PEARSON EDEXCEL GCSE CHEMISTRY · 1CH0

CHEMISTRY



MARK SCHEME

TOPIC 6: GROUPS IN THE PERIODIC TABLE (PACK 1)

SCORE	PERCENTAGE
/114	%

STEMUP

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Q1.

(a)

Many candidates scored here as they knew that magnesium nitrate was one of the products of the reaction. However a minority of candidates could also state that water and carbon dioxide were also formed.

Some incorrectly gave salt instead of magnesium nitrate.

More students gave only gave one additional product so failed to gain full credit.



Results Plus: Examiner Comments

A good answer that scored both marks.



Results Plus: Examiner Comments

This candidate gave just the generic answer to the question and did not link their knowledge to the question posed.

Results Plus: Examiner Tip

Remember to link your knowledge of chemistry to the context given in the question.

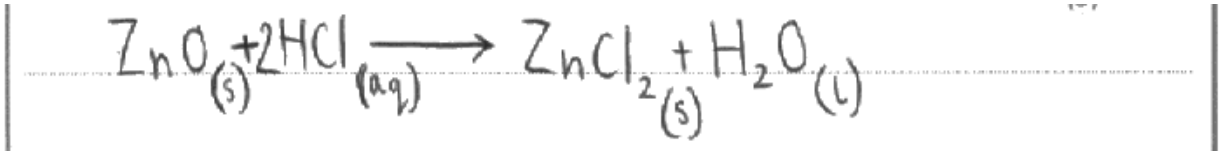


Results Plus: Examiner Comments

This response gained one mark for showing an understanding that magnesium nitrate and one other product (carbon dioxide) was produced, full credit was not awarded as they did not state that water was also produced.

(b)(ii)

Again, students showed a better understanding of how to balance equations than in previous sessions. Many students gained credit for their knowledge of correct formulae of either the product or reactants or both. Many provided a correct balanced equation as a result.

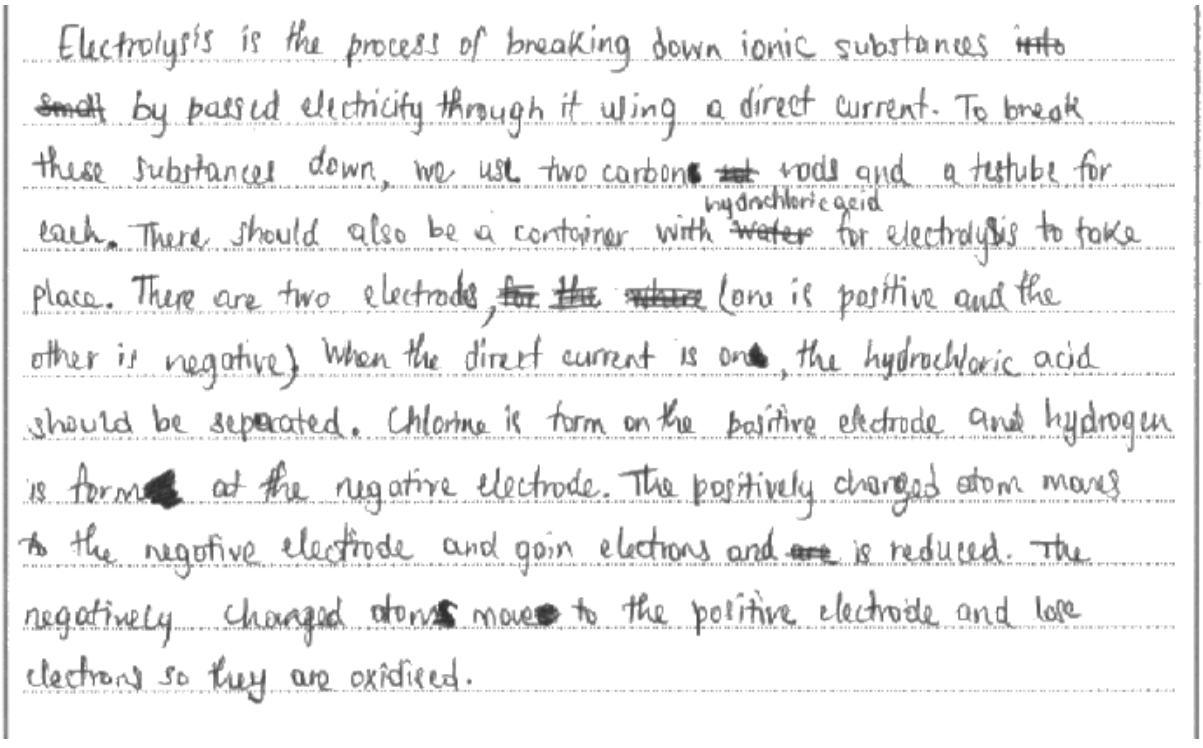


Results Plus: Examiner Comments

An excellent answer which scored full credit, state symbols were not asked for and so were ignored.

(c)

It was pleasing to see that the majority of candidates were familiar with this practical and had obviously carried it out, or at the very least seen it, as some very good explanations and diagrams were seen. However, many candidates lost marks as they did not fully address the question posed. Some candidates gave a fantastic description of how to set up the equipment including a detailed diagram but then failed to explain how they would test for each of the gases produced. Others gave an excellent description of how to test for the gases, including good detail such as damp blue litmus turning red before bleaching, instead of just stating litmus paper turned white, but then failed to describe how the experiment could be carried out. Some candidates gave incorrect methods for the tests such as using a glowing splint instead of a lit splint to test for hydrogen and some just stated that the squeaky pop test should be used, which did not gain credit.

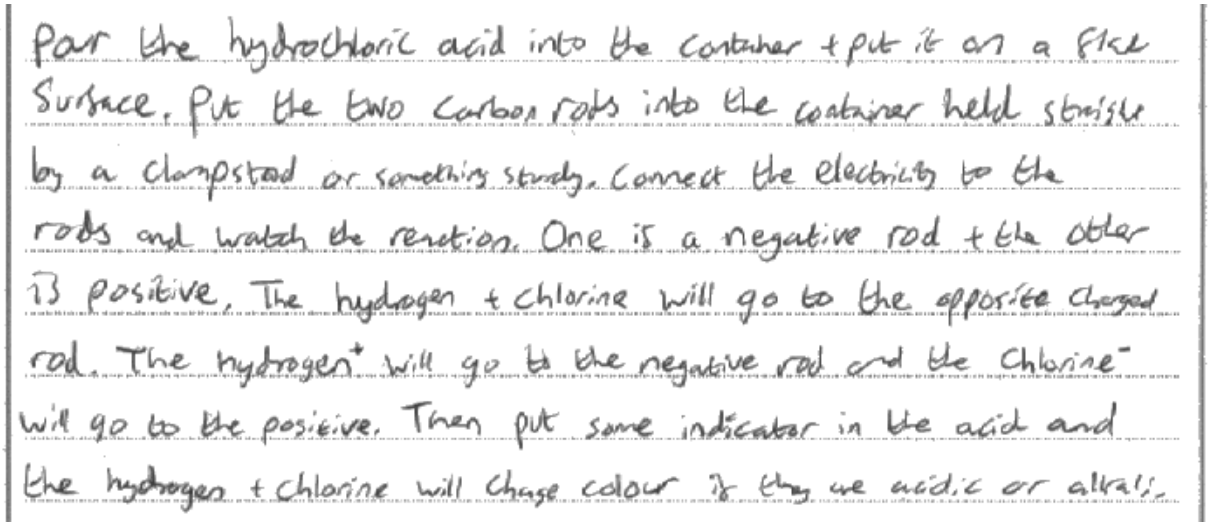

Electrolysis is the process of breaking down ionic substances ~~into~~ ~~small~~ by passed electricity through it using a direct current. To break these substances down, we use two carbon ~~rod~~ rods and a testube for each. There should also be a container with ~~water~~ hydrochloric acid for electrolysis to take place. There are two electrodes, ~~for the where~~ (one is positive and the other is negative) When the direct current is on, the hydrochloric acid should be seperated. Chlorine is form on the positive electrode and hydrogen is formed at the negative electrode. The positively charged atom moves to the negative electrode and gain electrons and ~~are~~ is reduced. The negatively charged atoms moves to the positive electrode and lose electrons so they are oxidised.

Results Plus: Examiner Comments

In this response, the candidate has given a good description of how the apparatus can be used to electrolyse the hydrochloric acid. However they have not fully addressed the question as they are also asked how the gases produced can be tested, and this has not been covered in the answer.

