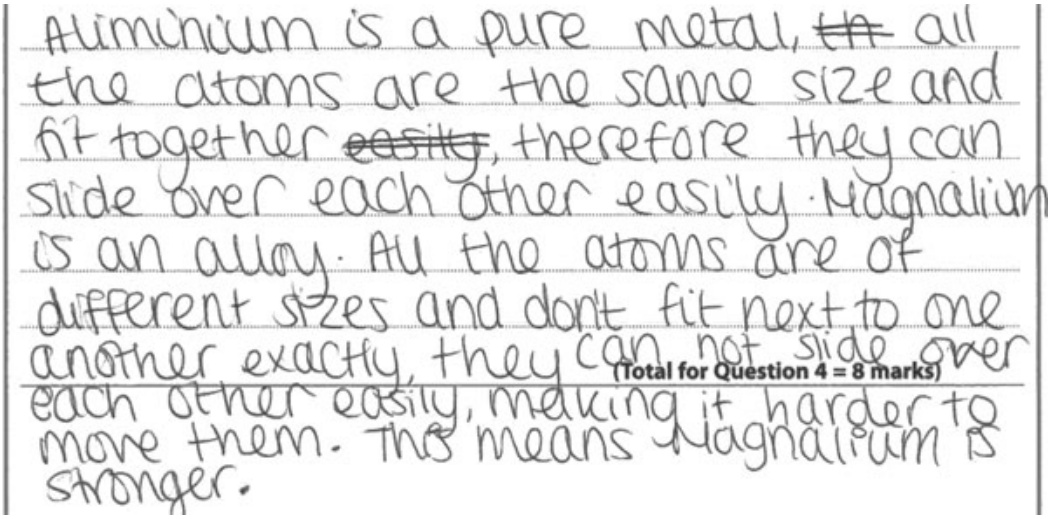
Results Plus: Examiner Tip

If you are not sure of an answer, never give a right and a wrong answer as the wrong answer will

cancel out the right one and you will always get zero marks.

ii

Candidates performed well on this question and could give a concise and detailed account as to why the alloy of magnalium is stronger than pure aluminum.


Aluminium is a pure metal, ~~it~~ all the atoms are the same size and fit together ~~easily~~, therefore they can slide over each other easily. Magnalium is an alloy. All the atoms are of different sizes and don't fit next to one another exactly, they can not slide over each other easily, making it harder to move them. This means Magnalium is stronger.

(Total for Question 4 = 8 marks)

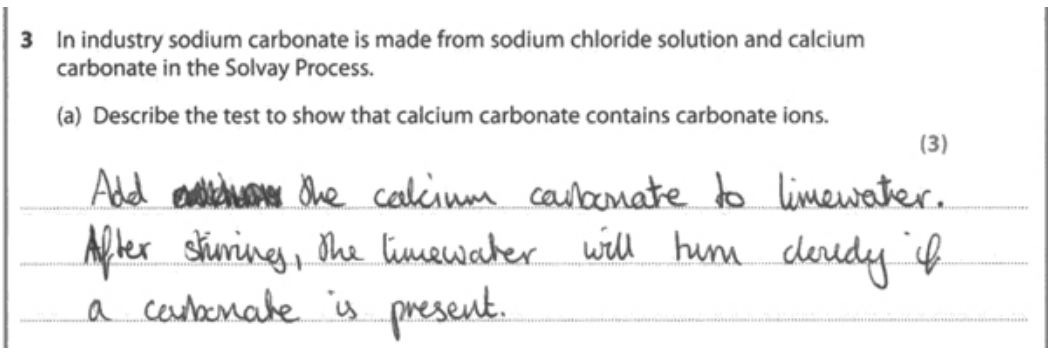
Results Plus: Examiner Comments

A very good answer which scores three marks.

Q13.

(a)

Candidates often scored 2 marks for mentioning carbon dioxide and describing a correct limewater test. However the need to add acid to the calcium carbonate or to heat it to produce the carbon dioxide was often omitted with a large number of candidates suggesting that the calcium carbonate should be added directly to the limewater. Some candidates described a flame test approach to identify calcium ions rather than the carbonate in calcium carbonate and so gained no credit.


3 In industry sodium carbonate is made from sodium chloride solution and calcium carbonate in the Solvay Process.

(a) Describe the test to show that calcium carbonate contains carbonate ions.

(3)

Add ~~calcium~~ the calcium carbonate to limewater. After stirring, the limewater will turn cloudy if a carbonate is present.

Results Plus: Examiner Comments

Quite a common answer which was awarded one mark for the result of a limewater test.

3 In industry sodium carbonate is made from sodium chloride solution and calcium carbonate in the Solvay Process.

(a) Describe the test to show that calcium carbonate contains carbonate ions.

(3)

Firstly, add dilute ~~acid~~ nitric acid to the calcium carbonate. Then, pass the gas given off through limewater, if it turns milky carbonate ions are produced/present.

Results Plus: Examiner Comments

A good answer worth all three marks.

3 In industry sodium carbonate is made from sodium chloride solution and calcium carbonate in the Solvay Process.

(a) Describe the test to show that calcium carbonate contains carbonate ions.

(3)

Carbonates give off carbon dioxide when heated. If you heat the calcium carbonate the fume off what gases are released into limewater, the limewater will turn milky.

Results Plus: Examiner Comments

An acceptable method of heating the calcium carbonate to produce the carbon dioxide and then correctly testing for it and so worth 3 marks.

(b)

The majority of candidates got this correct although there were the occasional addition errors, and a few candidates forgot to multiply 35.5 by 2. Some were awarded the mark (which was for the working) for doing the correct calculation but giving the answer as 110. Some weaker candidates gained no marks for incorrect calculations or did not attempt the question.

(b) Another product of the Solvay Process is calcium chloride.

Calculate the relative formula mass of calcium chloride, $CaCl_2$.
(Relative atomic masses: Ca = 40; Cl = 35.5)

(1)

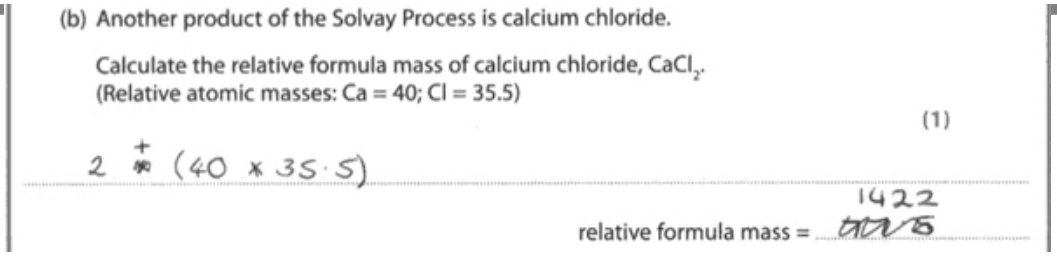
$40 + (35.5 \times 2) = 71.$

35.5
35.5
71.0

relative formula mass = 71.0

Results Plus: Examiner Comments

This gained the mark as it was given for showing the correct working despite the careless error in evaluating the answer.


(b) Another product of the Solvay Process is calcium chloride.

Calculate the relative formula mass of calcium chloride, $CaCl_2$.
(Relative atomic masses: Ca = 40; Cl = 35.5)

(1)

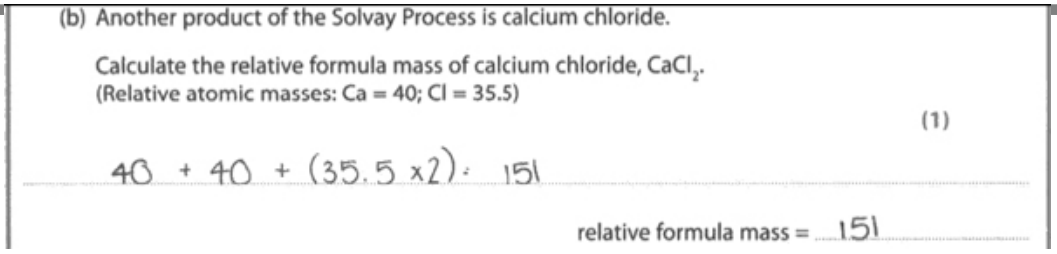
2 + (40 x 35.5)

1422

relative formula mass =

Results Plus: Examiner Comments

It was surprising what some candidates did with the relative atomic masses.


(b) Another product of the Solvay Process is calcium chloride.

Calculate the relative formula mass of calcium chloride, $CaCl_2$.
(Relative atomic masses: Ca = 40; Cl = 35.5)

(1)

40 + 40 + (35.5 x2) = 151

relative formula mass = 151

Results Plus: Examiner Comments

Some multiplied the Ar of calcium by two as well.

(c)

Stronger candidates answered this reacting mass calculation very well. Less confident candidates mixed up the numbers in the calculation e.g. (100x40)/106, but others did not seem to know how to approach it and performed random calculations with the numbers given. Others simply did not attempt it.

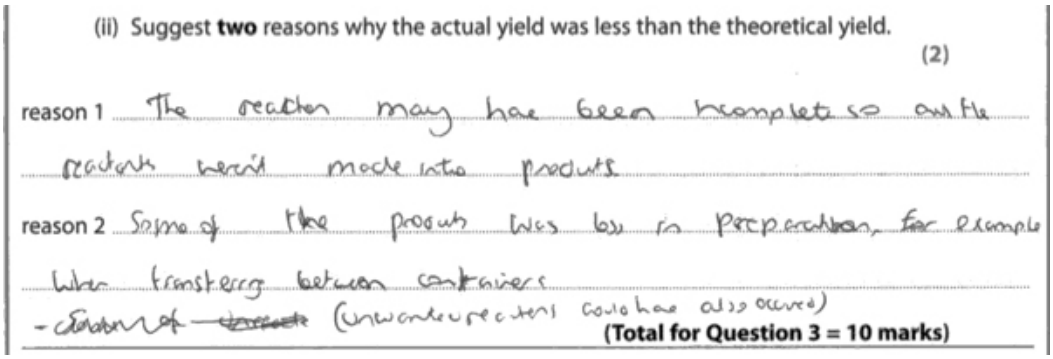
(d) (i)

The majority of candidates answered this correctly. Many were awarded one mark for showing 10.4/15.0 but were not awarded the second mark as they had not multiplied by 100. The most common error was made by those who got the calculation the wrong way round and divided 15.0 by 10.4. They seemingly failed to realise that 144% was not a sensible answer for a percentage yield.

(d) (ii)

Many students seem to have been well trained in their answers to this question. However a range of non-creditworthy answers were suggested. Some of these involved giving definitions of

theoretical yield or referred to the difference between theoretical and actual yield or stated that yield calculations are simply inherently faulty. Others made vague suggestions such as "human error" or errors due to parallax and the need to measure solutions at eye level.



(ii) Suggest **two** reasons why the actual yield was less than the theoretical yield.

(2)

reason 1 The reaction may have been incomplete so not the reactants could made into products

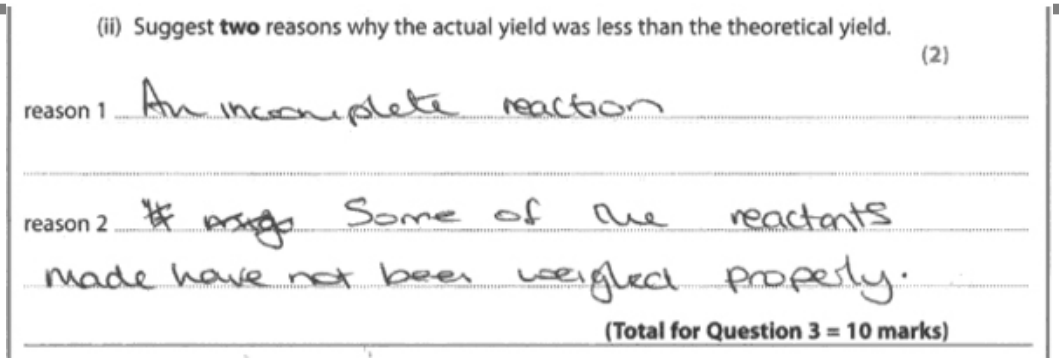
reason 2 Some of the product was lost in preparation, for example when transferring between containers

- ~~Solution of~~ (unwanted reaction could have also occured)

(Total for Question 3 = 10 marks)

Results Plus: Examiner Comments

An answer worth both marks.



(ii) Suggest **two** reasons why the actual yield was less than the theoretical yield.

(2)

reason 1 An incomplete reaction

reason 2 ~~# prog~~ Some of the reactants made have not been weighed properly.

(Total for Question 3 = 10 marks)

Results Plus: Examiner Comments

The first reason is correct but errors in weighing were not acceptable.

Q14.

(b)

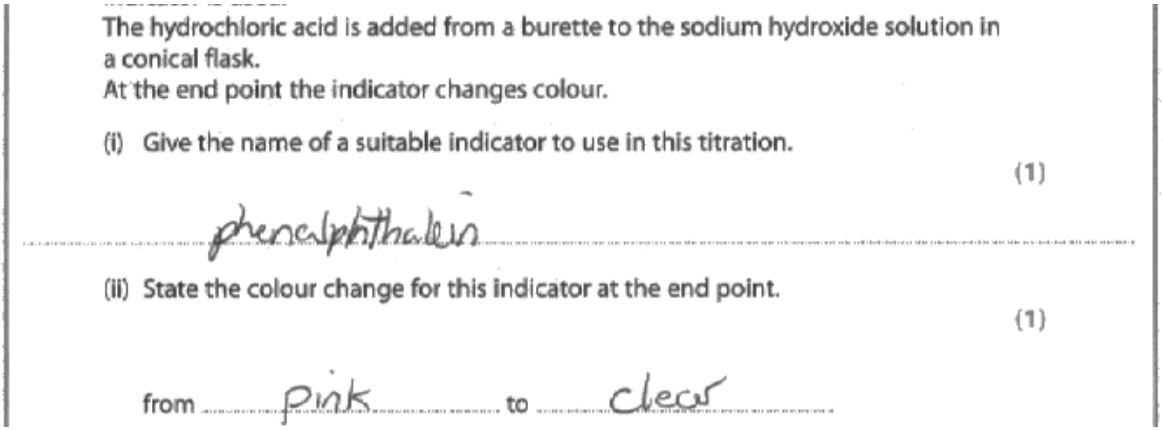
This question was very poorly answered. Most candidates struggled with writing the ionic equation for neutralisation. It was apparent that very few candidates knew what is meant by an ionic equation, let alone how to write one.

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)

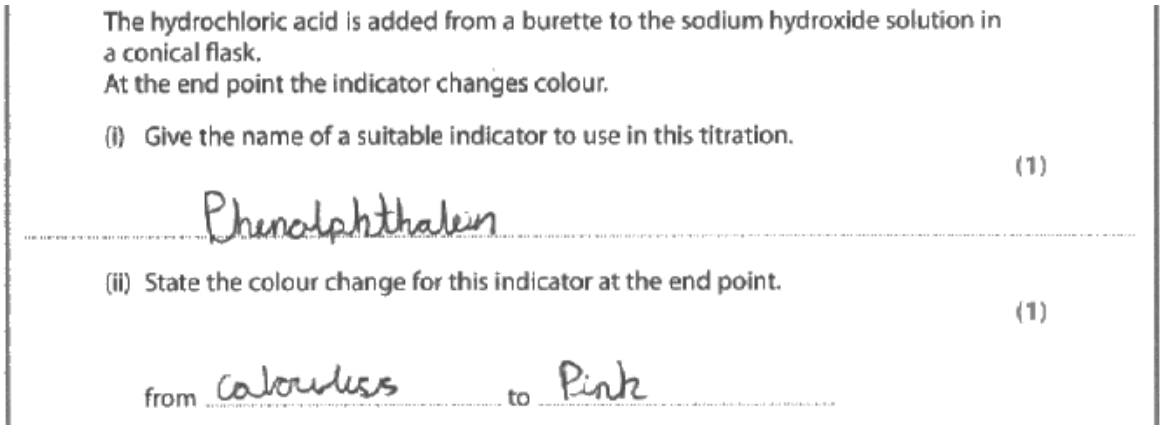
from pink to clear

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

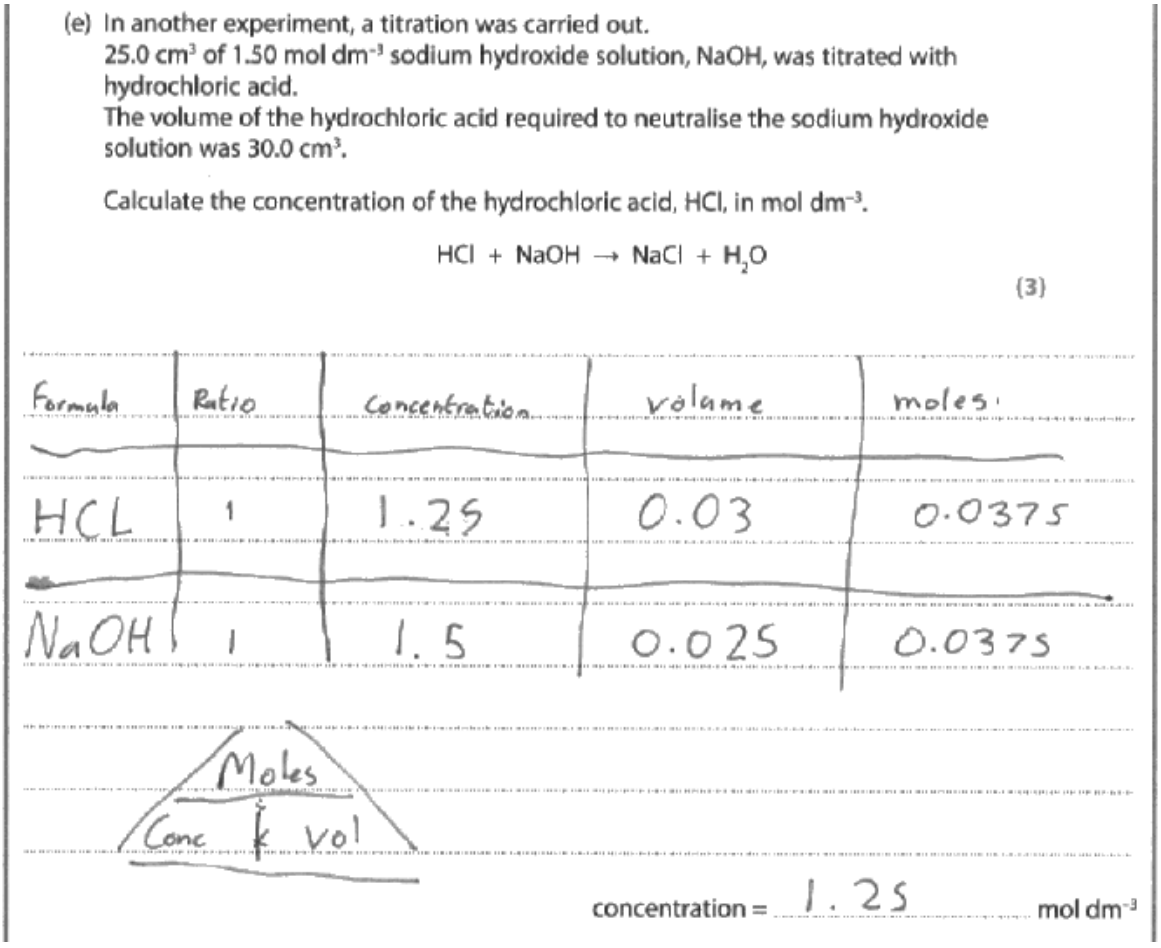
This response scored 1 mark only for correct indicator (and spelled correctly) in part (i), but the colour change is the wrong way round, so the second marking point was not scored.