Results Plus: Examiner Tip

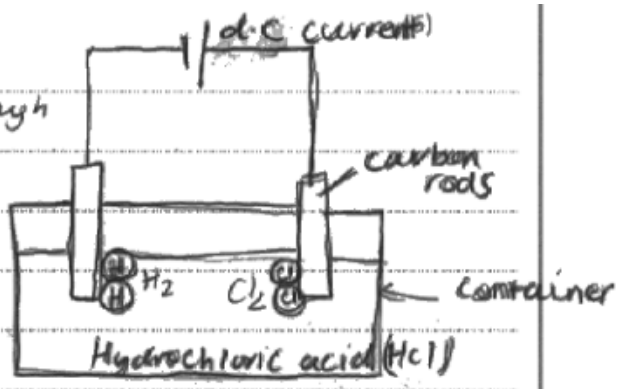
It is important that you address all parts of the question posed. Always re-read the question, followed by your answer to check that your answer is relevant to the question posed and that you have addressed all the appropriate points.


Pour the hydrochloric acid into the container + put it on a flat surface. Put the two carbon rods into the container held steady by a clampstand or something sturdy. Connect the electricity to the rods and watch the reaction. One is a negative rod + the other is positive. The hydrogen + chlorine will go to the opposite charged rod. The hydrogen$^+$ will go to the negative rod and the chlorine$^-$ will go to the positive. Then put some indicator in the acid and the hydrogen + chlorine will change colour if they are acidic or alkali.

Results Plus: Examiner Comments

This candidate has given a description of how the apparatus can be used to electrolyse the hydrochloric acid which gains credit. However the tests for hydrogen and chlorine are incorrect so do not gain credit.

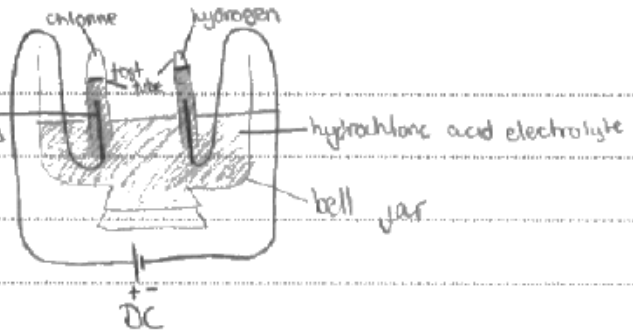
a direct ~~d.c~~ current can be used and passed through two carbon rods for the electrodes. If the hydrochloric acid is the electrolyte, it will be split up by electricity into hydrogen gas (H_2) and chlorine gas (Cl_2) these can then be collected in test tubes. The test for hydrogen is that a glowing splint in a test tube of hydrogen will create a ~~squeak~~ "squeaky pop". The test for chlorine is that it will bleach damp litmus paper from blue to white.



Results Plus: Examiner Comments

This candidate gives a good description of how to carry out the experiment. The diagram is useful and helps inform the candidate's answer. The response then goes on to describe the tests, chlorine is described correctly and gains credit. Because of the error in the description of the test (glowing splint) for the hydrogen test, credit could not be gained for this part of the answer...

(6)



ELECTROLYSIS:

In the process of electrolysis, a direct current is passed through an electrolyte to decompose it. The electrolyte, via two carbon electrodes. Hydrogen is produced at the cathode & chlorine at the anode, as collected in the test tubes.

To test for chlorine you would hold damp blue litmus paper over the test tube: which will turn red then white in the presence of chlorine, as it is bleached.

To test for hydrogen, hold a lit splint over the test tube & if you hear a squeaky pop, then hydrogen is present.

Results Plus: Examiner Comments

A very good answer that scored the full six marks available.

Q2.

(a) This proved to be a good discriminator. Some weaker candidates did not attempt the question. Of those that did, many used the formulae which had been given in the question but some then didn't balance the equation correctly. Other candidates were far too inclined to change the formulae from the ones stated in the question, often by incorrect use of subscripts in the product such as stating H_2Cl_2

(d) Hydrogen chloride, HCl, can be formed by the reaction of hydrogen, H_2, with chlorine, Cl_2.

Write the balanced equation for this reaction.

(2)

$H_2 + Cl_2 \rightarrow 4HCl$

Results Plus: Examiner Comments

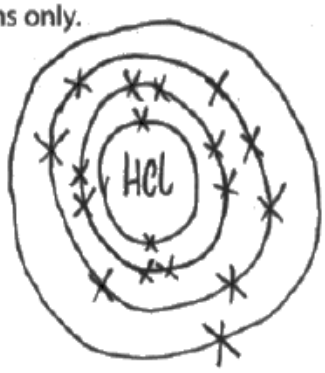
This was awarded 1 mark for the correct formulae but did not gain the second mark as it was incorrectly balanced.

(b) Candidates generally scored 2 marks or no marks on this question indicating they either knew it well or not at all. Many did not attempt the question. Of those that did, many answers saw candidates trying to combine the two elements into one single, combined structure labelled HCl. Many still drew inner shells despite being told not to in the question but were still able to score both marks. Some thought the bonding was ionic and drew diagrams indicating electron transfer from hydrogen to chlorine. However it was pleasing to see some very well drawn fully correct answers.

(e) The electronic configuration of hydrogen is 1.
The electronic configuration of chlorine is 2.8.7.

Draw a dot and cross diagram to show the arrangement of electrons in a molecule of hydrogen chloride, HCl.

Show outer electrons only.



(2)

(Total for Question 2 = 8 marks)

Results Plus: Examiner Comments

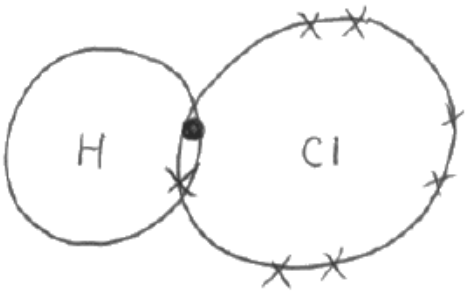
This type of answer was surprisingly common. The two atoms have been combined into one and labelled as one structure HCl.

(e) The electronic configuration of hydrogen is 1.
The electronic configuration of chlorine is 2.8.7.

Draw a dot and cross diagram to show the arrangement of electrons in a molecule of hydrogen chloride, HCl.

Show outer electrons only.

(2)



(Total for Question 2 = 8 marks)

Results Plus: Examiner Comments

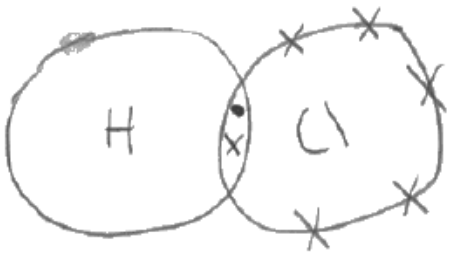
A well drawn fully correct answer.

(e) The electronic configuration of hydrogen is 1.
The electronic configuration of chlorine is 2.8.7.

Draw a dot and cross diagram to show the arrangement of electrons in a molecule of hydrogen chloride, HCl.

Show outer electrons only.

(2)



(Total for Question 2 = 8 marks)

Results Plus: Examiner Comments

This answer gained one mark for the shared pair of electrons but unfortunately has the incorrect number of electrons in the outer shell of chlorine.

Q3. No Examiner's Report available for this question

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. No Examiner's Report available for this question

Q8.

The vast majority of candidates balanced the equation, although not all got the correct state symbols – even though the question stated that potassium fluoride was a solid.

Q9. No Examiner's Report available for this question

Q10.

(i)

This question was not well answered with over half of responses not scoring the 1 mark available.

Many candidates were able to recall the 'halogens' as the name given to group 7 in the periodic table. However, many responses incorrectly referred to the names of other groups required in the specification, typically noble gases or alkali metals, or simply gave the incorrect term 'halides'.

(ii)

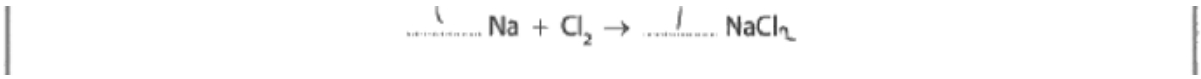
This question was not well answered with over half of responses not scoring the 1 mark available.

Many candidates were able to recall the 'noble gases' as the name given to group 0 in the periodic table. However, many responses incorrectly referred to the names of other groups required in the specification, typically halogens or alkali metals, or simply gave the incorrect and vague term 'gases'.

Q11.

(a)(i)

The majority of candidates were able to balance the equation. A common error was to put 2 in front of Na and 4 in front of NaCl. It was surprising to see some candidates using negative numbers in the equation. A few candidates put formulae or state symbols on the dotted lines instead of balancing numbers. Some candidates changed the formulae to balance the equation.

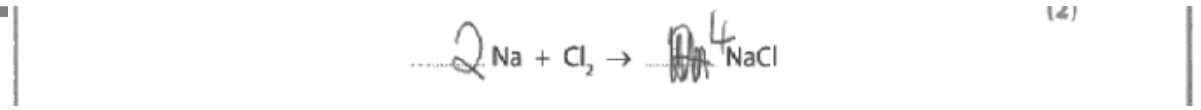


Results Plus: Examiner Comments

This candidate has changed the formula of sodium chloride to $NaCl_2$. If you are given an equation to balance, the formulae will always be correct and you need to balance the equation by putting numbers in front of the formulae in the spaces provided. This answer did not score any marks.