(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

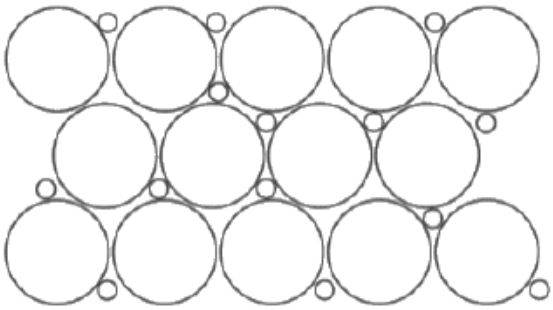
A typical example of a fully correct response, 3 marks. This candidate has used the correct formula triangle and shown all the quantities in a table (correctly calculated the number of moles of sodium hydroxide, and recognised that the reaction is in a 1:1 ratio, and has then calculated the concentration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

Q15. No Examiner's Report available for this question

Q16.

This proved to be a much more difficult free response question. There were some good responses but many others were very weak. It seemed that some candidates were not familiar with the diagram of a metal structure which was given to help them.

*(c) The diagram shows the structure of a metal.



Use the diagram to describe the structure of a metal and to explain why metals are malleable and conduct electricity.

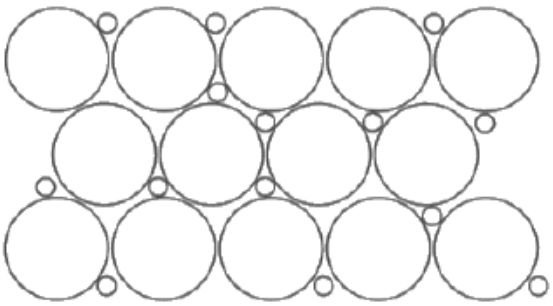
(6)

Metals have many different properties such as they are hard, shiny and are malleable which means they can be hammered into shape, the are also good conductors of electricity and heat, which is why copper is used in wires as it conducts electricity.
The structure shows big particles with small particles inbetween making the metal strong and compact but also allowing movement meaning the metal is malvable and can be hammered into shape with the use of heat.

Results Plus: Examiner Comments

The candidate has explained malleable but no other creditworthy information so level 1 with 2 marks.

*(c) The diagram shows the structure of a metal.



Use the diagram to describe the structure of a metal and to explain why metals are malleable and conduct electricity.

(6)

Metals have layers, which means that they can slip over eachother, meaning that they can be bent into a shape; this is what makes them malleable.

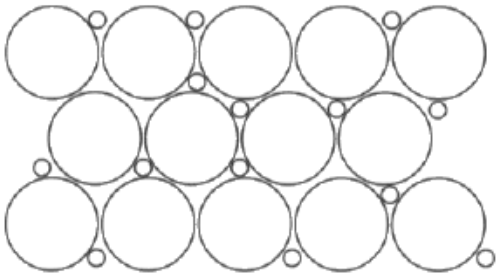
Metals have a delocalised sea of electrons. The electrons within metal are positive meaning that they're able to conduct electricity.

There is also small spaces within metals, allowing electricity to pass

Results Plus: Examiner Comments

This candidate has made two valid points about malleability. Another valid point is delocalised electrons (despite them being positive!) Level 2 and 4 marks.

*(c) The diagram shows the structure of a metal.



Use the diagram to describe the structure of a metal and to explain why metals are malleable and conduct electricity.

(6)

Metals have medium to high melting points and are solids at room temperature except for mercury. Metals can conduct electricity because positive ions are held together by sea of ~~delocia~~ delocalised electrons. Some metals have stronger bonds than others. Metals are malleable because they have layers of ions that can easily slide over one and another. Electrons can move freely in metals ~~meaning~~ so electricity can easily flow through it. As metals are malleable they can be easily bent into shapes and hampered into place/shape.

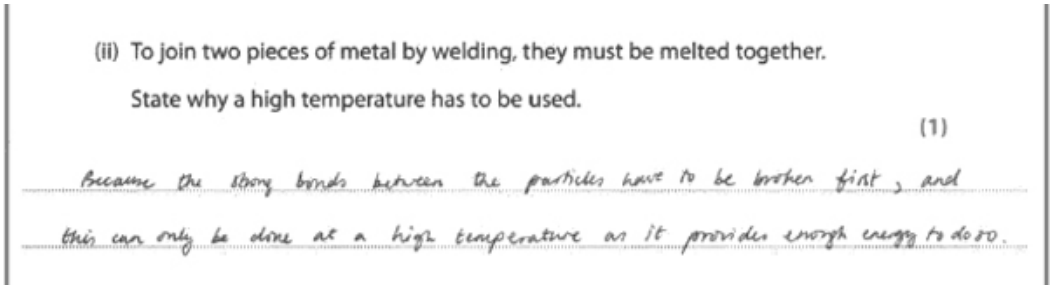
Results Plus: Examiner Comments

This response includes good references to all three aspects including positive ions and delocalised electrons, explanation of meaning of malleability also with layers of ions being able to slide over one another, electrons being able to move enabling electricity to flow. Level 3 and 6 marks.

Q17.

(a) (ii)

Many candidates gave the expected answer of high melting point but others answered in terms of energy required to break bonds and many of these answers were correct. However some incorrectly made references to ionic or covalent or intermolecular bonds. A small minority of the candidates discussed a high boiling point while others effectively just repeated the question.



(ii) To join two pieces of metal by welding, they must be melted together.

State why a high temperature has to be used.

(1)

Because the strong bonds between the particles have to be broken first, and this can only be done at a high temperature as it provides enough energy to do so.

Results Plus: Examiner Comments

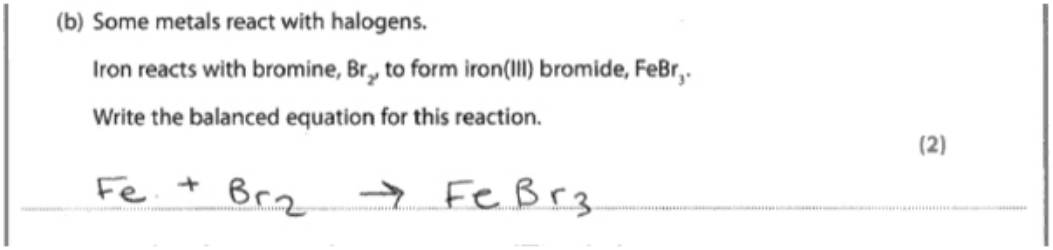
An acceptable way of answering the question worth the mark.

(a) (iii)

Many candidates gained one mark by correctly stating that argon is inert or unreactive or a noble gas. Some candidates then went on to gain a second mark by explaining this idea using the idea of the full outer shell and some others explained that oxygen would react with the metal. However, a significant number of candidates did not gain a second mark as they answered in terms of argon not reacting with oxygen or not being flammable and a surprising number thought argon was a catalyst.

(b)

Many candidates who gave correct symbols and formulae could also balance the equation. Some lost a mark by using the wrong case letters and others gave the wrong formula for $FeBr_3$ and/or Br_2 which should not have happened as these were given in the question. Other errors included putting charges or oxidation states on the iron or trying to balance the equation by putting a number in the middle of the formula, e.g. Fe2Br3.



(b) Some metals react with halogens.

Iron reacts with bromine, Br_2, to form iron(III) bromide, $FeBr_3$.

Write the balanced equation for this reaction.

(2)

$Fe + Br_2 \rightarrow FeBr_3$

Results Plus: Examiner Comments

Correct formulae but not balanced so worth 1 mark.

(d)

The majority of candidates seemed to know the order of the reactivity of the halogens. However there was a good deal of confusion as to when to use the name of the halogen and when to use

the name of the halide ion e.g. candidates referred to bromide and iodide being displaced. Some failed to score marks as they referred to the order of reactivity of the halide ions instead of the halogens. Some weaker candidates thought chlorine was the least reactive giving the reason that chloride would not react with any of the halogens.

Use the information in the table to explain the order of reactivity of the three halogens.

(2)

Chlorine is the most reactive as it displaces the other two halogens. Bromine is ~~the~~ not as reactive as chlorine but more reactive that iodine as it displaces it. Iodine is the least reactive as it doesn't displace any of the above halogens, this shows us the reactivity decreases as you go down the group.

(Total for Question 1 = 9 marks)

Results Plus: Examiner Comments

An answer worth two marks.

Use the information in the table to explain the order of reactivity of the three halogens.

(2)

Chlorine is the highest in reactivity order because it reacts with bromide ion and iodide ion, second is bromine which reacts with iodide ion, and third is iodine which reacts with none of the halide ions.

Results Plus: Examiner Comments

A good answer for two marks.

Use the information in the table to explain the order of reactivity of the three halogens.

(2)

the most reactive halogen out of these three is chlorine as it causes a displacement reaction with a bromide and iodide ion, Bromine is the second most reactive as it is below Chlorine in the periodic table, Iodine is the least reactive as it doesn't cause any displacement reactions, Iodine is below Bromine in the periodic table.

Results Plus: Examiner Comments

A good answer for 2 marks.

Q18.

(b)(i)

Students demonstrated a good understanding of why a gold alloy is stronger than the pure metal gold. The reference to different sized atoms within an alloy either disrupting the structure/layers or preventing the layers/atoms moving was well understood. Likewise many students showed their understanding that as all the atoms in gold are the same size, this meant that the atoms/layers could slide over each other easily, hence making it softer. A minority referred to 'molecules' instead of 'atoms'. Some candidates made their points clear by drawing diagrams of atoms in the pure metal and the alloy.

Pure
^ Gold has the same sized atoms. When copper and silver, which have different sized atoms are added, the different sized atoms disrupt and 'upset' the same sized atoms and make it more difficult for the layers to slide over eachother. This makes it more secure and strong and therefore ~~harder~~ harder.

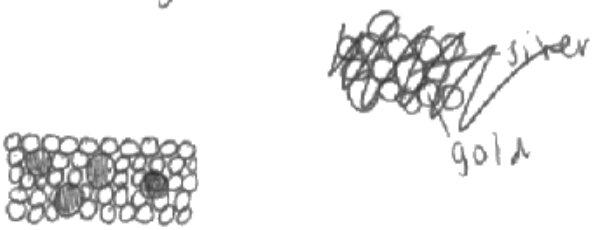
Results Plus: Examiner Comments

A good answer that scored the full 2 marks available.

Results Plus: Examiner Tip

There would be credit for stating that there are different sized atoms in the alloy and for that the atoms cannot slide. However, the candidate has been lax with their use of scientific vocabulary by stating that molecules instead of atoms are different sizes in the first part of the answer so full credit cannot be awarded.

Gold alloys are stronger than pure gold because ~~in~~ copper or silver molecules are different sizes to gold molecules so when they are put together the ~~rea~~ atoms cannot slide over eachother, making them stronger.

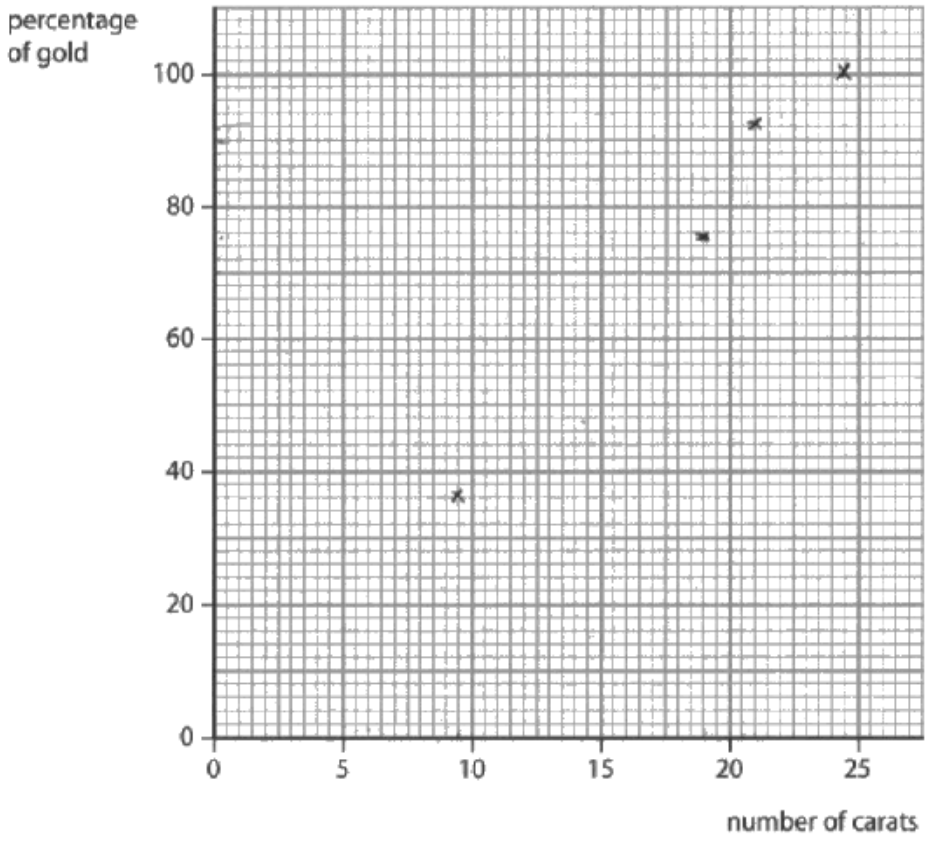


Results Plus: Examiner Comments

It is very important that you use scientific terminology correctly and that terms such as molecules, ions and atoms are used in the correct context, as the use of the wrong term can make your, otherwise correct answer, no longer valid.

(b)(ii-iii)

The majority of candidates were able to plot points accurately, construct a line that best fitted the points drawn and extrapolate to find the percentage of gold in a 14 carat ring. However some students lost marks as they drew a line of best fit from plot to plot or drew a very scruffy line of best fit.



(iii) A gold ring is 14 carat gold.

Use the graph to determine the percentage of gold in the ring.

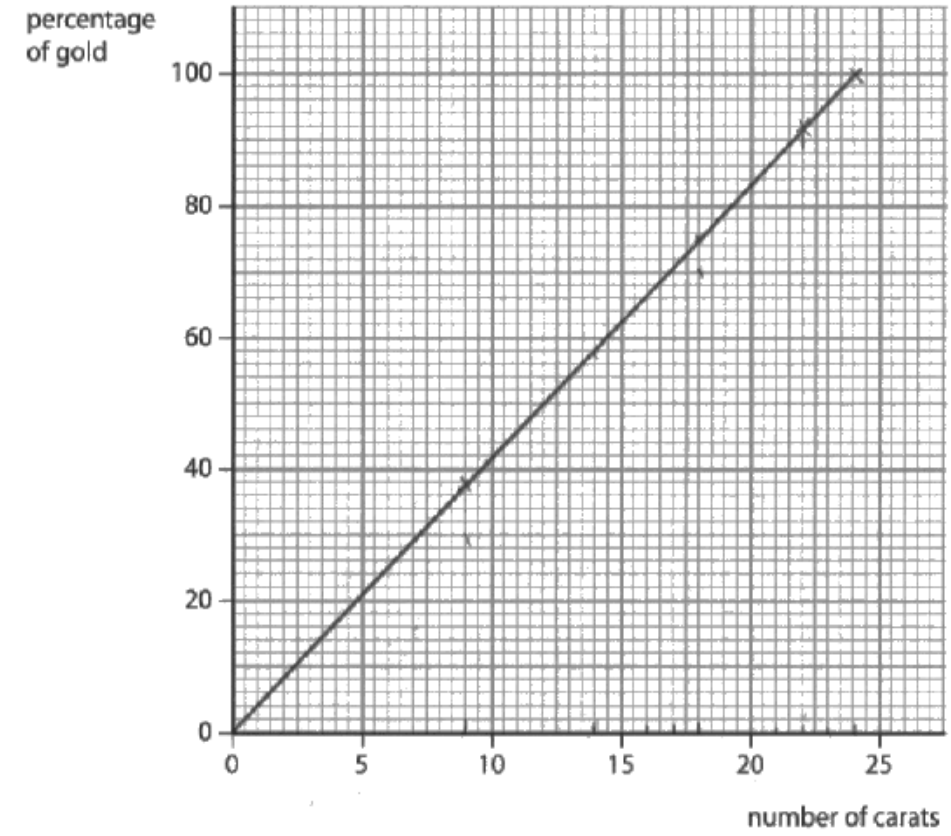
(1)

38%

Results Plus: Examiner Comments

This response scored no marks. There has been an attempt to plot the data. However one of the points was more than 1 small square away from the correct point. No line of best fit has been drawn.