Results Plus: Examiner Tip

Do not change any formulae you are given in a question to balance an equation.

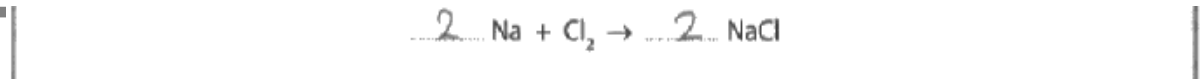


Results Plus: Examiner Comments

This candidate has the first balancing number correct, so scores 1 mark.

Results Plus: Examiner Tip

Count up the number of atoms on the left side of the equation first. There are 2 sodium atoms and 2 chlorine atoms. The number of atoms on the right of the equation must be the same as on the left. The equation is balanced by writing a 2 in front of NaCl.

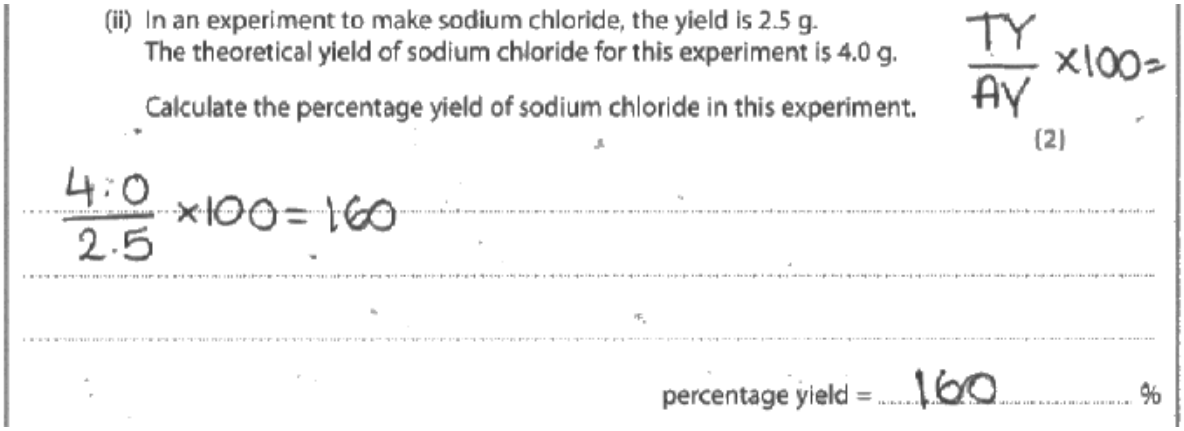


Results Plus: Examiner Comments

This is an example of a correct answer that scored 2 marks.

(a)(ii)

Many candidates were able to calculate the percentage yield. Some candidates divided 4.0 by 2.5 then multiplied by 100 to get a yield of 160%. They should realise that the yield cannot be higher than 100%. Candidates should show their working for calculations so that they have the opportunity to gain a consequential error mark if they have the final answer wrong.

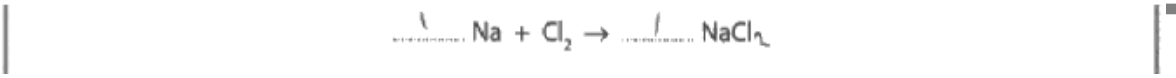


Results Plus: Examiner Comments

This answer is incorrect, but it scored 1 mark for some correct working. The first step is wrong as the candidate should have divided 2.5 by 4.0. The candidate has then shown their fraction multiplied by 100 to obtain the percentage and they score a consequential mark.

Results Plus: Examiner Tip

Always show your working for calculations.

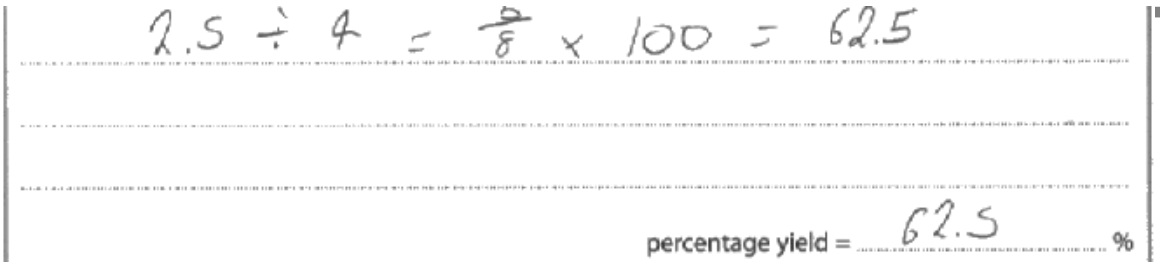


Results Plus: Examiner Comments

This is an incorrect answer and it scored no marks. If some working had been shown, it might have scored 1 mark for correct working, even if the final answer is wrong.

Results Plus: Examiner Tip

Show your working for all calculations.

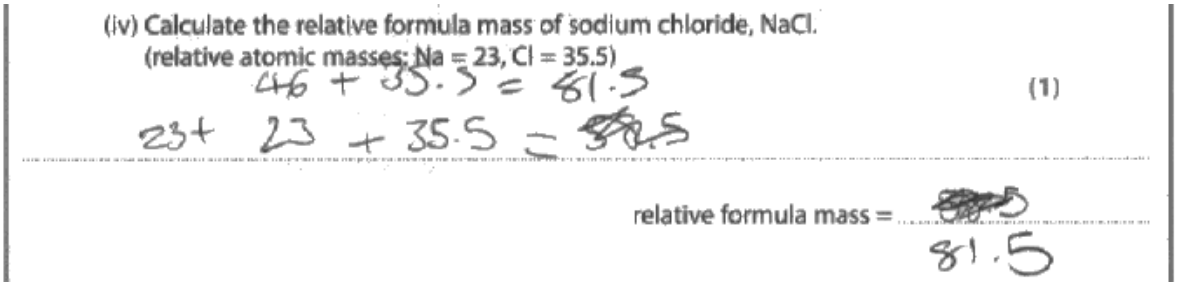


Results Plus: Examiner Comments

This is a very good answer, showing the correct working and answer. This scored 2 marks.

(a)(iv)

The majority of candidates could work out the relative formula mass for sodium chloride. Some candidates multiplied the relative atomic masses and a few subtracted or divided them.



Results Plus: Examiner Comments

This candidate has assumed the formula for sodium chloride is Na_2Cl as they have added the relative atomic mass of two sodium atoms to one chlorine atom. This did not score the mark.

Results Plus: Examiner Tip

Use the formula given in the question. NaCl contains one sodium and one chlorine atom.

23+35.5 = 58.5

relative formula mass = 58.5

Results Plus: Examiner Comments

This is an example of a correct answer, with the working shown. This scores 1 mark.

(b)

Many candidates were able to calculate the percentage of magnesium in magnesium sulfate.

Some candidates tried to calculate the relative formula mass for magnesium sulfate and got a different answer to the value given in the question.

$\frac{16+24+32}{120} \times 100 = 66.66$

percentage of magnesium = 66.66666667 %

Results Plus: Examiner Comments

This candidate has got the first step of the calculation wrong as they should have just divided the mass of magnesium (24) by 120. However, they have then multiplied their fraction by 100, so they score 1 mark.

Results Plus: Examiner Tip

Show your working in calculations.

$\frac{24}{120} \times 100 = 20\%$

percentage of magnesium = 20 %

Results Plus: Examiner Comments

This candidate has given correct working and has the correct answer so was awarded 2 marks.

(c)(i)

Very few candidates understood the term 'empirical formula', so they were unable to score a mark for this question. A common incorrect answer was CH_8.



Results Plus: Examiner Comments

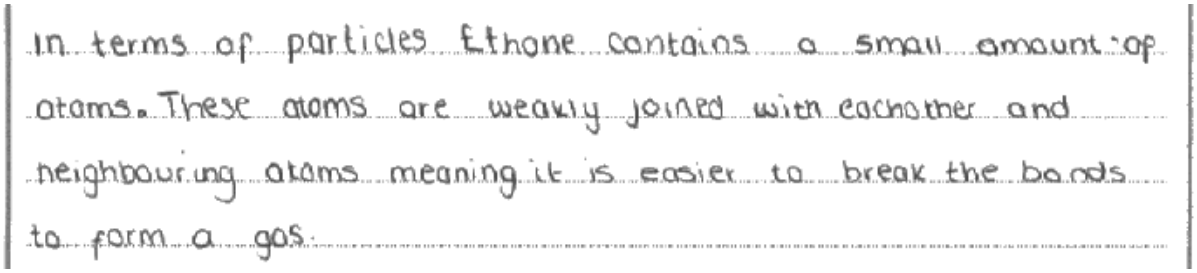
This candidate has correctly worked out that the simplest ratio of carbon to hydrogen is 1:3, but they did not score a mark as the question asked for the empirical formula.

The empirical formula shows the simplest whole number ratio of atoms in the formula. The correct empirical formula for ethane is CH_3.