The percentage of gold in the ring is incorrect.



(iii) A gold ring is 14 carat gold.

Use the graph to determine the percentage of gold in the ring.

(1)

58%

Results Plus: Examiner Comments

A good answer that scored full marks for plotting the correct points and drawing a clean line of best fit. The percentage of gold was correctly obtained from the graph.

(c)

Candidates that did well in this question did so as they had a good understanding of the processes involved and the chemistry behind the methods of extraction. They ensured that all areas of the question that had been posed were addressed. Candidates that did less well, either were let down by their weak understanding of the chemistry, for example they were able to state the three methods of extraction but they were not able to relate this to the reactivity of the metals. Or, in some cases, they did not fully address the question and left key areas out. In some cases very generic answers were given and because the detail was lacking marks could not be awarded. Although not required, the best candidates gave very thorough answers, that included correct symbol equations for the reactions taking place.

Gold is the least reactive meaning there is no need for electrolysis because it is already pure, iron is slightly more reactive than gold as it is higher up in the reactivity series. Iron is extracted and heated to be taken from its ore, as aluminum is the most reactive it has to be extracted using electrolysis. meaning it is expensive and will take time to get it. The expense for the process to take place is high meaning lots of money is used.

Results Plus: Examiner Comments

This response gives an explanation of how aluminium and gold are extracted and relates this to their position in the reactivity series. This candidate has also given some explanation in terms of cost for aluminium however they have made no reference to how iron is obtained.

Results Plus: Examiner Tip

Ensure that when you make statements in these six mark questions, you back them up with the chemistry. Once you have written your answer go back and check that you answer fully addresses the question posed.

(6)

If an element is higher than carbon in the series, then it is extracted using electrolysis. these are the most reactive elements, including aluminium. this is because if the element is more ~~attracted to~~ reactive // to carbon, then it wont work. large scale electrolysis is expensive as generating ~~electrolysis~~ electricity requires the burning of fossil fuels or using hydrocarbons. If an element is lower than carbon in the reactivity series, then it is heated with carbon in a blast furnace. this is for example iron to remove the oxygen from the ore by the process of reduction. this method of extraction is also expensive because the powering of a blast furnace requires fuel which will most likely be fossil fuels. However, if the element is on the bottom of the reactivity series, then it doesn't need to be extracted at all. one example is gold. this is because it is naturally found in the earth by itself, as pure metal. this is because it isn't reactive enough to bond with oxygen. Extracting ~~oxygen~~ gold would therefore be very cheap as it does not need to be extracted. An ore is how a metal found in the Earth. It is usually combined with oxygen which is why it's important to extract it to get the pure metal.

(Total for Question 6 = 12 marks)

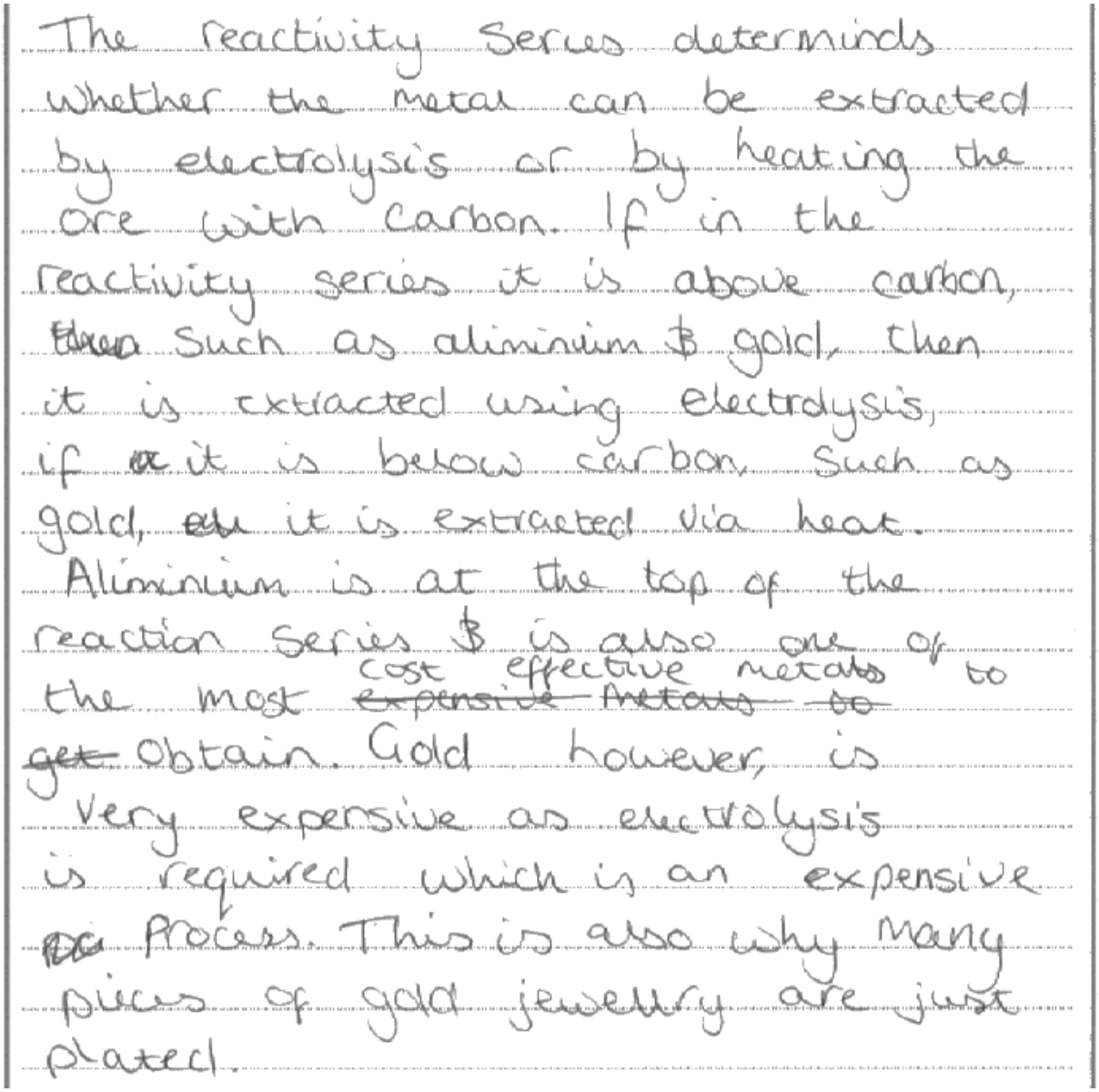
Results Plus: Examiner Comments

This response gives an explanation of how each metal is extracted. The methods of extraction are then justified in terms of the metals position in the reactivity series. There is also some reference to the cost of each method of extraction, a sound 6 mark answer.

Aluminium does not have to be extracted from it's ore using electrolysis because It is of high reactivity it can be heated with carbon to be extracted whereas iron and gold need to be exoacted using electrolysis because of lower reactivity they're more difficult to extract. It is more expensive to extract iron or gold than it is to extract aluminium.

Results Plus: Examiner Comments

There is no correct indication of how any of the metals can be extracted so therefore no marks can be awarded, even though relative reactivity has been mentioned. The reference to cost is also incorrect.


The reactivity Series determinds whether the metal can be extracted by electrolysis or by heating the ore with carbon. If in the reactivity series it is above carbon, ~~then~~ Such as aliminium & gold, then it is extracted using electrolysis, if ~~or~~ it is below carbon, Such as gold, ~~etc~~ it is extracted via heat. Aliminium is at the top of the reaction Series & is also one of the most ~~expensive metals to get~~ cost effective metals to obtain. Gold however, is very expensive as electrolysis is required which is an expensive ~~pro~~ Process. This is also why many pieces of gold jewellery are just plated.

Results Plus: Examiner Comments

This response has given a correct method of extraction for aluminium, however it has coupled this with gold which is incorrect. There is no reference to how iron is obtained.

Q19.

(b)

This question elicited many muddled responses. A large number either rephrased the question, stating what was reduced and what was oxidised, or rephrased the equation. There were a lot of "the lead has lost the oxide....". To score marks it was essential to refer to **oxygen**. It is important that candidates understand that reduction and oxidation are opposites and that, in chemistry, the word 'reduction' has a particular meaning.

(b) Lead oxide can be converted into lead by heating it with carbon.

The word equation for the reaction is

lead oxide + carbon → lead + carbon dioxide

Explain how this equation shows that lead oxide is reduced and carbon is oxidised.

(2)

~~M~~ The lead ~~oxi~~ is no longer with oxygen, but carbon dioxide is formed using the lead oxide's oxygen.

Results Plus: Examiner Comments

This answer shows a clear understanding about the transfer of oxygen.

(c)

The important part of this question was to realise that a contrast was required. Most answers scored 1 mark for comparing the densities of the metals, but not all described the fact that both metals conducted well. The alternative response, explaining why a low density was preferable, was not often seen, although some described aluminium cables as "safer" (i.e. less likely to fall if the cables were lighter).

Wrong answers referred to properties not in the table such as cost, or that aluminium "does not rust", or is stronger. Surprisingly, some linked a lower density to being a better conductor of electricity ("the electricity can flow more easily").

metal	ability to conduct electricity	density / g cm^{-3}
copper	good	8.9
aluminium	good	2.7

Overhead power cables, supported by pylons, are used to carry electricity around the country.

Use the information from the table to explain why aluminium, rather than copper, is used for overhead power cables.

(2)

(2)

Aluminium is as good at conducting as copper but aluminium is less dense which allows electricity to pass through faster making it more effective.

Results Plus: Examiner Comments

The answer has correctly identified the property contrast. Unfortunately, this has been contradicted by an incorrect assertion about faster conduction of electricity.

(c) The table shows some information about the metals copper and aluminium

metal	ability to conduct electricity	density / g cm^{-3}
copper	good	8.9
aluminium	good	2.7

Overhead power cables, supported by pylons, are used to carry electricity around the country.

Use the information from the table to explain why aluminium, rather than copper, is used for overhead power cables.

(2)

because it is boter in dersity /g cm^3 ~~co~~ dis 2.7.

Results Plus: Examiner Comments

This unclear answer does not score.

Results Plus: Examiner Tip

Be clear - what is "better" - is high or low better? The examiner will not guess if the answer is unclear.

(c) The table shows some information about the metals copper and aluminium

metal	ability to conduct electricity	density / g cm^{-3}
copper	good	8.9
aluminium	good	2.7

Overhead power cables, supported by pylons, are used to carry electricity around the country.

Use the information from the table to explain why aluminium, rather than copper, is used for overhead power cables.

(2)

because aluminium is much stronger than copper and it obsarbs electricity

Results Plus: Examiner Comments

The question asks for the answer to use information in the table, but this has not been done.

Results Plus: Examiner Tip

Where information is given, use it.

(e) (i)

Many answers were correct, although values less than 62.5 or above 63 were commonly seen so the graph had to be read carefully.

Some incorrect answers used the wrong scale - quoting 180 - which makes one wonder what is understood by "180% tin in a mixture".

(e) (ii)

A good number of well worded answers were seen here, although some failed to write about both parts of the trend seen, giving a meaningless answer. Some candidates used wording such as "easier/harder to melt", "melted faster/slower" which didn't really mean lower/ higher melting temperature.

A few wrong answers talked about changes in percentage by mass rather than the melting temperature. Some even mentioned boiling point.

(ii) Describe how the melting temperature changes as the percentage by mass of tin in the mixture increases from 0% to 100%.

(2)

The melting temperature rises as the mass of tin increases

Results Plus: Examiner Comments

This is an example of a meaningless answer - the graph clearly shows that the melting temperature drops then rises.

(ii) Describe how the melting temperature changes as the percentage by mass of tin in the mixture increases from 0% to 100%.

(2)

as the percentage of tin gets higher the melting temperature gets lower until a 63, then it starts to rise again.

Results Plus: Examiner Comments

A clearly described answer.

Results Plus: Examiner Tip

The candidate did well to mention the point where the graph changes gradient (with % would have been even better).

Q20. No Examiner's Report available for this question

Q21.

The important part of this question was to realise that a contrast was required. Most answers scored 1 mark for comparing the densities of the metals, but not all described the fact that both metals conducted well. The alternative response, explaining why a low density was preferable, was not often seen, although some described aluminium cables as "safer" (i.e. less likely to fall if the cables were lighter).

Wrong answers referred to properties not in the table such as cost, or that aluminium "does not rust", or is stronger. Surprisingly, some linked a lower density to being a better conductor of electricity ("the electricity can flow more easily").

metal	ability to conduct electricity	density / g cm^{-3}
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Overhead power cables, supported by pylons, are used to carry electricity around the country.

Use the information from the table to explain why aluminium, rather than copper, is used for overhead power cables.

(2)

(2)

Aluminium is as good at conducting as copper but aluminium is less dense which allows electricity to pass through faster making it more effective.

Results Plus: Examiner Comments

The answer has correctly identified the property contrast. Unfortunately, this has been contradicted by an incorrect assertion about faster conduction of electricity.

(c) The table shows some information about the metals copper and aluminium

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aluminium	good	2.7

Overhead power cables, supported by pylons, are used to carry electricity around the country.

Use the information from the table to explain why aluminium, rather than copper, is used for overhead power cables.

(2)

because it is better in density /g cm^3 ~~cop~~ it is 2.7.

Results Plus: Examiner Comments

This unclear answer does not score.

Results Plus: Examiner Tip

Be clear - what is "better" - is high or low better? The examiner will not guess if the answer is unclear.

(c) The table shows some information about the metals copper and aluminium

metal	ability to conduct electricity	density / g cm^{-3}
copper	good	8.9
aluminium	good	2.7

Overhead power cables, supported by pylons, are used to carry electricity around the country.

Use the information from the table to explain why aluminium, rather than copper, is used for overhead power cables.

(2)

because aluminium is much stronger than copper and it absorbs electricity

Results Plus: Examiner Comments

The question asks for the answer to use information in the table, but this has not been done.

Results Plus: Examiner Tip

Where information is given, use it.

Q22.

(i)

Most students knew how to calculate the percentage yield of a reaction. However, a few put (theoretical yield)/(actual yield) and obtained a percentage greater than 100. Some students tried to calculate percentage increase rather than percentage yield. Almost all candidates performed well in this question, but some lost the second mark by not converting the fraction to a percentage.

(i) In an experiment to produce lead, 7.67 g of lead are obtained.
The theoretical yield of lead for the experiment is 11.80 g.

Calculate the percentage yield of lead in this experiment.

(2)

$\frac{7.67}{11.80} = 0.65$

percentage yield = 0.65

Results Plus: Examiner Comments

The fraction giving 0.65 scored the first mark, but the candidate did not convert to a percentage. This was seen on many occassions by examiners. 1 mark only here.

(i) In an experiment to produce lead, 7.67 g of lead are obtained.
The theoretical yield of lead for the experiment is 11.80 g.

Calculate the percentage yield of lead in this experiment.

(2)

$\frac{7.67}{11.8} \times 100 = 65$ $100 - 65 = 35$

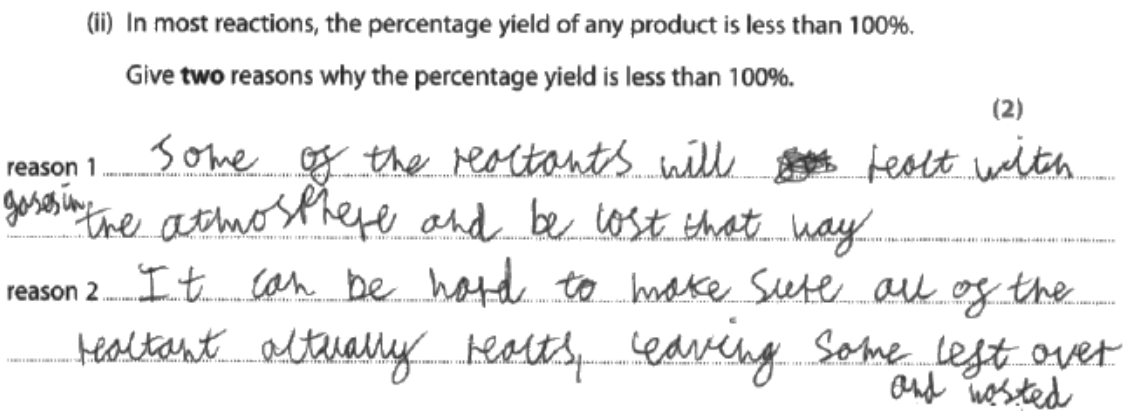
percentage yield = 35%

Results Plus: Examiner Comments

Some candidates produced this as their answer. The first part showing the fraction and converting to a pecentage being correct, but then another calculation was performed to obtain the final answer of 35% for a reason not clear to us. This scored only 1 mark.

(ii)

On the whole, this question was generally well answered. The common incorrect answers included gases escaping, and other products being formed. Some had the words reactants and products mixed up, as in 'not all the products reacted'. Losses through practical work had to refer to loss on transfer between containers rather than spillage or other similar. The majority scored at least one mark.


(ii) In most reactions, the percentage yield of any product is less than 100%.

Give **two** reasons why the percentage yield is less than 100%.