(c)(ii)

This question was designed to be answered correctly by the candidates working at the top end of the grade range for this paper and it achieved that aim. The concept of weak intermolecular forces between molecules was only given by the more able candidates. Many candidates wrote about the weak bonds between the atoms but a large number did not refer to bonds at all and wrote about few particles that are far apart in a gas.

Examiners were surprised to see some candidates writing about hydrogen bonds. There are no hydrogen bonds between ethane molecules and we would not expect candidates to know about specific intermolecular forces at GCSE.



Results Plus: Examiner Comments

This answer did not score a mark as it referred to the bonds between atoms being weak.

The bonds between atoms are strong but the forces between molecules are weak.

(2)

Ethane has a low boiling point as the ~~bonds~~ particles are held together by weak forces, therefore low boiling point is needed as it doesn't require massive amount of energy/heat inorder to break them.

Results Plus: Examiner Comments

This is an excellent answer that scored 2 marks.

Results Plus: Examiner Tip

Try to remember that the covalent bonds that hold the atoms together in molecules are strong. There are just weak forces between the molecules.

Q12.

A good proportion of candidates were able to correctly describe the test for chlorine gas. Of those that knew litmus paper was to be used a large proportion knew the correct result of this test with smaller proportion scoring just 1 mark.

Fluorine, chlorine, bromine, iodine and astatine are elements in group 7.

Describe the test to show that a gas is chlorine.

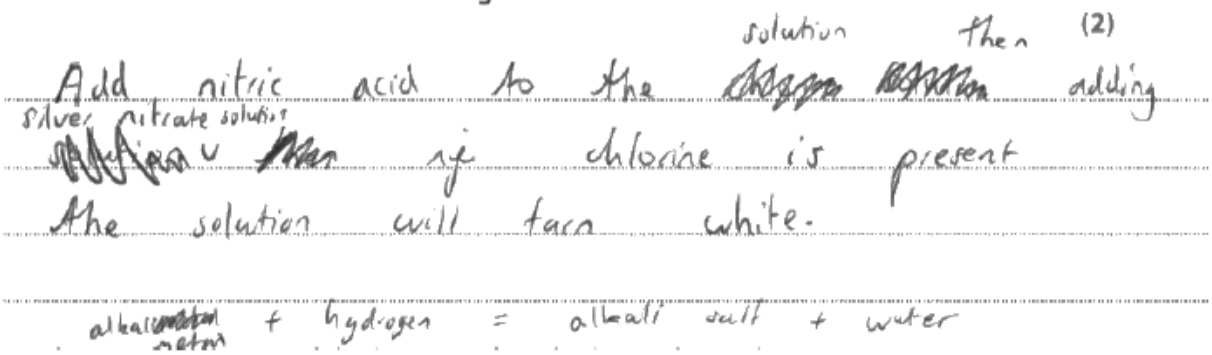
(2)

Add damp litmus paper to a test tube of ~~the~~ chlorine gas. In the presence of chlorine the damp litmus paper will be bleached.

Results Plus: Examiner Comments

A clear answer that gained both marks.

Describe the test to show that a gas is chlorine. (2)



Results Plus: Examiner Comments

Some candidates tried to describe the test for chloride ions or carbon dioxide gas rather than the chlorine gas, this gained no credit.

Results Plus: Examiner Tip

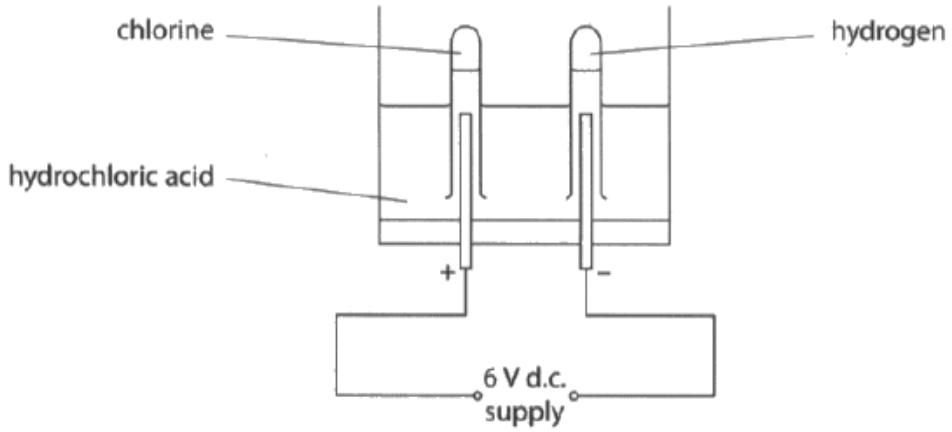
Candidates should be taught the difference between chloride and chlorine and their tests.

Q13.

(i)

Very few candidates managed to give a fully correct definition of electrolysis. Some candidates did not read the question correctly and gave a use of electrolysis rather than a definition of the term. Many knew that electricity was used, but could not correctly state for what. Some candidates lost marks as they stated that electrolysis is the separation of compounds rather than the breaking down of compounds. Others thought that it was the elements themselves that were broken down.

(d) Hydrochloric acid can be used to make chlorine in the apparatus shown.



(i) The experiment shown is an example of electrolysis.

Explain the meaning of **electrolysis**.

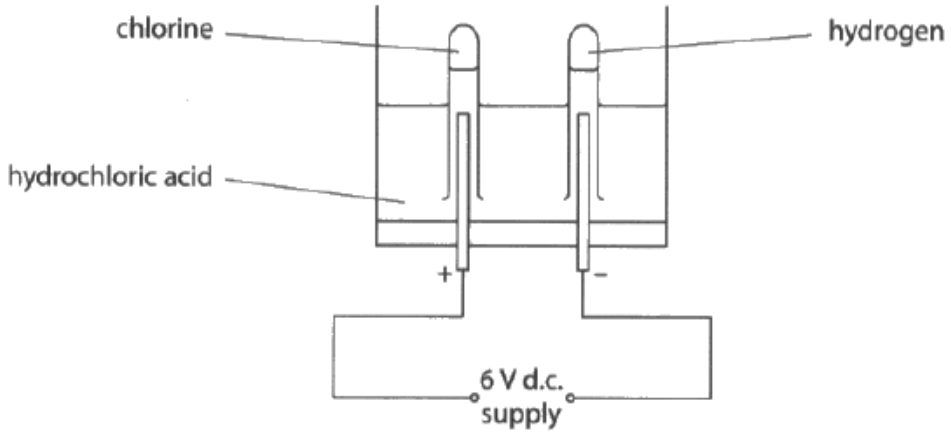
(2)

When you seperate chlorine and hydrogen.

Results Plus: Examiner Comments

The use of the term separate is not an alternative to breaking down or decomposing and so therefore cannot gain credit. There is no reference to using electricity or direct current for the second mark.
This answer therefore scored no marks.

(d) Hydrochloric acid can be used to make chlorine in the apparatus shown.



(i) The experiment shown is an example of electrolysis.

Explain the meaning of **electrolysis**.

(2)

Electrolysis is when electricity is used to break down a compound.

Results Plus: Examiner Comments

A good answer that scored the two marks available.

(ii)

Candidates performed better in this gas test for chlorine than in the previous carbon dioxide gas test. Many candidates gave a good, detailed answer to score both marks. Fewer candidates confused the test for chlorine with tests for other gases such as oxygen or hydrogen.

(ii) Describe the test to show a gas is chlorine.

(2)

Damp blue litmus paper is held in the mouth of the test tube, chlorine is present if the litmus paper turns red then white

Results Plus: Examiner Comments

A very good answer that included correct detail for the litmus paper and the result of the test. 2 marks.

(iii)

Most candidates performed well on this question by showing an understanding that chlorine is toxic and if released could cause death.

(iii) Great care has to be taken when chlorine is manufactured on a large scale.

Explain the potential hazards of storing large volumes of chlorine.

(2)

it could be toxic so could kill you if you breath it in.

Results Plus: Examiner Comments

A good answer that scored both marks.

(iv)

This question was generally poorly answered as candidates were too vague with their responses. The most common answer seen was swimming pools which was not worthy of credit.

(iv) State a large-scale use of chlorine.

(1)

Swimming pools.

Results Plus: Examiner Comments

The most common answer seen was 'swimming pools' but chlorine is not used for swimming in. If the candidate had stated that chlorine is used in swimming pools to sterilize or purify the water then this would have scored the mark.

Results Plus: Examiner Tip

Always use the science that you have learnt to answer the question and try to be as specific with your answer as you can.

(iv) State a large-scale use of chlorine.

(1)

make PVC.

Results Plus: Examiner Comments

To make PVC or bleach was a good answer that scored the mark.