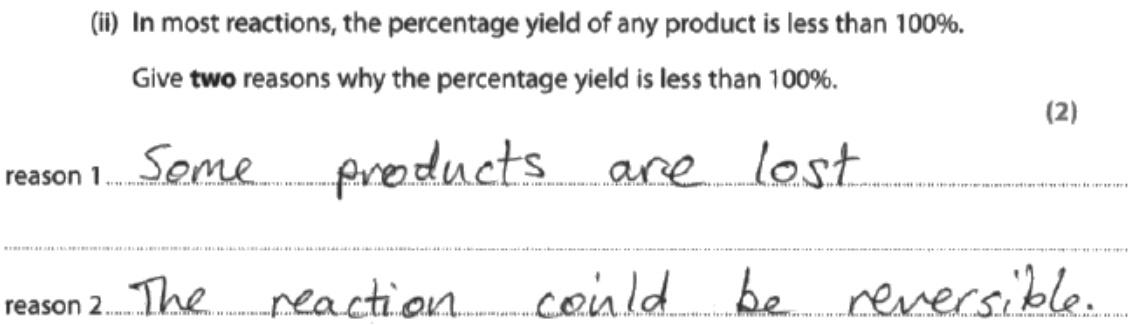
(2)

reason 1 Some of the reactants will react with gases in the atmosphere and be lost that way

reason 2 It can be hard to make sure all of the reactant actually reacts, leaving some left over and wasted

Results Plus: Examiner Comments

This scored 2 marks:
Reason 1 scored marking point 2
Reason 2 scored marking point 1


(ii) In most reactions, the percentage yield of any product is less than 100%.

Give **two** reasons why the percentage yield is less than 100%.

(2)

reason 1 Some products are lost

reason 2 The reaction coild be reversible.

Results Plus: Examiner Comments

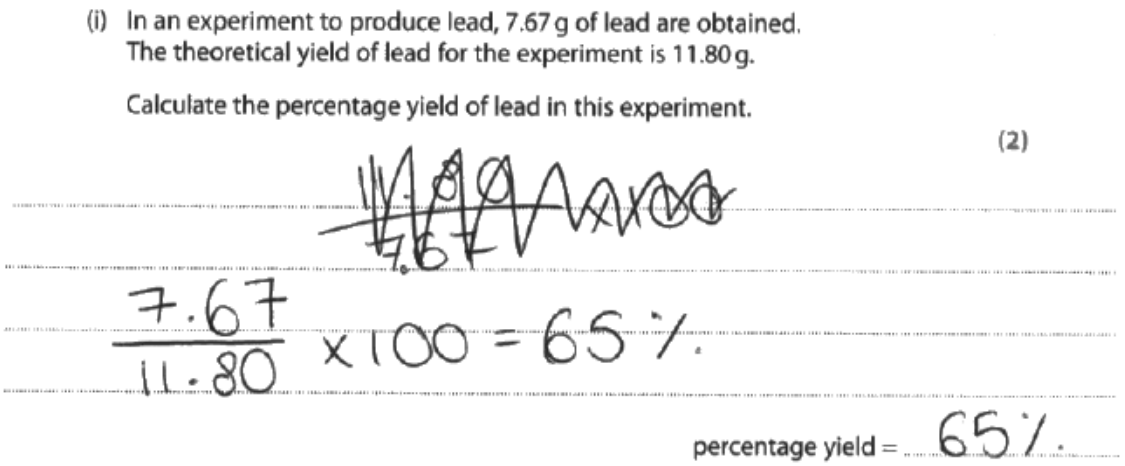
Only 1 mark scored here.

The 1st reason was too vague.

The 2nd reason scored a mark as a reversible reaction would be one were not all the reactants have been used up.

Q23.

In general this question was answered well with many scoring at least 1 mark for being able to calculate a percentage and a good proportion of candidates being able to correctly calculate the percentage yield to gain both available marks.


(i) In an experiment to produce lead, 7.67 g of lead are obtained.
The theoretical yield of lead for the experiment is 11.80 g.

Calculate the percentage yield of lead in this experiment.

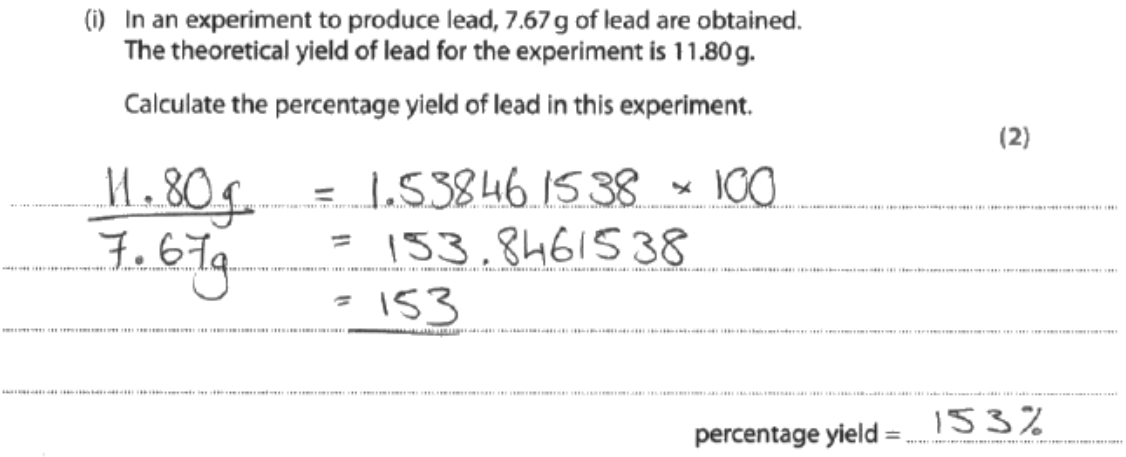
(2)

$\frac{7.67}{11.80} \times 100 = 65\%$.

percentage yield = 65%.

Results Plus: Examiner Comments

A correct answer that scored both marks.


(i) In an experiment to produce lead, 7.67 g of lead are obtained.
The theoretical yield of lead for the experiment is 11.80 g.

Calculate the percentage yield of lead in this experiment.

(2)

$\frac{11.80\text{g}}{7.67\text{g}} = 1.538461538 \times 100$

$= 153.8461538$

$= 153$

percentage yield = 153%

Results Plus: Examiner Comments

The fraction has been inverted in this answer and so the first mark could not be awarded. However a mark was awarded for the incorrect fraction x100.

(ii)

This question proved difficult with few gaining the full two marks available.

Many thought that the percentage yield was only an estimate and so would not be 100%, others repeated the stem of the question and simply stated that the percentage yield could never be 100%.

(ii) In most reactions, the percentage yield of any product is less than 100%.

Give **two** reasons why the percentage yield is less than 100%.

(2)

reason 1 not all the Reactants have Reacted

reason 2 The have been side Reaction

Results Plus: Examiner Comments

A good answer that scored both marks. Stating that not all the reactants have reacted was accepted for an incomplete reactions and the fact that there has been side reactions was also credidted.

(ii) In most reactions, the percentage yield of any product is less than 100%.

Give **two** reasons why the percentage yield is less than 100%.

(2)

reason 1 The theoretical yield isn't accurate as it's a prediction.

reason 2 For it to be 100% both yields must be exactly the same

Results Plus: Examiner Comments

Many thought that the therotical yield is simply a prediction rather than a calcuation.

Q24.

(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 papes

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.

Q25. No Examiner's Report available for this question

Q26. No Examiner's Report available for this question

Q27.

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.

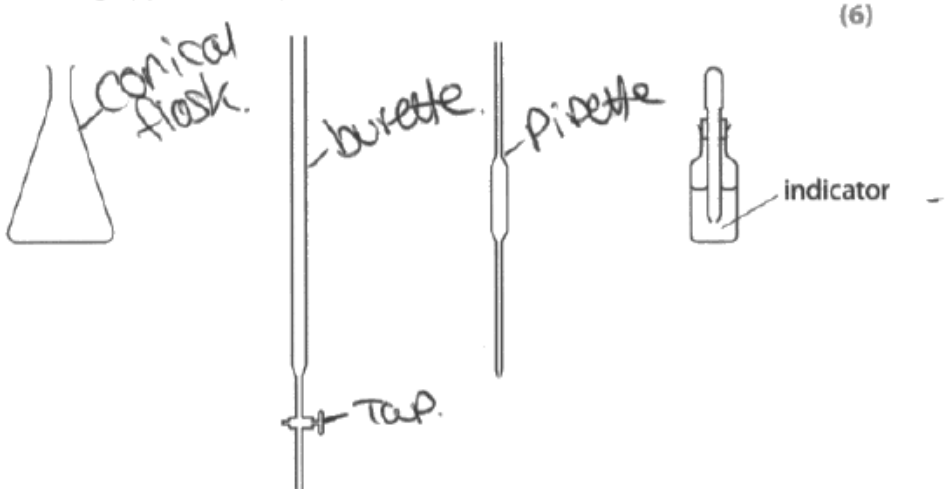
The student is told to carry out the experiment in four stages.

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 put the 25.0cm³ of the alkali, ammonia solution, along with a few drops of 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 + water. gently heat the salt and waters allowing the water to evaporate and 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

P 4 4 6 8 5 A 0 1 4 2 0

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.

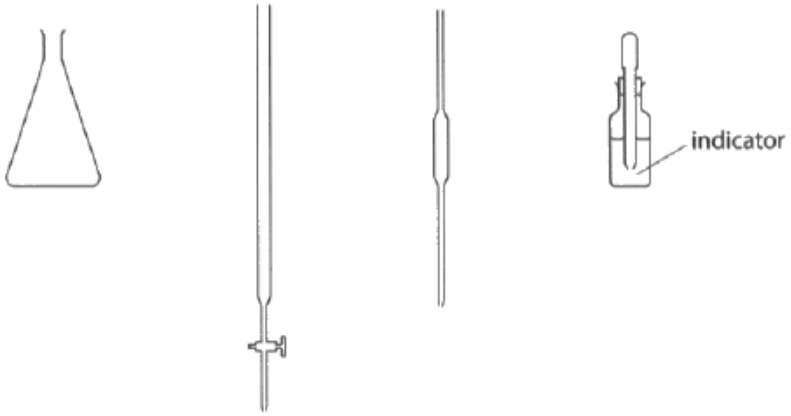
The student is told to carry out the experiment in four stages.

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 meral 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.

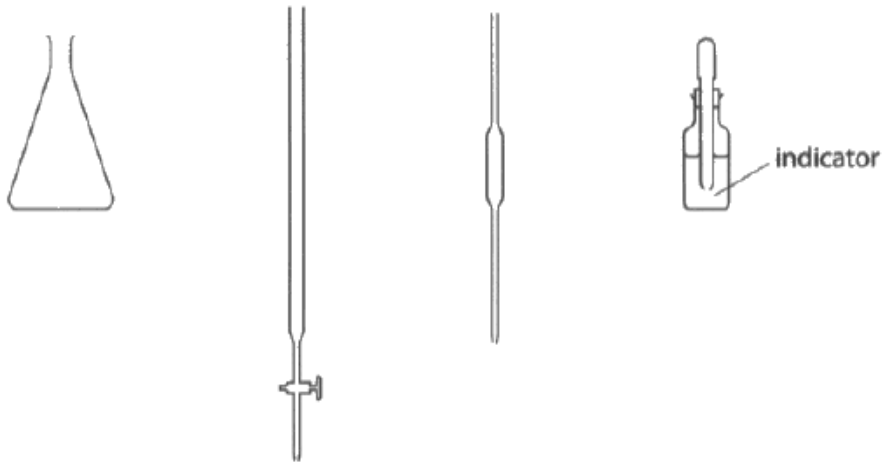
The student is told to carry out the experiment in four stages.

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.

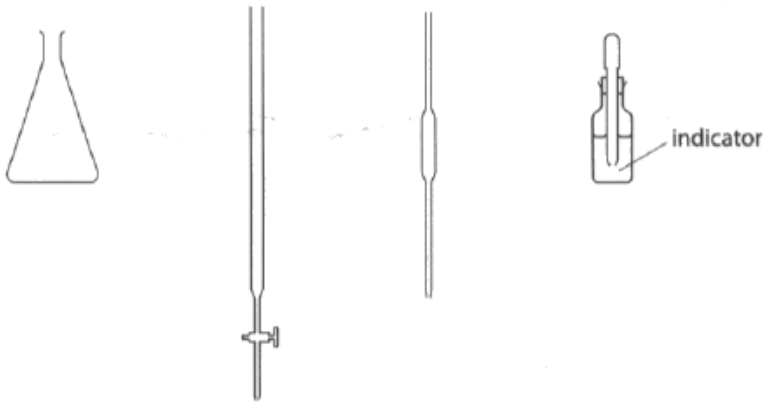
The student is told to carry out the experiment in four stages.

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.

Q28.

(i)

The majority of candidates were able to recall the meaning of the symbol and stated that it meant that the reaction is reversible.

(i) Ammonia can be manufactured by the Haber process.

The word equation for the reaction is

nitrogen + hydrogen ⇌ ammonia

State the meaning of the ⇌ symbol.

(1)

The reaction is reversable - ammonia can be brought back to Nitrogen and Hydrogen

Results Plus: Examiner Comments

This answer gained the mark.

(i) Ammonia can be manufactured by the Haber process.

The word equation for the reaction is

nitrogen + hydrogen ⇌ ammonia

State the meaning of the ⇌ symbol.

(1)

equilibrium

Results Plus: Examiner Comments

Some candidates stated that the symbol meant equilibrium which was accepted for the mark.

(ii)

The majority of candidates were able to use the graph to describe what happened to the

percentage yeild of ammonia as the temperature increases.

(ii) In the Haber process, the percentage yield of ammonia at equilibrium changes with temperature.

Figure 2 shows how the percentage yield of ammonia at equilibrium changes with temperature.

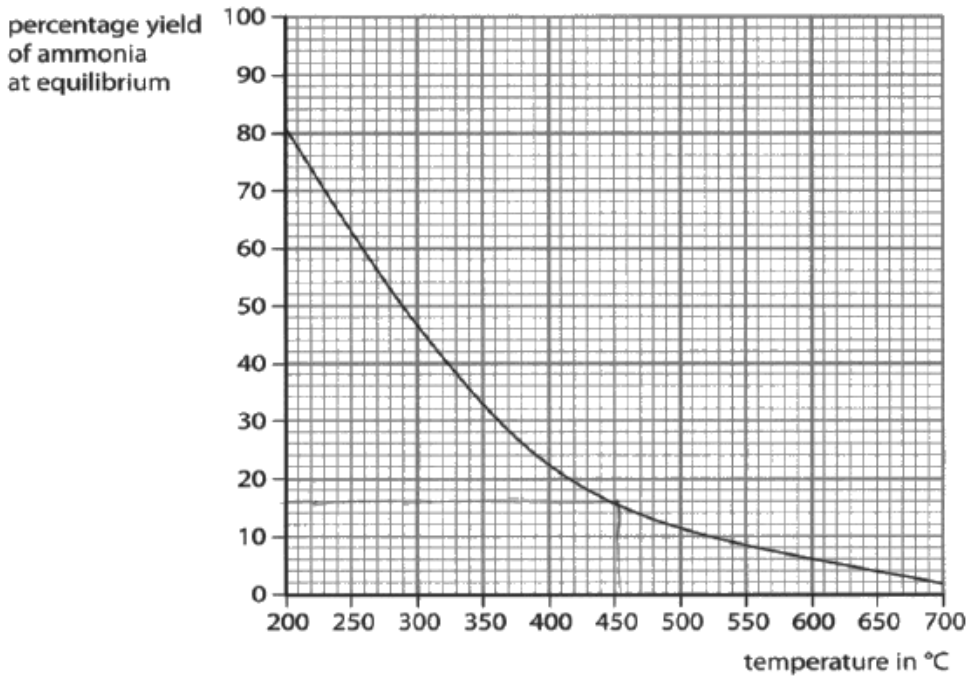


Figure 2

State what happens to the percentage yield of ammonia at equilibrium as the temperature increases.

(1)

As the temperature increases, the percentage yield of ammonia decreases.

Results Plus: Examiner Comments

This answer gained the mark.

(iii)

A large proportion of candidates were able to read off the values correctly to gain the mark.

(iii) Use the graph to find the percentage yield of ammonia at equilibrium at 450 °C.

(1)

percentage yield of ammonia at equilibrium = 13

Results Plus: Examiner Comments

In some cases, candidates did not read the scale correctly and gave a value of 13 or 18 rather than 16.

(iii) Use the graph to find the percentage yield of ammonia at equilibrium at 450°C.

(1)

percentage yield of ammonia at equilibrium = 16

Results Plus: Examiner Comments

The correct answer that scored the mark.

Q29. No Examiner's Report available for this question

Q30. No Examiner's Report available for this question

Q31.

It was disappointing to see the number of candidates who could not match up the properties of the elements with the correct element, with only about half the candidates scoring at least one mark on this question. Often iodine was matched with the yellow solid and copper matched with the grey solid.

Q32.

Some very well laid out answers were seen, as in the example shown, and some not so clear answers that were correct. Unfortunately, the working for many with an incorrect answer was unclear making it difficult or impossible for examiners to award part marks.

Common errors included the incorrect formula mass – 75.5 (CaCl) or 115.5 (Ca_2Cl), and dividing by 500 (cm^3) rather than 0.5 (dm^3).

5 (a) A solution is made by dissolving calcium chloride in water.

11.1 g of calcium chloride are dissolved in water.

The volume of the solution is made up to 500 cm^3.

Calculate the concentration, in mol dm^{-3}, of calcium chloride, $CaCl_2$, in this solution.

(relative atomic masses: Cl = 35.5, Ca = 40.0)

(3)

conc. = moles / vol.

$\frac{500}{1000} = 0.5\ dm^3$

Mr = $(40 + (35.5 \times 2)) = 111$

moles = $\frac{11.1}{111} = 0.1$ moles

conc. = $\frac{0.1}{0.5} = 0.2$

concentration = 0.2 mol dm^{-3}

Results Plus: Examiner Comments

The correct answer, 0.2, is on the answer line.

This example is ideally set out.

Q33. No Examiner's Report available for this question

Q34. No Examiner's Report available for this question

Q35. No Examiner's Report available for this question

Q36. No Examiner's Report available for this question

Q37.

(i)

This question was not well answered on the whole with less than half of responses scoring the 1 mark available.

Correct responses referred in similar frequency to either phosphorus, potassium or nitrogen.

Commonly seen incorrect responses frequently referred to other incorrect elements, such as 'oxygen', or gave the names of fertilisers rather than specific elements.

(ii)

This question was not well answered on the whole with less than half of responses scoring the 1 mark available.

Although, there were many fully correct responses, many candidates were unable to write the correct formula of potassium nitrate, or were unable to recognise that water is the other product in this neutralisation reaction.

Examiners noted that many candidates simply repeated the formula of the reactant, KOH, also as the product.

(ii) Potassium nitrate is present in some fertilisers.

Potassium nitrate is formed by the reaction of potassium hydroxide solution with nitric acid.

Complete the balanced equation for this reaction.

(2)

$KOH + HNO_3 \rightarrow$ 3KNO3 + water

Results Plus: Examiner Comments

This response scored 1 mark only.

The correct formula of one of the products, KNO3, has been given. However, although water has been identified as a product, its formula has not been given. Also, there is an incorrect attempt at balancing, so even though the formula of water been correctly stated, the response would have been limited to 1 mark.

(ii) Potassium nitrate is present in some fertilisers.

Potassium nitrate is formed by the reaction of potassium hydroxide solution with nitric acid.

Complete the balanced equation for this reaction.

(2)

$KOH + HNO_3 \rightarrow$ KNO_3 + H_2O

Results Plus: Examiner Comments

An example of a fully correct response. Both the formulae of the correct products, KNO_3, and H_2O, have been given.

Q38.

(ii) Most answers here were correct. However, some did not answer the question and talked about yield. A few thought that a catalyst slowed down the rate.

(iii) This question was answered correctly by many candidates with most of the remainder thinking that yield would be increased. Others talked about the rate of attainment of equilibrium.

Q39.

Most candidates got this right, but 'redox' was a common incorrect answer.

Q40.

Most candidates thought through this question well, and scored at least one mark, with many getting both marks. The main issue here was being insufficiently exact in the language of the answer. Protection from corrosion was often stated, but others just stated 'protects' but not stating from what, or thought that the electroplating was 'a sacrificial metal'. Others were mixing electroplating with alloying and saying 'to make it stronger'. Many marks were scored with the ideas of improving appearance or by saving cost with a cheaper metal being electroplated, but these answers had to be adequately stated, with vague responses such as 'cheaper' not credited.

Q41. No Examiner's Report available for this question

Q42.

The majority of candidates managed to convey the idea that the blue flame is the hottest, although some didn't get the mark because they used the word stronger or said that the reaction would be quicker rather than relating the answer to the heat energy required for the reaction.

Fewer candidates scored the second marking point. There was a common misconception that a lid was there either to prevent gases from escaping or to keep the reaction at a higher temperature. It was more common to see these answers than the correct answer.

Q43. No Examiner's Report available for this question

Q44. No Examiner's Report available for this question

Q45.

In part (i) most candidates scored with iron rusts/corrodes. The answer had to be specific – for example, 'iron is reactive' did not score, but a reference to the reaction with oxygen and/or water or to corrosion/rusting was required. The most common incorrect answer concerned the alleged non-electrical conductivity of iron.

The electrodes of a fuel cell are in contact with water and air.
The electrodes are made of platinum rather than iron.

(i) State why iron is not a suitable metal for the electrodes of the cell.

(1)

Iron will corrode (rust) when in contact with water and air.

Results Plus: Examiner Comments

This candidate has succinctly stated the correct answer.

Part (ii) was well answered. Where this was incorrect candidates referred to platinum's period or used 'in the middle' or 'between groups 2 and 3' as a description. Others just stated that platinum was a metal. A lot of unnecessary additional information was included for a 'state' type question, where a simple statement of the information, not an explanation, is asked for.

(ii) Platinum acts as a catalyst.

State, in terms of its position in the periodic table, why you would expect platinum to act as a catalyst.

(1)

As it is between group 2 and 3

Results Plus: Examiner Comments

This is true, but candidates are expected to know and use correct terminology.

Q46. No Examiner's Report available for this question

Q47.

(i) This question was poorly answered overall, with candidates offering generic suggestions or improvements to carrying out the titration overall rather than relating to the mass of potassium hydroxide as was asked for in the question. Many answers indicated that the candidates did not understand what the question was asking them to do, and there were also a lot of blank responses. The most common mark awarded was to use a pipette to measure the volume of potassium hydroxide solution more accurately than a measuring cylinder. Common incorrect responses included reading equipment at eye level, repeating (but not to concordant results) and rinsing equipment out with water before use.

Q48. No Examiner's Report available for this question

Q49. No Examiner's Report available for this question

Q50. No Examiner's Report available for this question

Q51. No Examiner's Report available for this question

Q52.

Many excellent answers were seen to this question. There were some very clear descriptions of carrying out a titration experiment. Unfortunately, some candidates did not read the whole question and they stopped their description when they had completed the titration. This limited their mark to level 2 as they did not give any description of how to obtain pure, dry crystals of sodium chloride. Some candidates were unfamiliar with the names of the apparatus and referred to 'a tube with a tap at the bottom' instead of a burette. Some candidates used Universal Indicator even though they had been told that it is not suitable in the previous part of the question. Although many candidates mentioned repeating the titration, only a small number explained the importance of concordant results. Many candidates did not mention the need to repeat the titration without the indicator before evaporating the water to obtain crystals. Some candidates thought the crystals were insoluble and used filtration to separate them.

*(c) Sodium chloride solution can be made from dilute hydrochloric acid and sodium hydroxide solution.

Describe a titration experiment to find the exact volume of hydrochloric acid needed to neutralise 25.0 cm^3 of sodium hydroxide solution and how you would use this result to obtain pure, dry crystals of sodium chloride.

(6)

fill a conical flask with 25 cm^3 sodium hydroxide, and make sure there is a black cross at the bottom of the flask.
Set up a burette filled with dilute HCl above the flask
Drop hydrochloric acid into the flask slowly until the solution turns white and cloudy enough so that you can't see the cross anymore
Record how much HCl you have used
To make sodium chloride, add an ~~a~~soluble salt ~~sodium sodium chloride~~ and leave overnight, and then you should have the insoluble salt sodium chloride.

Results Plus: Examiner Comments

This is an example of a level 1 answer, scoring 2 marks. The candidate has a limited knowledge of a titration experiment but seems to have confused it with using a black cross to time the rate of a reaction when sodium thiosulfate solution reacts with dilute hydrochloric acid.

*(c) Sodium chloride solution can be made from dilute hydrochloric acid and sodium hydroxide solution.

Describe a titration experiment to find the exact volume of hydrochloric acid needed to neutralise 25.0 cm^3 of sodium hydroxide solution and how you would use this result to obtain pure, dry crystals of sodium chloride.

(6)

Put the acid into a burette and the NaOH into a beaker at the ~~beker~~ bottom. Add the acid to the alkali slowly until the indicator turns colourless and then measure ~~how much~~ the ~~%~~ volume of HCl needed to neutrolise ~~the~~ ~~the~~ the NaOH. When the solution is neutralised, it can be heated and the water can be evaporated off. The dry ~~seed~~ NaCl will start to crystallise. ~~Bzzz~~ Lastly, remove the NaCl from the heat and allow to cool, ~~the~~ ~~crystals will form~~ larger crystals will be formed ~~in the liquid~~ as it cools.

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

Results Plus: Examiner Comments

This is a level 2 answer, scoring 4 marks. The answer does refer to the titration and how to obtain crystals, but there is not enough detail about how to carry out the titration experiment for it to be level 3.

Results Plus: Examiner Tip

Learn all the details of carrying out a titration experiment.

*(c) Sodium chloride solution can be made from dilute hydrochloric acid and sodium hydroxide solution.

Describe a titration experiment to find the exact volume of hydrochloric acid needed to neutralise 25.0 cm^3 of sodium hydroxide solution and how you would use this result to obtain pure, dry crystals of sodium chloride.

(6)

Firstly clean a burette with the acid been used to remove impurities. Then clean the pipette out with the alkali been used. Once clean fill the pipette up with the sodium hydroxide solution. The pipette is very accurate compared to a measuring cyclinder. pour the sodium hydroxide solution into a conical flask. It's important to use a conical flask as it is used to swirl the liquid without it spilling. Next, fill the burette with the hydrochloric acid. Record the volume you start with. Then place a white tile under the burette, put an indicator, like phenolphthalein, into the conical flask so we can see when neutralisation occurs. Place the conical flask under the burette (above the tile) and begin to add the acid whilst swirling the flask. Do a trial before hand so that you know, approximately, when your solution will be neutralised. From that point add the acid drop-by-drop until the pink solution (from the indicator) turns clear. Then record the amount of HCl used.

Results Plus: Examiner Comments

This candidate has written an excellent description of carrying out a titration experiment. Unfortunately, they have not mentioned anything about how to obtain crystals from the solution so was given level 2 and 4 marks.

Results Plus: Examiner Tip

Read the question carefully and make sure that you have answered all of it.

*(c) Sodium chloride solution can be made from dilute hydrochloric acid and sodium hydroxide solution.

Describe a titration experiment to find the exact volume of hydrochloric acid needed to neutralise 25.0 cm^3 of sodium hydroxide solution and how you would use this result to obtain pure, dry crystals of sodium chloride.

(6)

Firstly, a pipette would be used to accurately measure 25cm^3 of sodium hydroxide, and this would be placed in a conical flask. A burette would be filled with hydrochloric acid. This would need to be a measured amount so that the amount added to the sodium hydroxide solution could be recorded. Next, you would add an indicator to the sodium hydroxide solution (such as phenolphthalin, which dramatically changes colour in an alkali solution to a neutral one). Hydrochloric is slowly added, swirling the conical flask in a controlled way over a white tile, so that a colour change is noticed instantly. Towards the end, the acid should be added drop-by-drop. When the indicator changes colour, note the amount of acid from the burette that was needed to neutralise the sodium hydroxide solution. Repeat the experiment 3 times and find the mean adding the indicator, using the mean volume of hydrochloric acid. This solution will contain sodium chloride and water. To obtain just the sodium chloride, the water can be evaporated and the sodium chloride left to dry and crystalise. crystalise.

Results Plus: Examiner Comments

This was a very good description of carrying out a titration and obtaining crystals so it was awarded 6 marks.

Q53.

Many vague answers were seen to this question as candidates did not refer to the difficulty of seeing the colour change and instead wrote about the speed of the colour change. A common incorrect answer was that the indicator would contaminate the solution.

(b) Suggest why universal indicator must not be used in titration experiments.

(1)

It wouldn't be accurate enough.

Results Plus: Examiner Comments

This is an example of one of the vague answers that were seen and did not score a mark.

Results Plus: Examiner Tip

Write specific answers to questions. This question is about titrations and you should know that an indicator is used to find out when the solution is neutral because it changes colour. Universal indicator has a lot of different colours and there is no sharp change in colour at the end point of the titration.

(b) Suggest why universal indicator must not be used in titration experiments.

(1)

As it does not have a sharp colour change, instead it gradually changes colour

Results Plus: Examiner Comments

This is a very good answer and scored 1 mark.

Q54.

(i)

This question focused on the titration core practical – which requires the use of a burette, pipette and suitable indicator. It was found that few candidates were able to describe how the pipette should be used.

A titration of sodium hydroxide solution with hydrochloric acid can be carried out as follows

1 a pipette is used to measure 25.00 cm^3 of sodium hydroxide solution into a conical flask
2 a few drops of indicator are added to the sodium hydroxide solution
3 the burette is filled with hydrochloric acid
4 the hydrochloric acid is added to the sodium hydroxide solution until the indicator changes colour.

(i) Describe how the pipette should be used to measure exactly 25.00 cm^3 of sodium hydroxide solution into the conical flask.

(2)

because its more accurate than just pouring it into a flask

Results Plus: Examiner Comments

Some candidates did not read the question carefully and tried to explain why the pipette should be used rather than how it is used.

Results Plus: Examiner Tip

Candidates should be taught to read the question carefully and learn the difference between how and why as well as describe and explain.

A titration of sodium hydroxide solution with hydrochloric acid can be carried out as follows

1 a pipette is used to measure 25.00 cm^3 of sodium hydroxide solution into a conical flask
2 a few drops of indicator are added to the sodium hydroxide solution
3 the burette is filled with hydrochloric acid
4 the hydrochloric acid is added to the sodium hydroxide solution until the indicator changes colour.

(i) Describe how the pipette should be used to measure exactly 25.00 cm^3 of sodium hydroxide solution into the conical flask.

(2)

If a burette is used then it could ~~message~~ measure 25.00cm^3 as a pipette can only measure 5cm^3 of a liquid.

Results Plus: Examiner Comments

Candidates found it hard to describe how to use the pipette. Many described the use of a dropping or Pasteur pipette or described the use of a burette instead.

A titration of sodium hydroxide solution with hydrochloric acid can be carried out as follows

1 a pipette is used to measure 25.00 cm^3 of sodium hydroxide solution into a conical flask
2 a few drops of indicator are added to the sodium hydroxide solution
3 the burette is filled with hydrochloric acid
4 the hydrochloric acid is added to the sodium hydroxide solution until the indicator changes colour.

(i) Describe how the pipette should be used to measure exactly 25.00 cm^3 of sodium hydroxide solution into the conical flask.

(2)

Fill the ~~Pipet~~ Pipette using a pipette filler on the top then of the ~~Sodium~~ sodium hydroxide ~~Dish~~ sucy up water the ~~mark~~ marking and when it ~~is~~ reaches the line stop.

Results Plus: Examiner Comments

This answer scored the two marks available.

A titration of sodium hydroxide solution with hydrochloric acid can be carried out as follows

1 a pipette is used to measure 25.00 cm^3 of sodium hydroxide solution into a conical flask
2 a few drops of indicator are added to the sodium hydroxide solution
3 the burette is filled with hydrochloric acid
4 the hydrochloric acid is added to the sodium hydroxide solution until the indicator changes colour.

(i) Describe how the pipette should be used to measure exactly 25.00 cm^3 of sodium hydroxide solution into the conical flask.

(2)

Squeeze the solution out of the pipette and into a measuring cylinder first and keep putting it in until it reaches the 25cm^3 mark

Results Plus: Examiner Comments

The most common incorrect answer seen described the use of a dropping pipette used to fill a measuring cylinder or beaker to the correct value.

(ii)

A fair proportion of candidates understood that the acid was used to remove any water that was in the burette, but few were able to take the further and explain that the water would otherwise dilute the acid or would make the titration inaccurate. Some stated that it would effect the experiment but did not say how it would effect the experiment.

Candidates should be taught to always be explicit in their answers and not leave room for doubt, simply stating that a result would be affected is not sufficient, candidates should state in which way the result would be affected.

(ii) The burette is first washed with water.
It is then rinsed with some of the acid before it is filled with the acid to begin the titration.

Explain why the burette is rinsed with the acid.

(2)

To kill any other ~~germs~~ germs that the water couldn't get rid of & so the results will not be affected.

Results Plus: Examiner Comments

A common misconception was that the burette was rinsed with acid to kill any bacteria that was present.

Q55.

(i)

The predictable use of a burette or measuring cylinder was seen here, but a less understandable confusion of a teat pipette and volumetric pipette was also noted. The most common second mark was for using a pipette filler. Others gave descriptions of a titration but did not direct themselves to the question.

Q56. No Examiner's Report available for this question

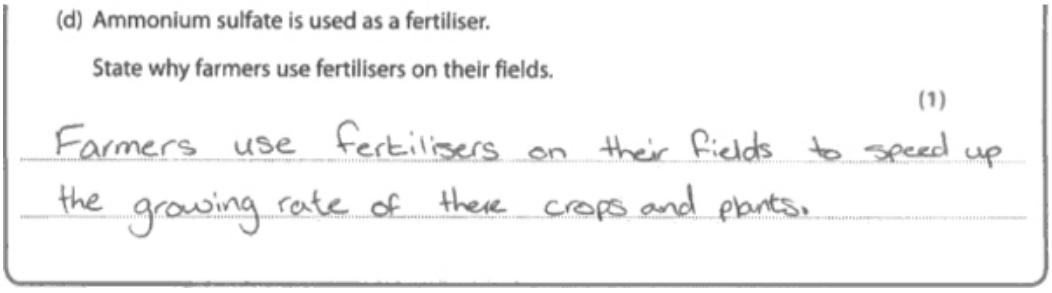
Q57.

This question was well answered, with the majority of candidates clearly understanding the role of a fertiliser, to score the 1 mark available.

The most common correct answers referred to increasing the rate of plant growth or the addition of nutrients / mineral salts to the soil.

Where some candidates failed to score, the main misconception was to confuse fertilisers with pesticides or herbicides.

A typically seen correct response for 1 mark.


(d) Ammonium sulfate is used as a fertiliser.