Q14.

i

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

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

Results Plus: Examiner Comments

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



Results Plus: Examiner Comments

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

Results Plus: Examiner Tip

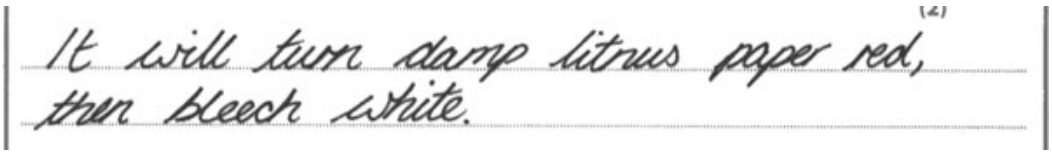
When thinking about electrolysis remember

electro– electricity

lysis– splitting.

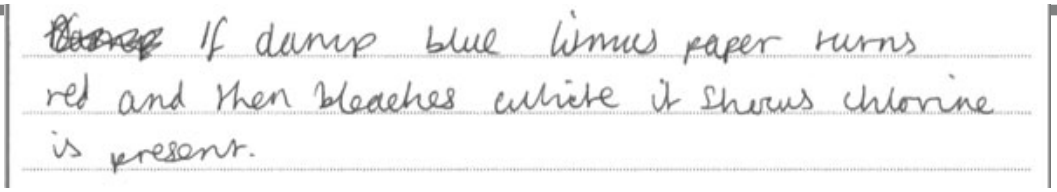
ii

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



Results Plus: Examiner Comments

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



Results Plus: Examiner Comments

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

using a damp litmus paper should change colour

Results Plus: Examiner Comments

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

Results Plus: Examiner Tip

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

iii

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

Chlorine

Results Plus: Examiner Comments

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

polyethene

Results Plus: Examiner Comments

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

Results Plus: Examiner Tip

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

poly– to show that it is a polymer

chloro– it contains chlorine

eth– from ethane

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

Q15.

(b)(i)

The majority of candidates knew that argon can be used to put out fires because it is nonflammable.

(b)(ii)

The majority of candidates knew that helium is used in airships because it has a low density.

(c)(i)

It was disappointing that not many candidates knew the appearance of chlorine at room temperature. The appearance of bromine and iodine were given as a colour and a physical state and there were 2 marks for this question, so candidates should also have given the appearance of chlorine as a colour and a physical state. A common incorrect answer was that chlorine is a blue liquid, showing that candidates were probably confused with the use of chlorine in swimming pools. Candidates would benefit from being shown a gas jar of chlorine.

halogen	appearance at room temperature
chlorine	gas
bromine	dark red liquid
iodine	grey solid

Results Plus: Examiner Comments

This candidate scored 1 mark for gas.

Results Plus: Examiner Tip

If you are given some information in a question, try to see if there is a pattern and answer in a similar way. In this question, the appearances of bromine and iodine are described with a colour and a physical state. The appearance of chlorine should also include the colour and physical state.

halogen	appearance at room temperature
chlorine	Green gas
bromine	dark red liquid
iodine	grey solid

Results Plus: Examiner Comments

This is an example of an answer that scored 2 marks as it includes the correct colour and physical state for chlorine.

(c)(ii)

The majority of candidates could write the correct word equation.

Some candidates decided to attempt to write a balanced equation, but credit was only given if this was completely correct. Symbols such as H or Cl should not be used for hydrogen and chlorine gas. Candidates are advised to write word equations when they are asked to do so in a question.

Some candidates also lost marks by writing CL as the symbol for chlorine and others changed the product to hydrochloric acid, hydrochloride or hydrogen chlorine.

Hydrogen + chlorine → hydrogen chlorine

Results Plus: Examiner Comments

This answer scores 1 mark for hydrogen + chlorine. The candidate has written the name of the product as hydrogen chlorine, which is incorrect.

Results Plus: Examiner Tip

Copy the names of chemicals carefully from the question.



Results Plus: Examiner Comments

This candidate tried to write a balanced equation, but the formulae are incorrect so no marks were given.

Results Plus: Examiner Tip

If a question asks for a word equation, do not try to write a balanced equation.



Results Plus: Examiner Comments

This is an example of a correct word equation, scoring 2 marks.

Q16.

Generally poorly answered with the majority of candidates scoring 1 mark only of the 3 available.

The most commonly seen responses scored 1 mark either for the left hand side or the right hand side – but few candidates managed both. Few candidates were able to correctly write a balanced equation. There were a few lost marks through a capital L as the second letter in a symbol.

Aluminium reacts with chlorine to form aluminium chloride. Al^3 Cl^- → $AlCl_3$

Write the balanced equation for this reaction.

Al + 3Cl → $AlCl_3$

Results Plus: Examiner Comments

This response scored 1 of the 3 marks available.

The response is awarded 1 mark for the correct formula of aluminium chloride shown on the right hand side of the equation. The formula of chlorine shown on the left hand side of the equation is incorrect since the subscripted 2 is missing from the formula. The balancing mark cannot be awarded, since it is dependent on the correct formulae of all species being shown.

Results Plus: Examiner Tip

Ensure that you can write the formula for the simple molecules used in the specification, *e.g.* remember that the formula of a molecule of chlorine is Cl_2.

Aluminium reacts with chlorine to form aluminium chloride.

Write the balanced equation for this reaction.

(3)

2Al + Cl_2 → 2AlCl

Results Plus: Examiner Comments

This response scored 1 of the 3 marks available.

The response is awarded 1 mark for the correct species, namely Al + Cl_2, shown on the left hand side of the equation. The formula of aluminium chloride shown on the right hand side of the equation is incorrect. The balancing mark cannot be awarded, since it is dependent on the correct formulae of all species being shown.

Q17.

The balancing here was refreshingly well done. As in question 3e, state symbols were poor, with water as aq a common mistake.

The 2 in front of the sodium was very often correct and more so than the 2 in front of the sodium hydroxide.

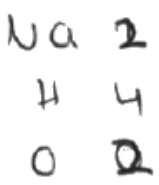
Again, it was clear that some candidates had not used state symbols before and tried to add further elements, compounds or numbers in the brackets.

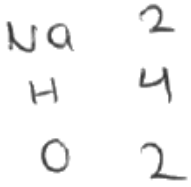
Sodium reacts with water to form sodium hydroxide in solution and hydrogen.

Complete the balancing of the equation for this reaction and add the state symbols for each substance.

(3)

2 Na(S) + 2H_2O(L) → 2 NaOH(aq) + H_2(g)





Results Plus: Examiner Comments

This candidate has carefully counted the atoms of each element on each side of the equation.

Q18.

Generally very well answered with most candidates able to score 2 or 3 of the 3 marks available for balancing the equation and giving the correct state symbols.

Common errors in responses were:

Writing numbers instead of state symbols or candidates thinking that the formula needed to be completed, *e.g.* Na(OH) where OH was written in the space for the state symbol or incorrectly giving (aq) as the state symbol for water.

Sodium reacts with water to form sodium hydroxide solution and hydrogen.

Complete the balancing of the equation for this reaction and add the state symbols for each substance.

(3)

$$\text{.....Na(.....)} + 2H_2O(\text{.....}) \rightarrow \text{.....} NaOH(\text{.....}) + H_2(\text{.....})$$

Results Plus: Examiner Comments

This response scored 1 mark only.

The candidate has not attempted to balance the equation. The mark awarded is for the correct state symbols which are marked independently of the balancing.

Sodium reacts with water to form sodium hydroxide solution and hydrogen.

Complete the balancing of the equation for this reaction and add the state symbols for each substance.

(3)

$$\text{.....Na(.....)} + 2H_2O(\text{.....}) \rightarrow \text{.....} NaOH(\text{.....}) + H_2(\text{.....})$$

Results Plus: Examiner Comments

This response scored 2 of the 3 marks available.

The equation is correctly balanced and scores 1 mark for 2 Na and 1 mark for 2 NaOH. Clearly the mark for the state symbols is not scored. This is marked independently of the balancing. Although the OH in brackets is clearly changing the formula of Na to NaOH, this would not affect the awarding of the first two marks for balancing the equation.

Q19.

(ii)

It was pleasing to see that many candidates had obviously seen this practical demonstrated and gave a good response, with very few blank responses. Many were able to describe how the teacher could demonstrate the experiment.

In addition to describing the experiment, better candidates also described how the results of the experiment give the order of reactivity of the metals.

Common safety precautions credited were the used of safety goggles, gloves, use of a safety shield and ensuring that the students were stood well back. Some candidates gave generic lab rules such as wearing your hair up, tucking chairs under tables etc; these were not credited. Concerned, if not necessarily high-scoring, candidates suggested the teacher should "stay calm", "have a fire extinguisher close", "tell students to wear PPE" and "carry out the experiment whilst still thinking of maximum safety".

Other points such as the need to cut the metal into small pieces, the fact that a large bowl would be needed, that tweezers should be used to transfer the metals were less common.

The biggest source of error in the description was to do the experiment in beakers or test tubes or simply not stress the size of the container of water. When it came to the analysis of the results, some candidates simply copied out the table, which gained no marks. As with the other 6 mark question lots of candidates finished their answer with one aspect (method of experiment) and did not talk about the reactivities at all; again they need to tackle the whole question.