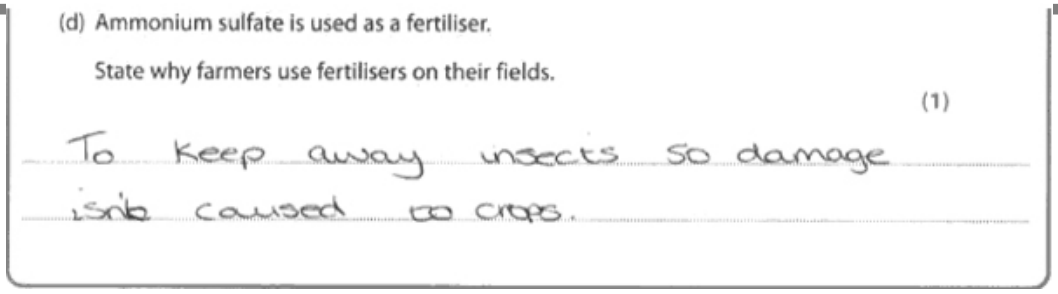
State why farmers use fertilisers on their fields.

(1)

Farmers use fertilisers on their fields to speed up the growing rate of there crops and plants.

Results Plus: Examiner Comments

A typical correct response referring to 'speed up rate of growth', so this was awarded 1 mark.


(d) Ammonium sulfate is used as a fertiliser.

State why farmers use fertilisers on their fields.

(1)

To keep away insects so damage isn't caused to crops.

Results Plus: Examiner Comments

A common misconception, namely to confuse insecticides and fertilisers, so this response did not score.

Q58.

Some really good answers were given here. However, the unfamiliarity of hydrazine caused some candidates difficulty despite the information provided. Some suggested that **water** was used up by hydrazine (therefore there was no rusting) and some thought nitrogen inhibited corrosion (a sort of protective layer). A few wrote about hydrazine corroded instead, perhaps thinking that hydrazine is a metal. The second mark was often lost because the decrease in oxygen amount was not clearly linked to the fact that oxygen was needed for corrosion. Candidates are advised that just reproducing the stem of the question: 'hydrazine reacts with oxygen' or 'hydrazine slows corrosion' will not score without further explanation.

Q59.

Many candidates performed well in this question and understood that the oil acted as barrier or protected the steel. But many only mentioned one factor needed for rusting, either oxygen or water, and so lost out on the second mark. The main misconception was where students mentioned oil minimising friction and then made the link to this causing a decrease in the corrosion with some students thinking lubrication was a sacrificial method of protection.

Figure 1 shows the chain on a bicycle.



Figure 1

Explain how lubricating the chain with oil prevents corrosion of the steel chain.

(2)

It prevents oxygen or water from coming into contact with the steel and reacting with it causing corrosion.

Results Plus: Examiner Comments

A good answer. The oil acting as a barrier for the first marking point is seen from 'It prevents ..... from coming into contact with ...'. Also, '... oxygen or water ...' showing that both of these are needed for corrosion scored the second marking point.

Results Plus: Examiner Tip

Focus your answer on the question being asked.

Figure 1 shows the chain on a bicycle.



Figure 1

Explain how lubricating the chain with oil prevents corrosion of the steel chain.

(2)

Oiling and greasing (lubricating) will reduce the amount of friction created. This makes the the bicycle chain not ~~co~~ corrode. The steel is coated with another metal to prevent the corrosion.

Results Plus: Examiner Comments

The first line of this does not answer the question. Lubricating the chain will reduce friction, but the question is about how lubricating the chain reduces corrosion. This idea of reducing friction was commonly seen and received no credit. There was no mention of air or water in the answer and their involvement in corrosion. So this answer scored 0 marks.

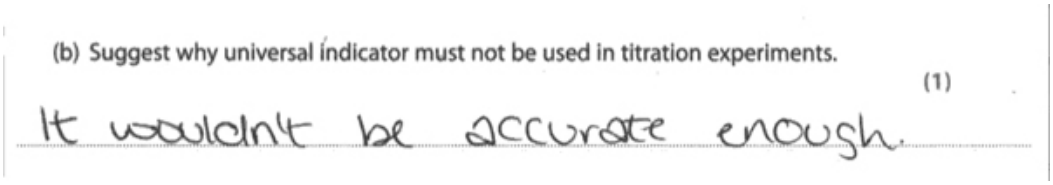
Results Plus: Examiner Tip

Read the question carefully and answer the question that is stated even underlining key words if it helps you.

Q60.

(b)

Many vague answers were seen to this question as candidates did not refer to the difficulty of seeing the colour change and instead wrote about the speed of the colour change. A common incorrect answer was that the indicator would contaminate the solution.


(b) Suggest why universal indicator must not be used in titration experiments.

(1)

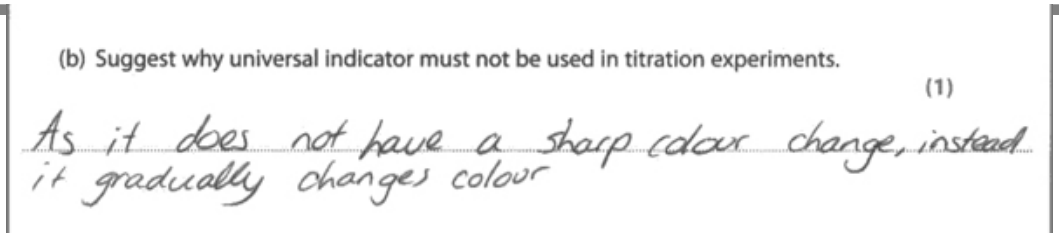
It wouldn't be accurate enough.

Results Plus: Examiner Comments

This is an example of one of the vague answers that were seen and did not score a mark.

Results Plus: Examiner Tip

Write specific answers to questions. This question is about titrations and you should know that an indicator is used to find out when the solution is neutral because it changes colour. Universal indicator has a lot of different colours and there is no sharp change in colour at the end point of the titration.


(b) Suggest why universal indicator must not be used in titration experiments.

(1)

As it does not have a sharp colour change, instead it gradually changes colour

Results Plus: Examiner Comments

This is a very good answer and scored 1 mark.

(c)

Many excellent answers were seen to this question. There were some very clear descriptions of carrying out a titration experiment. Unfortunately, some candidates did not read the whole question and they stopped their description when they had completed the titration. This limited their mark to level 2 as they did not give any description of how to obtain pure, dry crystals of sodium chloride. Some candidates were unfamiliar with the names of the apparatus and referred to 'a tube with a tap at the bottom' instead of a burette. Some candidates used Universal Indicator even though they had been told that it is not suitable in the previous part of the question. Although many candidates mentioned repeating the titration, only a small number explained the importance of concordant results. Many candidates did not mention the need to

repeat the titration without the indicator before evaporating the water to obtain crystals. Some candidates thought the crystals were insoluble and used filtration to separate them.

*(c) Sodium chloride solution can be made from dilute hydrochloric acid and sodium hydroxide solution.

Describe a titration experiment to find the exact volume of hydrochloric acid needed to neutralise 25.0 cm^3 of sodium hydroxide solution and how you would use this result to obtain pure, dry crystals of sodium chloride.

(6)

fill a conical flask with 25 cm^3 sodium hydroxide, and make sure there is a black cross at the bottom of the flask.
Set up a burette filled with dilute HCl above the flask
Drop hydrochloric acid into the flask slowly until the solution turns white and cloudy enough so that you can't see the cross anymore
Record how much HCl you have used
To make sodium chloride, add an soluble salt ~~sodium sodium chloride~~ and leave overnight, and then you should have the insoluble salt sodium chloride.

Results Plus: Examiner Comments

This is an example of a level 1 answer, scoring 2 marks. The candidate has a limited knowledge of a titration experiment but seems to have confused it with using a black cross to time the rate of a reaction when sodium thiosulfate solution reacts with dilute hydrochloric acid.

*(c) Sodium chloride solution can be made from dilute hydrochloric acid and sodium hydroxide solution.

Describe a titration experiment to find the exact volume of hydrochloric acid needed to neutralise 25.0 cm^3 of sodium hydroxide solution and how you would use this result to obtain pure, dry crystals of sodium chloride.

(6)

Put the acid into a burette and the NaOH into a beaker at the ~~beker~~ bottom. Add the acid to the alkali slowly until the indicator turns colourless and then measure ~~how much~~ the ~~%~~ volume of HCl needed to neutrolise ~~the~~ ~~the~~ the NaOH. When the solution is neutralised, it can be heated and the water can be evaporated off. The dry ~~seed~~ NaCl will start to crystallise. ~~Bzzz~~ Lastly, remove the NaCl from the heat and allow to cool, ~~the~~ ~~crystals will form~~ larger crystals will be formed ~~in the liquid~~ as it cools.

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

Results Plus: Examiner Comments

This is a level 2 answer, scoring 4 marks. The answer does refer to the titration and how to obtain crystals, but there is not enough detail about how to carry out the titration experiment for it to be level 3.

Results Plus: Examiner Tip

Learn all the details of carrying out a titration experiment.

*(c) Sodium chloride solution can be made from dilute hydrochloric acid and sodium hydroxide solution.

Describe a titration experiment to find the exact volume of hydrochloric acid needed to neutralise 25.0 cm^3 of sodium hydroxide solution and how you would use this result to obtain pure, dry crystals of sodium chloride.

(6)

Firstly clean a burette with the acid been used to remove impurities. Then clean the pipette out with the alkali been used. Once clean fill the pipette up with the sodium hydroxide solution. The pipette is very accurate compared to a measuring cyclinder. pour the sodium hydroxide solution into a conical flask. It's important to use a conical flask as it is used to swirl the liquid without it spilling. Next, fill the burette with the hydrochloric acid. Record the volume you start with. Then place a white tile under the burette, put an indicator, like phenolphthalein, into the conical flask so we can see when neutralisation occurs. Place the conical flask under the burette (above the tile) and begin to add the acid whilst swirling the flask. Do a trial before hand so that you know, approximately, when your solution will be neutralised. From that point add the acid drop-by-drop until the pink solution (from the indicator) turns clear. Then record the amount of HCl used.

Results Plus: Examiner Comments

This candidate has written an excellent description of carrying out a titration experiment. Unfortunately, they have not mentioned anything about how to obtain crystals from the solution so was given level 2 and 4 marks.

Results Plus: Examiner Tip

Read the question carefully and make sure that you have answered all of it.

*(c) Sodium chloride solution can be made from dilute hydrochloric acid and sodium hydroxide solution.

Describe a titration experiment to find the exact volume of hydrochloric acid needed to neutralise 25.0 cm^3 of sodium hydroxide solution and how you would use this result to obtain pure, dry crystals of sodium chloride.

(6)

Firstly, a pipette would be used to accurately measure 25cm^3 of sodium hydroxide, and this would be placed in a conical flask. A burette would be filled with hydrochloric acid. This would need to be a measured amount so that the amount added to the sodium hydroxide solution could be recorded. Next, you would add an indicator to the sodium hydroxide solution (such as phenolphthalin, which dramatically changes colour in an alkali solution to a neutral one). Hydrochloric is slowly added, swirling the conical flask in a controlled way over a white tile, so that a colour change is noticed instantly. Towards the end, the acid should be added drop-by-drop. When the indicator changes colour, note the amount of acid from the burette that was needed to neutralise the sodium hydroxide solution. Repeat the experiment 3 times and find the mean adding the indicator, using the mean volume of hydrochloric acid. This solution will contain sodium chloride and water. To obtain just the sodium chloride, the water can be evaporated and the sodium chloride left to dry and crystalise. crystalise.

Results Plus: Examiner Comments

This was a very good description of carrying out a titration and obtaining crystals so it was awarded 6 marks.

(d) (i)

Many candidates calculated the correct average of the titration results. However, there were a significant number who took the average of all 3 results, rather than just the two concordant values.

(i) State the volume of hydrochloric acid that must be used to calculate the concentration of sodium hydroxide solution.

(1)

volume of hydrochloric acid = 22.83 cm^3

Results Plus: Examiner Comments

This candidate has included the rough titration result in the average, so has not scored a mark.

Results Plus: Examiner Tip

When you take the average of titration results, only include the results which are concordant (very close readings).

(i) State the volume of hydrochloric acid that must be used to calculate the concentration of sodium hydroxide solution.

(1)

volume of hydrochloric acid = 22.7 cm^3

Results Plus: Examiner Comments

This candidate has scored 1 mark for correctly working out the average of the concordant titration results.

(d) (ii)

Many excellent answers were seen to this calculation, with working clearly explained. Some candidates would benefit from more practice with questions involving concentrations of solutions.

(ii) In a different experiment, 25.0 cm^3 of sodium hydroxide solution reacted with 23.2 cm^3 of 0.100 mol dm^{-3} hydrochloric acid, HCl.

Calculate the concentration of this sodium hydroxide solution, NaOH, in mol dm^{-3}.

mole / conc × vol

(3)

$NaOH + HCl \rightarrow NaCl + H_2O$

$\frac{23.2}{1000} \times 0.1 = 2.32 \times 10^{-3}$ moles

1 mole of NaOH to neutralise 1 mole of HCl.

$\frac{2.32 \times 10^{-3}}{(25 \div 1000)} = 0.0928$ mol dm^{-3}

concentration of sodium hydroxide solution = 0.0928 mol dm^{-3}

Results Plus: Examiner Comments

This is a very good answer, scoring 3 marks.

(ii) In a different experiment, 25.0 cm^3 of sodium hydroxide solution reacted with 23.2 cm^3 of 0.100 mol dm^{-3} hydrochloric acid, HCl.

Calculate the concentration of this sodium hydroxide solution, NaOH, in mol dm^{-3}.

(3)

$NaOH + HCl \rightarrow NaCl + H_2O$

2.32×10^{-3}

Sodium hydroxide - volume = 25.0cm³ conc. = ?

Hydrochloric acid - volume = 23.2cm³ conc. = 0.100mol dm

no. of moles = conc x volume.

$\frac{23.2}{1000} = 0.0232 \times 0.100 = 2.32 \times 10^{-3}$ = moles of HCl

$\text{conc.} = \frac{\text{no. of moles}}{\text{volume}} = \frac{2.32 \times 10^{-3}}{25.0\text{cm}^3}$

concentration of sodium hydroxide solution = ... mol dm^{-3}

Results Plus: Examiner Comments

This candidate has scored 2 marks for the working. They have calculated the number of moles of hydrochloric acid and realised that they need to divide this by the volume of sodium hydroxide. They have just forgotten to multiply by 1000 at the end.

Results Plus: Examiner Tip

Always show your working for a calculation as it might be worth some marks, even if the final answer is wrong.

(ii) In a different experiment, 25.0 cm^3 of sodium hydroxide solution reacted with 23.2 cm^3 of 0.100 mol dm^{-3} hydrochloric acid, HCl.

Calculate the concentration of this sodium hydroxide solution, NaOH, in mol dm^{-3}.

(3)



Vol
mol

$NaOH + HCl \rightarrow NaCl + H_2O$

$\frac{23.2}{0.100} \times \frac{mol}{Vol} = \frac{0.1}{23.2cm^3} = 2.32$

hydrochloric

concentration of sodium hydroxide solution = ... mol dm^{-3}

Results Plus: Examiner Comments

This candidate does not know how to calculate the number of moles from a volume and a concentration, so has not scored any marks.

Results Plus: Examiner Tip

Learn the formulae for calculating amounts in moles for solids, gases and solutions.

Q61. No Examiner's Report available for this question

Q62.

(ii)

Many candidates gave the expected answer of high melting point but others answered in terms of energy required to break bonds and many of these answers were correct. However some incorrectly made references to ionic or covalent or intermolecular bonds. A small minority of the candidates discussed a high boiling point while others effectively just repeated the question.

(ii) To join two pieces of metal by welding, they must be melted together.

State why a high temperature has to be used.

(1)

Because the strong bonds between the particles have to be broken first, and this can only be done at a high temperature as it provides enough energy to do so.

Results Plus: Examiner Comments

An acceptable way of answering the question worth the mark.

(iii)

Many candidates gained one mark by correctly stating that argon is inert or unreactive or a noble gas. Some candidates then went on to gain a second mark by explaining this idea using the idea of the full outer shell and some others explained that oxygen would react with the metal. However, a significant number of candidates did not gain a second mark as they answered in terms of argon not reacting with oxygen or not being flammable and a surprising number thought argon was a catalyst.

Q63. No Examiner's Report available for this question

Q64. No Examiner's Report available for this question

Q65. No Examiner's Report available for this question

Q66.

This question was generally answered well with the large majority of candidates knowing or deducing that water was the product, although some formed OH or H_2O_2. There were perhaps more errors in the formulae for hydrogen and oxygen, with some answers including ions or H and/or O. The large majority of equations with correct formulae were correctly balanced.

In a hydrogen-oxygen fuel cell, hydrogen and oxygen react at the electrodes.

The overall reaction occurring in this fuel cell is a reaction of hydrogen with oxygen.

Write the balanced equation for this reaction.

(2)

$H_2 + O \longrightarrow H_2O$

Results Plus: Examiner Comments

Many candidates forget that gaseous elements, excluding group 0, are diatomic.

In a hydrogen-oxygen fuel cell, hydrogen and oxygen react at the electrodes.

The overall reaction occurring in this fuel cell is a reaction of hydrogen with oxygen.

Write the balanced equation for this reaction.

(2)

$H_2^+ + O^{2-} \rightarrow H_2O$

Results Plus: Examiner Comments

Candidates should learn that charges should only be included in ionic or half equations.

Q67. No Examiner's Report available for this question

Q68.

In (i) the vast majority of candidates were able to write the steps required to carry out the titration in the correct order and most were able to suggest an alternative piece of apparatus to a measuring cylinder that could be used to obtain exactly 25cm^3 of potassium hydroxide in part (ii) with most suggesting the use of a pipette. Some candidates suggested the use of a balance but this was ignored.

Mark Scheme

Q1.

Question Number	Answer	Mark
	An explanation that combines identification - knowledge (1 mark) and reasoning/justification - understanding (1 mark): • magnesium more reactive (than iron in steel) (1) • magnesium has a greater tendency to form ions/reacts instead of the iron (1)	(2)

Q2.

Question number	Answer	Mark
	B high melting point The only correct answer is B. A, C and D are incorrect because good conductor of electricity, malleable and shiny when cut or polished, are properties of both transition metals and group 1 metals, not just transition metals.	(1)

Q3.

Question number	Answer	Mark
(i)	D increases does not change A, B, C are incorrect because catalysts increase rate of attainment of equilibrium and do not change equilibrium yield	(1)

Question number	Answer	Mark
(ii)	C the amounts of nitrogen, hydrogen and ammonia become constant A, B, D are incorrect because when the reaction reaches equilibrium the amount of nitrogen, hydrogen and ammonia remain constant	(1)

Question number	Answer	Additional guidance	Mark
(iii)	an explanation linking • equilibrium attained in a shorter period of time / rate of attainment of equilibrium {faster/ increases} (1) • equilibrium yield increases (1) • equilibrium shifts to the {right / forward / to products side} (1) • decrease in number of molecules (1)	allow moves to fewer molecules	(4)

Q4.

Question number	Answer	Mark
	• volumes of solution too large for titration method (1) • large volumes of liquid need to be heated and then allowed to crystallise (1)	(2)

Q5.

Question number	Answer	Mark
(i)	C	(1)

Question number	Answer	Mark
(ii)	C	(1)

Q6.

Question number	Answer	Additional guidance	Mark
	<table><tr><th></th><th>true</th><th>false</th></tr><tr><td>iron is a poor conductor of heat</td><td></td><td>✓</td></tr><tr><td>iron can act as a catalyst</td><td>✓</td><td></td></tr><tr><td>iron forms compounds that are coloured</td><td>✓</td><td></td></tr><tr><td>iron has a low density</td><td></td><td>✓</td></tr><tr><td>iron has a very high melting point</td><td>✓</td><td></td></tr></table>	(first tick given) 4 correct ticks = 3 marks 3 or 2 correct ticks = 2 marks 1 correct tick = 1 mark	(3)

Q7.

	Answer	Acceptable answers	Mark
(a)(i)	A carbonate ion CO_3^{2-}		**(1)**
(a)(ii)	A description including warm / heat / boil (1) {**gas/ammonia**} turns (damp red/pink) litmus blue / (damp red/pink) litmus turns blue when held above (the mixture)(1)	maximum (1) if additional reagents added ignore any ppt allow pungent smell / smell of {ammonia/wet nappies} /alkaline **gas** /effect of ammonia on other named indicators /dense white fumes with conc hydrochloric acid ignore litmus turns blue in ammonium ions/sodium hydroxide/mixture do not allow gas/ammonia if blue litmus turns red/pink	**(2)**
(b)	$Al^{3+} + 3OH^- \rightarrow Al(OH)_3$ OH^- (1) $Al(OH)_3$ (1) balancing 3, conditional on correct formulae (1)	allow multiples allow HO^- (1) allow $Al(HO)_3$ (1) do not allow $Al(HO)^3$/lower case h ignore state symbols/$3Na^+$ on both sides	**(3)**

		Indicative Content	
QWC	***(c)**	An explanation including some of the following points **test for cation** • flame test • if the flame is yellow/not lilac, sodium ions are	

		• if the flame is lilac/not yellow, potassium ions **test for iodide ions** • make a solution of the crystals in water • add dilute nitric acid • add silver nitrate solution • if there is a yellow precipitate, iodide ions are • if there is no precipitate, sulfate ions are prese • $Ag^{+} + I^{-} \rightarrow AgI$ OR • make a solution of the crystals in water • add chlorine water • then cyclohexane • if the cyclohexane/top layer turns purple, iodic present • if there is no colour change, sulfate ions are pr • $Cl_2 + 2I^{-} \rightarrow 2Cl^{-} + I_2$ **test for sulfate ions** • make a solution of the crystals in water • add dilute {hydrochloric/nitric} acid • add barium {chloride/nitrate} solution • if there is a white precipitate, sulfate ions are • if there is no precipitate, iodide ions are prese • $Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4$

Level	**0**	No rewardable content
1	**1 - 2**	• a limited description of test for any 1 ion e.g. flame test, yellow flame, sodium ions are present. • 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 to identify a cation and an anion e.g. if the substance is sodium sulfate, it will give a yellow flame in a flame test and a white precipitate with barium chloride solution. • 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 to identify at least 3 ions e.g. carry out a flame test, yellow flame, sodium ions present, lilac flame, potassium ions present, add silver nitrate solution to solution of substance, yellow precipitate, iodide ion. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Q8.

Question number	Answer	Mark
	An explanation that combines identification – improvement of the experimental procedure (maximum 2 marks) and justification/reasoning, which must be linked to the improvement (maximum 2 marks): • add excess sodium sulfate solution rather than a few drops (1) • so more reaction occurs to form more lead sulfate (1) • filter the reaction mixture rather than pour off the liquid(1) • so none of the lead sulfate is lost on separation(1) • wash the lead sulfate (1) • so the impurities are removed (1) • place the lead sulfate in an oven/warm place (1) • so the lead sulfate is dry (1)	**(4)**

Q9.

Question Number	Answer	Acceptable answers	Mark
	• to {increase/higher/raised} strength (1) • to {increase/higher/raised} resistance to rusting (1)		**(2)**

Q10.

Question Number	Answer	Mark
	C oxidised	**(1)**

Q11.

Question Number	Answer	Acceptable answers	Mark
	A oxidised		**(1)**

Q12.

	Answer	Acceptable answers	Mark
	an explanation linking the following • a mixture of (1) • metals (1)	 reject compound ignore combined/joined specific examples reject reference to non-metals metals melted together (2)	(2)
	an explanation linking any**three** of • in pure metal /aluminium atoms are all same size (1) • in pure metal /aluminium {layers/sheets/atoms} {slide/slip/move} (over one another) easily(1) • magnesium atoms larger (1) • disrupt {layers/structure/arrangement} of aluminium atoms (1) • prevent {layers/sheets/atoms} {slip/slide/move} (1)	ions or particles for atoms reject molecules once only different sized particles {lock/hold/jam} layers together	(3)

Q13.

	Answer	Acceptable answers	Mark
(a)	A description including: • add (dilute) (hydrochloric) acid (1) • gas/carbon dioxide (passed	 correct formulae heat/thermally decompose	**(3)**

	into/tested) with limewater (1) • limewater goes milky / cloudy / white ppt (1)	bubbled through limewater dependent on use of limewater	
(b)	40 +[2 × 35.5] (=111)	111 alone	**(1)**
(c)	• 100 (kg) (calcium carbonate) → 106 (kg) (sodium carbonate) (1) $\frac{106 \times 40}{100}$ (1) (=42.4)	OR alternative 106÷100 40000÷100 /40÷100 (moles approach) Only 42.4 with no working worth 2 marks 42400**g** worth 2 marks	**(2)**
(d)(i)	• 10.4/15.0 **(1)** • (10.4/15.0) ×100**(1)** (= 69.3)	69.3 alone worth 2 marks If no/incomplete working shown answer to 2 or more sf scores 2 marks Ignore any units	**(2)**
(d)(ii)	Two suggestions from • reaction incomplete (1) • impure reactants (1) • other unwanted/side reaction(s) occur (1) • product lost during experiment/practical (1)	reversible ignore by-products form could be an example eg some products left in apparatus ignore generic experimental errors eg measuring/weighing errors/human error/spillage	**(2)**

Q14.

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)**

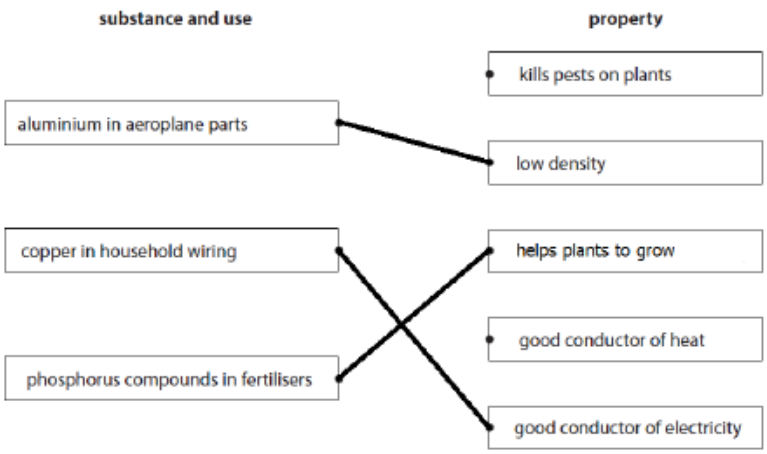
Question Number	Answer	Acceptable answers	Mark
(c)(i)	suitable acid-base indicator eg methyl orange, phenolphthalein	litmus reject universal indicator allow recognisable phonetic spelling	**(1)**

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)**

Q15.

Question Number	Answer	Mark
	one mark for each correct line  **(3)**	

Q16.

Question Number		Indicative Content	Mark
QWC	*	A description / explanation including some of the following points **CREDIT CAN BE GIVEN FOR LABELS/ANNOTATIONS ON DIAGRAM** **Structure of a metal** • positive ions/cations/atoms • in regular arrangement/lattice • delocalised/sea of electrons **Metals are malleable** • malleable means can be bent/hammered into shape because • rows/sheets/layers of ions/ atoms • slide over each other • electrons fill spaces **Metals conduct electricity** • free electrons • (electrons) can move/flow • through structure • (electrons) transfer charge	**(6)**

Level	0	No rewardable content
1	1 - 2	• a limited description eg a limited description of one of structure, malleability, and conduction • 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 eg a limited description of **two** from structure, malleability and conduction **OR** an explanation of **one** of structure, malleability and conduction • 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 eg a description of all three of structure, malleability, and conduction **OR** a detailed explanation of one of them and a limited description of another • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Q17.

	Answer	Acceptable answers	Mark
(a)(i)	C cations in a sea of electrons		**(1)**
(a)(ii)	(metals have) high melting <u>point</u>	a lot of energy needed to break/overcome (metallic) bonds energy needed to break/overcome strong (metallic) bonds Ignore references to boiling point Reject reference to intermolecular forces/covalent (bonds) /attraction between ions/breaking ionic bonds/ breaking covalent bonds	**(1)**
(a)(iii)	An explanation including two of the following points • argon is inert/does not react/is unreactive (1) • because it has 8 electrons in its outer shell (1)	Ignore argon is in group 0/8 argon is a noble gas Ignore argon does not burn does not {gain/lose/share} electrons has a full outer shell (of electrons) has a stable electron configuration	**(2)**

	• metals would react in/with air/oxygen (1) • argon will exclude air from welding point (1)	form (metal) oxide prevents oxidation	
(b)	$2\ Fe + 3\ Br_2 \rightarrow 2\ FeBr_3$ M1 Correct symbol/formulae (1) M2 balancing of correct symbol/formulae (1)	Reject incorrect use of upper/lower case / subscripts for M1 but allow ECF for M2	**(2)**
(c)	C – grey solid		**(1)**
(d)	A explanation including M1 order of reactivity chlorine > bromine > iodine (1) and M2 one of the following points • chlorine displaces bromine (from bromide) AND chlorine displaces iodine (from iodide) (1) • bromine displaces iodine (from iodide) AND bromine does not displace chlorine (from chloride) (1) • iodine does not displace chlorine(from chloride) AND iodine does not displace bromine (from bromide) (1)	For M1 reject reference to reactivity of halide ions eg chlorine more reactive than bromide halogens/they decrease in reactivity down the group/table chlorine is most reactive and iodine is least reactive Ignore reference to displacement of halide ions eg chlorine displaces bromide Ignore "replaces" chlorine reacts with bromide AND iodide chlorine takes part in two (displacement) reactions bromine reacts with iodide AND does not react with chloride bromine takes part in one (displacement) reactions iodine does not react with chloride or bromide iodine does not take part in any (displacement) reactions	**(2)**

Q18.

Question Number	Answer	Acceptable answers	Mark
(a)	**B** tin oxide is reduced		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)(i)	An explanation linking two of the following • alloys have different sized atoms • {atoms/layers/sheets/particles} {slide/slip/move} over each other (easily) in pure metal • {structure/layers} disrupted (in alloy) • stop {atoms/layers/sheets/particles} {sliding/slipping/moving} over one another (easily) in	suitable labelled diagrams reject molecules once	**(2)**

Question Number	Answer	Acceptable answers	Mark
(b)(ii)	all points plotted correctly (1) best fit line across 4 plotted points (1)	+/- 1 small square	**(2)**

Question Number	Answer	Acceptable answers	Mark
(b) (iii)	Correct value from their graph +/- one small square (%)		**(1)**

Question Number		Indicative Content	Mark
QWC	* **(c)**	An explanation including some of the following points gold • gold is an unreactive metal/at the bottom of the reactivity series • it does not combine with other elements in the Earth's crust • so is found as uncombined metal • cost of recovery is low iron • iron is a more reactive metal than gold and less reactive than aluminium/middle of reactivity series • found combined with other elements • it is extracted by heating with carbon • electrolysis can be used • but electrolysis is more expensive (than heating with carbon) aluminium • aluminium is a very reactive metal/near to top of the reactivity series • found combined with other elements • it is extracted by electrolysis • because it is very difficult to reduce • electrolysis is a powerful method of reduction • use of electricity makes this method expensive	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. a simple justification in terms of reactivity or cost for how one of the metals is extracted OR an indication of how two of the metals are extracted • 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. a simple indication of how all three metals are extracted OR an indication of how two of the metals are extracted with a justification in terms of reactivity or cost for one • 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. indicates how all three metals are extracted with a justification for at least two in terms of reactivity and a reference to cost • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Q19.

	Answer	**Acceptable answers**	**Mark**
(a)(i)	Carbon Exact spelling only	Ignore C	**(1)**
(a)(ii)	Electricity	Allow any phonetically correct spelling	**(1)**
(b)	An explanation linking • lead oxide loses **oxygen**(1) • carbon gains **oxygen** (1)	**oxygen** {moved /transferred} from lead to carbon (2) oxide transferred gets no credit	**(2)**
(c)	An explanation linking two of		**(2)**

	• both good conductors of electricity (1) • (aluminium) has low(er) density (1) • so cables lighter • (therefore) fewer pylons (1)	Allow light(er)	
(d)	D more resistant to corrosion		**(1)**
(e) (i)	62.5 - 63 Allow anywhere in this range		**(1)**
(e)(ii)	A description including • decreases first (1) • then increases (1)	"decreases then increases" scores 2 decreases or increases alone scores 0	**(2)**

Q20.

Question number	Answer	Additional guidance	Mark
(i)	**C** ammonium nitrate **A, B, D** are incorrect names		**(1)**

Question number	Answer	Additional guidance	Mark
(ii)	An explanation linking any two from • crops require fertilisers to grow (1) • fertilisers contain N / P / K compounds (1) • promote plant growth (1) • increased yield (means greater profits) (1)		**(2)**

Q21.

	Answer	Acceptable answers	Mark
	An explanation linking two of • both good conductors of electricity (1) • (aluminium) has low(er) density (1) • so cables lighter	Allow light(er)	**(2)**

	• (therefore) fewer pylons (1)		

Q22.

Question Number	Answer	Additional guidance	Mark
(i)	final answer of 65(%) with or without working (2) OR 7.67 (= 0.65) (1) 11.80 7.67 x 100 (=65(%)) (1) 11.80	 allow any fraction x 100 (1) 153.84.... scores 1	**(2)** AO 2 1

Question Number	Answer	Additional guidance	Mark
(ii)	any two from • incomplete / reversible reactions • competing/unwanted/side reactions • practical losses during the experiment / loss on transfer from one piece of equipment to another	 ignore gases formed / impure substances / losses through incompetence / products not used up	**(2)** AO 1 1

Q23.

Question Number	Answer	Additional guidance	Mark
(i)	final answer of 65(%) with or without working (2) OR 7.67 (= 0.65) (1) 11.80 7.67 x 100 (=65(%)) (1) 11.80	 allow any fraction x 100 (1) 153.84.... scores 1	**(2)** AO 2 1

Question Number	Answer	Additional guidance	Mark
(ii)	any two from • incomplete / reversible reactions • competing/unwanted/side reactions • practical losses during the experiment / loss on transfer from one piece of equipment to another	ignore gases formed / impure substances / losses through incompetence / products not used up	(2) AO 1 1

Q24.

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

Q25.

Question Number	Answer	Mark
	An answer that combines three of the following points of application of knowledge and understanding to provide a logical description • add some ammonia solution/ hydrochloric acid (to a beaker/flask) (1) • add an indicator (1) • add the other reagent until the indicator just changes colour (1) • repeat using same volumes but without indicator (to obtain pure solution) (1)	**(3)**

Q26.

Question Number	**Answer**	**Mark**
	An answer that combines three of the following points of application of knowledge and understanding to provide a logical description • add some ammonia solution/ hydrochloric acid (to a beaker/flask) (1) • add an indicator (1) • add the other reagent until the indicator just changes colour (1) • repeat using same volumes but without indicator (to obtain pure solution) (1)	**(3)**

Q27.

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

Q28.

Question Number	Answer	Additional guidance	Mark
(i)	reversible (reaction) / reaction can go both ways	OWTTE allow reaction is happening forwards and backwards allow equilibrium	(1) AO 1 1

Question Number	Answer		Mark
(ii)	(the percentage of ammonia produced) decreases / goes down	allow goes lower	(1) AO 3 1a

Question Number	Answer		Mark
(iii)	any number between 15 and 16 inclusive		(1) AO 3 2b

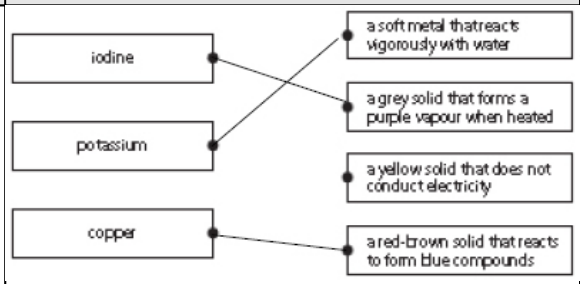
Q29.