It was encouraging (although not necessary) to see some candidates giving the science behind the observations, most of this seemed correct.

*(ii) A teacher demonstrated this experiment.

The results are shown in Figure 14.

	lithium	sodium	potassium
position of metal in water	floats	floats	floats
movement of metal	slow	fast	very fast
effervescence / bubbling	slow	fast	very fast

Figure 14

Describe, in detail, how the teacher would demonstrate this experiment safely, showing how the results give the order of reactivity of the metals.

(6)

Half-fill a small tank with water. Weigh and record a sample of solid lithuim, wearing safety goggles. ~~Continuing to wear safety goggles, add the piece of lithium to the water tank using a pair of tongs.~~ Place a screen around the tank of water to avoid being hurt. Continuing to wear safety goggles, add the piece of Lithuim to the water tank using a pair of tongs. The lithuim does not move very quickly and produces a small amount of bubbling. This is because

Lithium is at the top of group 1 (alkali metals) and so the forces of attraction between the nucleus and electrons are strong as it only has 2 shells of electrons. This means it will be difficult for these forces of attraction to be overcome, so hence the lithium is not very reactive. Repeat this experiment in the same way with clean water. Weigh a piece of sodium of the same size as the piece of lithium. Place the sodium in the water tank. Sodium moves faster and bubbles faster than lithium. It is below lithium in group 1 of the Periodic Table. This means it is less reactive than lithium as the atom has an extra electron shell, so the outer electron is further from the nucleus and the forces of attraction between the nucleus and electron are easier to overcome, so sodium is more reactive. Potassium moves very fast and bubbles very fast. This is because it is more reactive than lithium and sodium as it is below both in group 1 of the Periodic Table. The electrons are further from the nucleus, and so the electron is able to leave the atom more easily.

Results Plus: Examiner Comments

This is a Level 3 answer. The explanation of the reactivity in terms of electronic configuation was NOT expected. Even without this, the answer covers both the method in enough detail and the trend.

*(ii) A teacher demonstrated this experiment.

The results are shown in Figure 14.

	lithium	sodium	potassium
position of metal in water	floats	floats	floats
movement of metal	slow	fast	very fast
effervescence / bubbling	slow	fast	very fast

Figure 14

Describe, in detail, how the teacher would demonstrate this experiment safely, showing how the results give the order of reactivity of the metals.

(6)

The teacher would demonstrate this safely by standing up rather than getting acid in her lap. She would wear gloves and goggles to protect acid ~~the~~ irritating skin and splashing in eyes. Use Lithium, then Sodium and potassium in order of their reactivity series. Lithium was least reactive as it was slow bubbeling, however sodium was next and then potassium as it gave the ~~&~~ very fast bubbling.

Results Plus: Examiner Comments

This is a Level 2 answer.

There are some practical details and the trends is given. Unfortunately, in using data from the table the candidate just copies these out. It would have been better to say that potassium bubbbles the fastest, then sodium, and lithium bubbles the slowest. giving an interpretation to the words in the table.

Q20. No Examiner's Report available for this question

Q21.

It appeared that in this question, those candidates that had some experience of carrying out displacement reactions practically were able to answer in a much better way than those that had not and were relying just on their theoretical knowledge. These candidates often gave all five of the marking points in their answer. A common error seen was that the potassium was displacing the halogen from the solution rather than a more reactive halogen displacing a less reactive one. Others thought that iodine was the most reactive as it left a brown solution in all three reactions. Candidates that simply copied information from the stem of the question did not gain credit.

Bromine, chlorine and iodine are dissolved in water to make aqueous solutions. Potassium iodide solution is added to each of these solutions.

Figure 6 shows the observations.

halogen	initial colour of aqueous solution	final colour of mixture
bromine	orange	brown
chlorine	pale green	brown
iodine	brown	brown

Figure 6

Explain the observations shown in the table.

(4)

bromine displaces iodide from the solution because bromine is more reactive. chlorine displaces the iodide from solution because chlorine is more reactive so it turns brown because iodide is brown. Iodine does not displace itself so the solution remains brown.

Results Plus: Examiner Comments

A good answer that gained all 4 marks.

Q22.

This question was poorly answered overall with approximately a quarter of responses scoring 1 or 2 of the 2 marks available.

Questions in relation to the uses of the noble gases linked to their inertness feature regularly in this and the previous specifications.

In the very few correct responses seen, candidates mainly scored by correctly linking the atomic structure of argon (or its position in periodic table) with its lack of reactivity rather than by the alternative route of discussing the reactivity of oxygen.

Overall there was significant confusion in candidates' responses in regard to the reason for the use of argon in filament light bulbs. Commonly seen errors included: argon is better at conducting heat so the bulb can get hotter; as argon glows more brightly than air; because argon is more dense; references to argon or oxygen reacting with heat rather than to the reaction with the metal filament.

A common misconception in a significant number of responses was that it was 'air' that was reactive and they were unable to identify 'oxygen' as the reactive component.

For many years, argon was used to fill filament light bulbs.

A filament light bulb is shown in Figure 4.

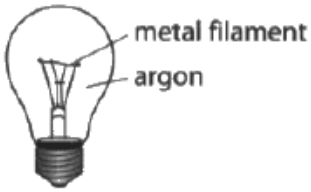


Figure 4

When the bulb is in use the metal filament becomes extremely hot.

Explain why argon, rather than air, was used to fill filament light bulbs.

(2)

Because it is an inert gas, therefore it is very unreactive and ensures that the metal filament does not burn out, whereas air is reactive and would cause the filament to burn.

Results Plus: Examiner Comments

This response scored both marks available.

There is a correct reference made to argon being inert and to the correct ideas of it being unreactive and not reacting with the metal filament.

Q23. No Examiner's Report available for this question

Q24.

There were many candidates who could explain the trend in reactivity of the group 1 and of the group 7 elements, although some did try to justify why the group 7 elements are more reactive further down the group towards iodine. Having completed that, most then could make an explained judgement as to which pair of elements would be the most violent when they reacted together. A few candidates did rank the order of reactivity however a couple of candidates did manage to get the order in completely the wrong way.

A couple of candidates decided that rubidium + iodine would be the most violent, but did not back it up with a reasoned justification which would have enabled them to be credited with some marks.

Q25.

(i) (1)

Although the majority of the candidates could offer suitable values for the density of argon, a blank space was the usual cause for the mark not being awarded.

(i) (2)

A large majority of the candidates scored the mark here, and invariably an incorrect answer was down to giving the symbol of krypton incorrectly as 'KR' or as 'kr'.

(i) (3)

Again a large majority of the candidates followed the pattern of reactivity correctly and gave a correct answer of 'no reaction'; of the remainder quite a few blank spaces were seen and several answers of 'reaction' were given.

(ii)

Many candidates scored at 1 mark, usually for mentioning something about lack of reactivity, but only a small percentage of candidates were able to explain this lack reactivity to score the second mark. Many answers included irrelevant properties such as density or electrical conductivity. It was clear that many candidates did not understand the role of argon in a light bulb. Several thought that the argon was reacting with the metal filament and giving out light as a result. Some thought that using argon made the lighter brighter than if air had been used. Overall, almost half of the candidates scored at least 1 mark.

Explain why argon, instead of air, is used inside these light bulbs.

(2)

Because Argon is unreactive so it will not react with anything ~~Heat~~ which makes the light bulb safer. It's density is greater than air's.

Results Plus: Examiner Comments

This answer indicated that argon was so unreactive that it did not react with anything - for this, 1 mark was awarded.

Explain why argon, instead of air, is used inside these light bulbs.

(2)

Because argon is a non-reactant metal and a good conductor of heat to prevent the light ~~bo~~ bulb from blowing up or catching fire, its a good light sauce which helps the light bulb look brighter and work

Results Plus: Examiner Comments

The candidate thought that argon was a metal and did not understand the purpose of its presence in a light bulb. There was nothing here to credit.

Explain why argon, instead of air, is used inside these light bulbs.

(2)

Argon is used instead of air because it is thinner, making the light shine brighter from the bulb.

Results Plus: Examiner Comments

Several answers of this type were seen where candidates thought that the argon made the light shine brighter. No marks were awarded here.

Results Plus: Examiner Tip

Learn the simple properties of the group 0 elements and be able to explain the lack reactivity in terms of full shells of electrons.

Q26. No Examiner's Report available for this question

Q27. No Examiner's Report available for this question

Q28.

(i) It was surprising that this proved difficult, given that if the mixture "turns brown" it must be a product and therefore even if you knew nothing about halogens there was a 50:50 choice. The majority of incorrect answers identified bromine.

(ii) OILRIGS are fast disappearing in this new eco age! Those who use them do remember that reduction is gain (of electrons), so most gained this mark. The problem with a good acronym is that it can hide a lack of understanding, so far too many suggested that iodine/iodide was reduced (or even sodium or sodium iodide).

Q29. No Examiner's Report available for this question

Q30. No Examiner's Report available for this question

Q31. No Examiner's Report available for this question

Q32.

(a)

Candidates found this empirical formula calculation challenging and so it proved to be a good discriminator with about a third gaining full marks.

A significant number of students confused the empirical formula calculation with relative atomic mass type calculations. Some students were able to correctly calculate the simplest whole number ratio but then mixed up the numbers with the elements so gave the incorrect formula Fe_2Cl. Another common error was to divide the mass by the wrong relative atomic mass e.g. 2.8/35.5

6 (a) A compound of iron and chlorine was formed by reacting 2.80 g of iron with 3.55 g of chlorine.

Calculate the empirical formula of the compound.
(relative atomic masses: Cl = 35.5, Fe = 56.0)

(3)

$\frac{(35.5 \times 17) + (56.0 \times 26)}{100} =$

empirical formula 20.595

Results Plus: Examiner Comments

Quite a number of candidates seemed to confuse empirical formula with a relative atomic mass type calculation.

6 (a) A compound of iron and chlorine was formed by reacting 2.80 g of iron with 3.55 g of chlorine.

Calculate the empirical formula of the compound.
(relative atomic masses: Cl = 35.5, Fe = 56.0)

(3)

35.5 → 3.55 56 → 2.80

$\frac{2.80}{56} = 0.05$ $\frac{3.55}{35.5} = 0.1$

× 1000, 0.05 : 0.1 × 100

5 : 1 = Fe_5Cl

empirical formula Fe_5Cl

Results Plus: Examiner Comments

Significant numbers started the question well but then could not give a correct empirical formula. This was awarded 2 marks.

6 (a) A compound of iron and chlorine was formed by reacting 2.80 g of iron with 3.55 g of chlorine.

Calculate the empirical formula of the compound.
(relative atomic masses: Cl = 35.5, Fe = 56.0)

(3)

Iron chlorie

$\frac{56.0}{2.80}$ $\frac{35.5}{3.55}$

= 20 = 10

$\frac{20}{10}$ $\frac{10}{10}$ Fe_2Cl

= 2 = 1

empirical formula Fe_2Cl

Results Plus: Examiner Comments

Some used the numbers "upside down" as in this example but were still credited with two marks.

6 (a) A compound of iron and chlorine was formed by reacting 2.80 g of iron with 3.55 g of chlorine.

Calculate the empirical formula of the compound.
(relative atomic masses: Cl = 35.5, Fe = 56.0)

(3)

Fe = 2.8 Cl = 3.55

56 35.5

0.05 0.1

0.05 0.05

1 : 2 Fe : Cl

empirical formula 1 : 2

Results Plus: Examiner Comments

In this example the candidate performs the first two steps correctly but does not give a final empirical formula.

(b) Sodium reacts with chlorine to form sodium chloride.

$2Na + Cl_2 \rightarrow 2NaCl$

Calculate the maximum mass of sodium chloride that could be formed by reacting 9.20 g of sodium with excess chlorine.
(relative atomic masses: Na = 23.0, Cl = 35.5)

(3)

$2Na + Cl \longrightarrow 2NaCl$

$(23 \times 2) + (35.5) \rightarrow 2(23 + 35.5)$

$46 + 35.5 \rightarrow 81.5$

Na	NaCl
46	81.5
9.2	X

$81.5 \times 9.2 = \frac{749.8}{46}$

$= 16.3$

mass of sodium chloride 16.3 g

Results Plus: Examiner Comments

This candidate has made just one error when they incorrectly calculated 2(23+35.5) to give 81.5 instead of 117. It was awarded two marks.

(c)

This question caused a great deal of confusion and many examiners wondered whether candidates had actually seen, or better still carried out the relevant practical work. Some did include descriptions of the halogens but in their pure elemental form – this is not what is seen when this is carried out using halogen and halide solutions.

Some candidates were correctly able to state the order of reactivity of the halogens, but then went on to try to describe experiments in which reaction rates were to be measured.

Good numbers were able to suggest a suitable method of reacting correct combinations of the given solutions, and also a correct explanation or order of reactivity to achieve Level 2. However it was disappointing to see the number who did not know the correct order of reactivity.

Word equations were often helpful in answers as were tables of showing results of experiments. There was the usual confusion about the use of □ide and □ine e.g. "potassium bromine is formed". Those who attempted formulae equations very often gave incorrect formulae such as KCl2 and monatomic halogens. A reversal of the order of reactivity was also fairly often given.

*(c) Chlorine, bromine and iodine are in group 7 of the periodic table.

The order of reactivity of these three elements can be shown by carrying out displacement experiments.

You are provided with

potassium bromide solution
potassium chloride solution
potassium iodide solution
bromine solution
chlorine solution
iodine solution

Describe how these solutions could be used to carry out experiments to show the order of reactivity of bromine, chlorine and iodine, explaining how the results would show the order of reactivity.
You may use equations if you wish.

(6)

Take well once you are all set up with safety gear and the solutions to show the order of reactivity you would make it a fair test by doing it in the same place same time same temp etc. then by timing the reactions of bromine, chlorine and iodine, one right after the other.

By putting the potassium bromide solution with the bromine solution chloride with chlorine etc.

this would be the fastest way to get out results but you could draw a table and use all the top three solutions with all the three bottom solution @ naturally. to get an overall test.

Results Plus: Examiner Comments

This is an example where quite a lot has been written but unfortunately nothing of credit.

*(c) Chlorine, bromine and iodine are in group 7 of the periodic table.
halogens
The order of reactivity of these three elements can be shown by carrying out displacement experiments.

You are provided with

- potassium bromide solution
- potassium chloride solution
- potassium iodide solution
- 2 bromine solution
- 3 chlorine solution
- 1 iodine solution

Describe how these solutions could be used to carry out experiments to show the order of reactivity of bromine, chlorine and iodine, explaining how the results would show the order of reactivity.
You may use equations if you wish.

(6)

In a displacement reaction, the more reactive ~~element~~ substance displaces a less reactive substance from the compound. In group 7, there are the halogens which are ordered in increasing reactivity (the reactivity increases as you go down the group.) Therefore, iodine is the most reactive, followed by bromine and then chlorine as the least reactive from the three. A displacement reaction can be carried between Potassium bromide and the iodine solution to form potassium iodide and Bromine so iodine displaces the bromine as it is more reactive so it is clear that iodine is more reactive than Bromine. Another displacement reaction can happen between Potassium chloride and the bromine solution to form potassium bromine and Chlorine. So the bromine displaces the Chlorine to show that bromine is more reactive than Chlorine. ~~Furthermore there can be another displacement reaction between~~

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Potassium iodide and the chlorine solution to form potassium chloride and iodine. So the chlorine displaces the iodine As a result by using these reactions, these halogen can be put into order of reactivity.

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

Results Plus: Examiner Comments

The addition of a halogen solution to a halide solution has been made (even though with incorrect results) but there is a wrong order of reactivity. It was awarded Level 1.

*(c) Chlorine, bromine and iodine are in group 7 of the periodic table.

The order of reactivity of these three elements can be shown by carrying out displacement experiments.

You are provided with

potassium bromide solution
potassium chloride solution
potassium iodide solution
bromine solution
chlorine solution
iodine solution

Describe how these solutions could be used to carry out experiments to show the order of reactivity of bromine, chlorine and iodine, explaining how the results would show the order of reactivity.
You may use equations if you wish.

(6)

If potassium bromide solution was reacted with ~~potassium~~ ~~chloride~~ chlorine solution: $2KBr + Cl_2 \rightarrow 2KCl + Br_2$ this equation shows that Chlorine would replace Bromine (a displacement reaction). This is because Chlorine is more reactive than bromine, as Chlorine is higher than bromine in the reactivity series. However, if potassium bromide solution was reacted with iodine solution, than bromine would still remain with potassium as bromine is higher than iodine in the reactivity series. So no change would occur; $KBr + I_2 \rightarrow KBr + I_2$. If potassium iodide solution was reacted with chlorine solution; $2KI + Cl_2 \rightarrow 2KCl + I_2$. Chlorine would replace Iodine as it is ~~still higher~~ higher than iodine in the reactivity series. If potassium bromide solution reacts with bromine solution, no reaction will happen, because it's the same, so no displacement reaction occurs. Displacement only happens if the halide is high in the reactivity series if it isn't nothing changes.

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

Results Plus: Examiner Comments

This is an excellent response with correct descriptions of suitable experiments with correct explanations and balanced equations. It was given Level 3 and 6 marks.

*(c) Chlorine, bromine and iodine are in group 7 of the periodic table.

The order of reactivity of these three elements can be shown by carrying out displacement experiments.