Question Number	Answer	Mark
	C yes high coloured **The only correct answer is C** ***A*** *is not correct because transition metal chlorides are coloured* ***B*** *is not correct because all properties are incorrect* ***D*** *is not correct because transition metals are used as catalysts and have a high density*	(1) AO 1 1

Q30.

Question Number	Answer	Mark
	Any **three** of the following points • high melting point (1) • high density (1) • compounds are coloured (1) • can be used as catalysts (1)	**(3)**

Q31.

	Answer	**Acceptable answers**	**Mark**
	 all 3 correct – 2 marks any two correct – 1 mark one correct – 0 marks	if two answer lines from one element, then ignore	**(2)**

Q32.

Question Number	Answer	Acceptable answers	Mark
	$CaCl_2$ = 40 + 35.5 + 35.5 (=111) (1) THEN moles = 11.1 / 111 (= 0.1) (1) conc = **moles** x 1000/500 (=0.2) (1) OR mass conc = 11.1 x 1000/500 (=22.2) (1) conc = **mass conc**/111 (= 0.2) (1)	0.2 scores 3 ecf: 11.1 / Mr ecf: mass conc / 111	**(3)**

Q33.

	Answer	Acceptable answers	Mark
	D more resistant to corrosion		**(1)**

Q34.

Question number	Answer	Mark
	equilibrium position/usefulness of by-products	**(1)**

Q35.

Question number	Indicative content	Mark
	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant. **AO1 (6 marks)** • suitable use of aluminium eg cooking foil • related property – malleable, low toxicity, low reactivity • suitable use of copper eg water pipes • related property – low reactivity • suitable use of gold eg electronic contacts • related property – does not corrode, good electrical conductor • suitable use of brass eg pins for electric plugs • related property – strong and hard wearing • suitable use of magnalium eg aircraft parts • related property – low density	**(6)**

Level	Mark	Additional Guidance	General additional guidance – the decision within levels Eg - At each level, as well as content, the scientific coherency of what is stated backed up by planning detail will help place the answer at the top, or the bottom, of that level.
	0	No rewardable material.	
Level 1	1–2	Additional guidance Identifies at least one property OR use of at least one metal or alloy and attempts to relate it to a suitable use.	Possible candidate responses • aluminium has a low density (alone) • gold can be used in jewellery (alone) • copper is used in wiring because it is a good conductor of electricity (upper part of level)
Level 2	3–4	Additional guidance Identifies at least one property alloys and links of two metals OR this to their uses.	Possible candidate responses • copper and gold are both used in electrical wiring because they are good conductors of electricity • copper is used in wiring because it is a good conductor of electricity. Gold is used in jewellery • magnalium has a low density so can be used in aircraft parts. Gold can be used in jewellery because it is unreactive – upper part of level
Level 3	5–6	Additional guidance Identifies properties of at least one metal AND one alloy and explains their uses related to these properties.	Possible candidate responses • copper is used in electrical wiring because it is a good conductor of electricity so a current can pass through it. Magnalium is used in aircraft parts because it has a low density • gold is used in jewellery because it is unreactive and so will not cause irritation to the wearer. Brass is used for making electrical plug pins because it is strong, so will not break easily – upper part of level

Q36.

Question number	Answer	Mark
(i)	malleable / malleability	(1) AO2

Question number	Answer	Additional guidance	Mark
(ii)	does not corrode/ insoluble/ unreactive/ inert / non-toxic / hard	ignore references to appearance	(1) AO2

Q37.

Question number	Answer	Additional guidance	Mark
(i)	phosphorus /potassium /nitrogen	accept phonetically correct spellings allow P / K / N	(1)
(ii)	$KOH + HNO_3 \rightarrow$ KNO_3 (1) + H_2O (1)	incorrect balancing of correct species 1 mark max allow OH_2 / HOH / NO_3K	(2)

Q38.

Question number	Answer	Additional guidance	Mark
(i)	Haber process (1)	accept phonetically correct spellings e.g Harber	(1)

Question number	Answer	Mark
(ii)	rate increased / speeded up / quicker / faster (1)	(1)
(iii)	yield unchanged/ stays same / none (1)	(1)

Q39.

Question number	Answer	Additional guidance	Mark
(i)	neutralisation OR exothermic	allow exothermic	(1)

Question number	Answer	Mark
(ii)	**D** ammonium nitrate is the only correct answer **A** is incorrect because the cation is ammonium and the anion is nitrate **B** is incorrect because the cation is ammonium **C** is incorrect because anion is nitrate	(1)

Q40.

Question number	Answer	Additional guidance	Mark
	Any two from: • improves the appearance/ shiny (1) • improves resistance to corrosion/ does not corrode/ prevents reaction with {air/oxygen/water}/ prevents oxidation (1) • can make e.g. 'gold' object more cheaply using a gold layer on a cheaper base / looks more expensive than it is (1)	allow does not rust ignore durable/ protects unqualified etc. ignore 'makes more valuable'	(2)

Q41.

Question number	Answer	Additional guidance	Mark
	one nitrogen (atom) and three hydrogen (atoms) (1)	allow 1 N and 3 H (atoms) (1)	(1)

Q42.

Question number	Answer	Additional guidance	Mark
	blue flame: hot(test) / very hot (1) lid: to stop {zinc oxide/ product} escaping (1)		(2) AO2

Q43.

Question number	Answer	Additional guidance	Mark
(i)	alloys stronger / pure metals weaker / alloys more corrosion resistant	ignore harder ignore 'more desirable properties'	(1)

Question number	Answer	Additional guidance	Mark
(ii)	0.40 x 30 (1) (= 12) 12 (1) (= 0.12)(g) 100	0.12 (g) without working (2)	(2)

Q44.

Question number	Answer	Mark
(i)	to make plants grow more/ faster/ bigger	(1) AO1

Question number	Answer	Mark
(ii)	K: potassium N: nitrogen P: phosphorus all three correct (2); one or two correct (1)	(2) AO2

Q45.

Question number	Answer	Additional guidance	Mark
(i)	iron rusts/ corrodes/ reacts {with oxygen/ water} / iron oxidises / forms iron oxide	ignore erodes/ corrosive	(1)

Question number	Answer	Additional guidance	Mark
(ii)	platinum is a **transition** {metal/ element}	ignore 'in the middle' etc. ignore any irrelevant/ additional information	(1)

Q46.

Question number	Answer	Additional guidance	Mark
	An explanation linking • voltage decreases • as {reactant / transition metal} used up	 allow highest rate of reaction at the beginning of the reaction gives most voltage (1) allow reaction is complete when voltage = 0 (1)	**(2)**

Q47.

Question number	Answer	Additional guidance	Mark
(i)	Suggestions to include any three from • make the potassium hydroxide solution using a volumetric flask (1) • use distilled / deionised water (to make up solution) (1) • make solution of total volume 250 cm^3 (rather than adding 250 cm^3 water to the solid) (1) • use of pipette to measure out the potassium hydroxide solution (1) • repeat until titres within ±0.2(0) cm^3 of each other / concordant titres and use to calculate the mean titre (1)	 allow add solution from burette dropwise only near end point (1) allow conduct rough titration first (1)	**(3)** **AO3**

Question number	Answer	Mark
(ii)	**C** pink colourless is the only correct answer A and B have colours for methyl orange. D has the colours reversed.	**(1)** **AO1**

Q48.

Question Number	Answer	Additional guidance	Mark
(i)	• group 5 (1) • period 2 (1)		(2)

Question Number	Answer	Additional guidance	Mark
(ii)	reversible (reaction)	allow (reaction that may reach) equilibrium	(1)

Q49.

	Answer	Acceptable answers	Mark
	A – air		**(1)**

Q50.

Question Number	Answer	Mark
	An explanation that combines identification - knowledge (1 mark) and reasoning/justification - understanding (2 marks) • rate increased / time to reach equilibrium reduced (1) • (because) gas molecules closer together (1) • (so) increased collision rate / more frequent collisions (1)	(3)

Q51.

Question Number	Answer	Mark
(i)	pipette	(1)

Question Number	Answer	Mark
(ii)	• name of indicator: suitable indicator e.g. methyl orange / phenolphthalein (1) • colour change: correct colour change of indicator eg yellow to orange / pink (magenta) to colourless (1)	(2)

Question Number	Answer	Additional guidance	Mark
(iii)	• swirl flask (1) • add acid drop by drop near end point (1)	allow any suitable practical technique that improves the accuracy	(2)

Q52.

		Indicative Content	
QWC	*	A description including some of the following points **titration experiment** • rinse pipette with alkali and burette with acid • measure alkali using a pipette • into suitable container e.g. flask/beaker • add a few drops of indicator / suitable named i methyl orange/phenolphthalein) • flask on a white tile • fill burette with acid • read level/volume (of acid) in burette • add acid from burette to the flask slowly / swir • until {indicator just changes colour/correct col for named indicator (eg methyl orange yellow peach/orange, phenolphthalein pink to colourl is neutral} • read level/volume (of acid) in burette • repeat experiment • until concordant results **salt preparation** • mix the same volume of alkali with the volume determined from the first experiment but do n indicator (or add (activated) charcoal to remov then filter) • pour solution into an evaporating basin • {heat solution/leave the water to evaporate} crystals are left	
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description of titration and/or salt preparation e.g. add hydrochloric acid to sodium hydroxide solution in a flask, then	

		evaporate the water from solution. • 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 of titration and/or salt preparation e.g. pipette sodium hydroxide solution into flask, add indicator, place hydrochloric acid in burette, add acid to alkali until colour change. • 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 including titration **and**salt preparation e.g. pipette sodium hydroxide solution into flask, add indicator, hydrochloric acid in burette, add acid to alkali until colour change, repeat until concordant results, evaporate water. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Q53.

	Answer	**Acceptable answers**	**Mark**
	Any one from • no {sharp/clear/distinct} change in colour • gradual colour change • there are too many different colours	ignore not as accurate/reliable allow too difficult to see when it is {neutral/reaction is complete} ignore speed of colour change	**(1)**

Q54.

Question Number	Answer	Additional guidance	Mark
(i)	A description including any two from : • use a pipette filler (1) • wash pipette with sodium hydroxide solution (1) • draw the liquid up so (the bottom of the meniscus) touches the line (1)		**(2)** AO 1 2

Question Number	Answer	Additional guidance	Mark
(ii)	An explanation linking any two from : • to remove water from the burette (1) • because this would dilute the original acid (1) • this will give an inaccurate result / ORA (1)	ignore to avoid contamination ignore to kill bacteria	**(2)** AO 1 2

Q55.

Question Number	Answer	Acceptable answers	Mark
(i)	A description linking • **pipette** (1) • one practical point eg draw liquid up to line/ use pipette filler/ rinse first / read at eye level (1)	**ignore** burette etc for 1st mpt if using measuring cylinder/ burette allow suitable practical point eg read at eye level/ add dropwise from burette near 25 cm^3 (1) ignore as 2nd point: transfer liquid to flask / safety precautions	**(2)**

Question Number	Answer	Acceptable answers	Mark
(ii)	**D** 25.20 cm^3		**(1)**

Q56.

Question number	Answer	Mark
	• A will rust, as there is air/oxygen and water present (1) • B will not rust, as there is no air/oxygen present (1) • C will not rust, as no water is present (1)	(3)

Q57.

	Answer	Acceptable answers	Mark
	improve crop yields / promote plant growth	crops grow faster adds essential elements / OWTTE	(1)

Q58.

Question number	Answer	Additional guidance	Mark
	An explanation linking • {less oxygen / no oxygen / oxygen is removed} by the hydrazine (1) • oxygen is needed for {rusting / reaction} / corrosion/so oxidation prevented (1)	For MP1 allow 'oxygen reacts with hydrazine instead of the metal' (1) ignore hydrazine {displaces/ more reactive than} oxygen no oxygen so no rusting scores 2	(2)

Q59.

Question Number	Answer	Mark
	An explanation linking • {air/oxygen} excluded / {water/moisture} excluded / oil acts as a barrier (1) • {air/oxygen} **and** {water/moisture/damp conditions} both needed (for iron to rust / corrosion) (1)	(2) AO 1 1

Q60.

	Answer	Acceptable answers	Mark
(a)	A neutralisation		**(1)**
(b)	Any one from • no {sharp/clear/distinct} change in colour • gradual colour change • there are too many different colours	ignore not as accurate/reliable allow too difficult to see when it is {neutral/reaction is complete} ignore speed of colour change	**(1)**

		Indicative Content	
QWC	***(c)**	A description including some of the following points **titration experiment** • rinse pipette with alkali and burette with acid • measure alkali using a pipette • into suitable container e.g. flask/beaker • add a few drops of indicator / suitable named i methyl orange/phenolphthalein) • flask on a white tile • fill burette with acid • read level/volume (of acid) in burette • add acid from burette to the flask slowly / swir • until {indicator just changes colour/correct col for named indicator (eg methyl orange yellow peach/orange, phenolphthalein pink to colourl is neutral} • read level/volume (of acid) in burette • repeat experiment • until concordant results **salt preparation** • mix the same volume of alkali with the volume determined from the first experiment but do n indicator (or add (activated) charcoal to remov then filter) • pour solution into an evaporating basin • {heat solution/leave the water to evaporate} u crystals are left	
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description of titration and/or salt preparation e.g. add hydrochloric acid to sodium hydroxide solution in a flask, then evaporate the water from solution.	

		• 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 of titration and/or salt preparation e.g. pipette sodium hydroxide solution into flask, add indicator, place hydrochloric acid in burette, add acid to alkali until colour change. • 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 including titration **and**salt preparation e.g. pipette sodium hydroxide solution into flask, add indicator, hydrochloric acid in burette, add acid to alkali until colour change, repeat until concordant results, evaporate water. • 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**
(d)(i)	$\frac{22.6 + 22.8}{2}$ (1) (= 22.7)		**(1)**
(d)(ii)	marks are for the working no. moles HCl = $\frac{23.2 \times 0.1}{1000}$ (1) (= 2.32×10^{-3}) no. moles NaOH = no. moles HCl (1) no. moles NaOH = no. moles HCl (1) conc NaOH = $\frac{2.32 \times 10^{-3} \times 1000}{25.0}$ (1) (= 0.0928 mol dm^{-3}) mark consequentially OR $\frac{\text{no. moles NaOH reacting}}{\text{no. moles HCl reacting}} = \frac{1}{1}$ (1) $\frac{25.0 \times \text{conc}}{23.2 \times 0.1} = \frac{1}{1}$ (1) conc NaOH = $\frac{0.1 \times 23.2}{25.0}$ (1) (= 0.0928) mol dm^{-3} OR use of $c_1v_1 = c_2v_2$ (1) 0.1 x 23.2 = conc x 25.0 (1) conc NaOH = $\frac{0.1 \times 23.2}{25.0}$ (1) (= 0.0928) mol dm^{-3}	0.0928/0.093 with or without working (3) 0.09 with no working (2) common incorrect answers with working 0.108/0.1077 (2) – used 1:1 ratio but 25x0.1/23.2 0.928 (2) – used 1:1 ratio but missed out 0.1	**(3)**

Q61.

Question Number	Answer	Mark
	B 750 **The only correct answer is B** ***A*** *is not correct because 375.5 dm³ is half the actual volume formed* ***C*** *is not correct because 1125.5 dm³is one and a half times the actual volume formed* ***D*** *is not correct because 1500 dm³ is double the actual volume formed*	**(1)** AO 2 1

Q62.

	Answer	Acceptable answers	Mark
(i)	C cations in a sea of electrons		**(1)**
(ii)	(metals have) high melting <u>point</u>	a lot of energy needed to break/overcome (metallic) bonds energy needed to break/overcome strong (metallic) bonds Ignore references to boiling point Reject reference to intermolecular forces/covalent (bonds) /attraction between ions/breaking ionic bonds/ breaking covalent bonds	**(1)**
(iii)	An explanation including two of the following points • argon is inert/does not react/is unreactive (1) • because it has 8 electrons in its outer shell (1)	Ignore argon is in group 0/8 argon is a noble gas Ignore argon does not burn does not {gain/lose/share} electrons has a full outer shell (of electrons)	**(2)**

	• metals would react in/with air/oxygen (1) • argon will exclude air from welding point (1)	has a stable electron configuration form (metal) oxide prevents oxidation	

Q63.

Question Number	Answer	Mark
	D copper	**(1)**

Q64.

Question Number	Answer	Mark
	An explanation that combines identification - application of knowledge (1 mark) and reasoning/justification - application of understanding (1 mark) • high density (1) • (so that) Bunsen does not tip over (1)	**(2)**

Q65.

Question Number	Answer	Mark
	An explanation that combines identification - application of knowledge (1 mark) and reasoning/justification - application of understanding (1 mark) • high density (1) • (so that) Bunsen does not tip over (1)	(2)

Q66.

Question number	Answer	Additional guidance	Mark
	$2H_2 + O_2 \rightarrow 2H_2O$ (2) fully correct balanced equation (2) If not (2), then H_2O as product in an equation format, regardless of any other errors (1)	Allow =, ⇌ for → Ignore all words and state symbols Allow multiples reject formulae with charges Do not penalise small letters e.g allow h_2O If H2O or H^2O in otherwise fully correct equation, allow (1)	(2)

Q67.

Question number	Answer	Additional guidance	Mark
(i)	K, L, J, N, M		(1)

Question number	Answer	Additional guidance	Mark
(ii)	(volumetric) pipette	allow burette reject dropping pipette ignore balance	(1)

Q68.

Question number	Answer	Additional guidance	Mark
(i)	K, L, J, N, M		(1)

Question number	Answer	Additional guidance	Mark
(ii)	(volumetric) pipette	allow burette reject dropping pipette ignore balance	(1)