You are provided with

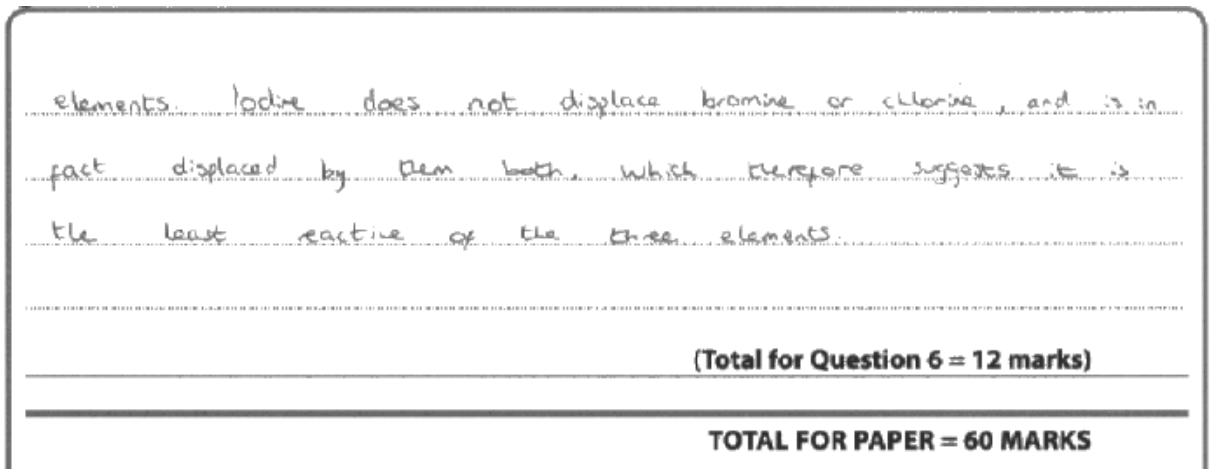
- potassium bromide solution
- potassium chloride solution
- potassium iodide solution
- bromine solution
- chlorine solution
- iodine solution

Cl
Br
I

Describe how these solutions could be used to carry out experiments to show the order of reactivity of bromine, chlorine and iodine, explaining how the results would show the order of reactivity.
You may use equations if you wish.

(6)

Firstly we could start with potassium chloride solution. If we add bromine solution to potassium chloride solution, no reaction will take place. Similarly if we add iodine solution, no reaction will take place. Next we could use potassium bromide solution. If we add chlorine solution to potassium bromide solution, a displacement reaction will take place and we would be left with potassium chloride and bromine. However if we add iodine solution to potassium bromide solution, no reaction will take place. Finally we would use potassium iodide solution. If we add chlorine solution to potassium iodide solution, a displacement reaction will take place and we will be left with potassium chloride and iodine. Similarly, if we add bromine solution to potassium iodide a displacement reaction will take place and we will be left with potassium ~~chloride~~ bromide and iodine. The fact chlorine displaces both bromine and iodine suggests that it is the most reactive of the three elements. Bromine displaces iodine, but not chlorine, which suggests it is the second most reactive of the three


elements iodine does not displace bromine or chlorine, and is in fact displaced by them both, which therefore suggests it is the least reactive of the three elements.

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

Results Plus: Examiner Comments

Suitable experiments have been suggested and correct explanations and order of reactivity given. However it was limited to Level 2 and 4 marks as there was no mention of correct observations or balanced equations.

Q33.

(c) (i) (1)

Although the majority of the candidates could offer suitable values for the density of argon, a blank space was the usual cause for the mark not being awarded.

(c) (i) (2)

A large majority of the candidates scored the mark here, and invariably an incorrect answer was down to giving the symbol of krypton incorrectly as 'KR' or as 'kr'.

(c) (i) (3)

Again a large majority of the candidates followed the pattern of reactivity correctly and gave a correct answer of 'no reaction'; of the remainder quite a few blank spaces were seen and several answers of 'reaction' were given.

(c) (ii)

Many candidates scored at 1 mark, usually for mentioning something about lack of reactivity, but only a small percentage of candidates were able to explain this lack reactivity to score the second mark. Many answers included irrelevant properties such as density or electrical conductivity. It was clear that many candidates did not understand the role of argon in a light bulb. Several thought that the argon was reacting with the metal filament and giving out light as a result. Some thought that using argon made the lighter brighter than if air had been used. Overall, almost half of the candidates scored at least 1 mark.

Explain why argon, instead of air, is used inside these light bulbs.

(2)

Because Argon is unreactive so it will not react with anything ~~Heat~~ which makes the light bulb safer. It's density is greater than air's.

Results Plus: Examiner Comments

This answer indicated that argon was so unreactive that it did not react with anything - for this, 1 mark was awarded.

Explain why argon, instead of air, is used inside these light bulbs.

(2)

Because argon is a non-reactant metal and a good conductor of heat to prevent the light ~~bo~~ bulb from blowing up or catching fire, its a good light sauce which helps the light bulb look brighter and work

Results Plus: Examiner Comments

The candidate thought that argon was a metal and did not understand the purpose of its presence in a light bulb. There was nothing here to credit.

Explain why argon, instead of air, is used inside these light bulbs.

(2)

Argon is used instead of air because it is thinner, making the light shine brighter from the bulb.

Results Plus: Examiner Comments

Several answers of this type were seen where candidates thought that the argon made the light shine brighter. No marks were awarded here.

Results Plus: Examiner Tip

Learn the simple properties of the group 0 elements and be able to explain the lack reactivity in terms of full shells of electrons.

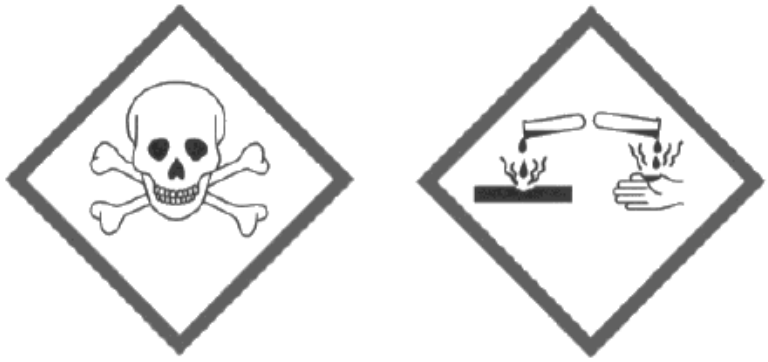
(d)

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.

Q34.

Most candidates scored at least 1 mark but many did not answer the question instead describing what the symbols meant. Others were too vague when discussing precautions and answers such as 'wear protective equipment/clothing' frequently appeared which could not be credited.

(b) These two hazard symbols are attached to a container of liquid bromine.



A chemist uses bromine in an experiment.

Use the hazard symbols to suggest safety precautions the chemist should take when using the bromine.

(2)

The use of the hazard symbols are corrosive and harmful

Results Plus: Examiner Comments

Answers such as this were unfortunately quite common. The candidate is trying to explain the meaning of the hazard symbols rather than suggesting safety precautions which the chemist should take.

(b) These two hazard symbols are attached to a container of liquid bromine.



A chemist uses bromine in an experiment.

Use the hazard symbols to suggest safety precautions the chemist should take when using the bromine.

(2)

The chemist should wear gloves so the chemicals do not touch the skin. The chemist should also wear safety goggles so nothing touches the eyes.

Results Plus: Examiner Comments

This was the most common way of scoring two marks.

Q35.

Many candidates gave yellow as the colour for chlorine and orange as the colour for bromine. It seems possible that many candidates had seen bromine water but were not familiar with pure liquid bromine. It was good to see that many students identified iodine as a solid although some did think it was a liquid, possibly suggesting confusion with iodine solution being used as a test for starch.

Halogens

1 The table gives information about the colours and physical states at room temperature of the halogens, chlorine, bromine and iodine.

(a) Complete the table.

(3)

name	colour at room temperature	physical state at room temperature
chlorine	yellow	gas
bromine	clear	liquid
iodine	grey	solid

Results Plus: Examiner Comments

Yellow was commonly seen as the incorrect colour for chlorine. "Clear" is not a colour and solid iodine was awarded a mark.

Halogens

1 The table gives information about the colours and physical states at room temperature of the halogens, chlorine, bromine and iodine.

(a) Complete the table.

(3)

name	colour at room temperature	physical state at room temperature
chlorine	Clear	gas
bromine	Orange	liquid
iodine	grey	liquid

Results Plus: Examiner Comments

These answers were commonly seen. "Clear" is not a colour for chlorine, orange was not credited for bromine and was possibly due to candidates thinking of an aqueous solution of bromine. Iodine as a liquid was possibly due to confusion with iodine solution which is often used as a test for starch.

Q36.

This was often well answered. However some candidates added extra reactants or products and others tried to write symbol equations in place of word equations, usually incorrectly with MgBr often been quoted as the formula for magnesium bromide.

(c) Magnesium reacts with bromine to form magnesium bromide.

Write the word equation for this reaction.

(2)

Mg + Br → MgBr$_2$

Results Plus: Examiner Comments

This candidate did not give a word equation as requested but made the question harder for themselves by trying to write a formula equation. They were awarded 1 mark for the correct formula of magnesium bromide on the right hand side of the equation.

(c) Magnesium reacts with bromine to form magnesium bromide.

Write the word equation for this reaction.

(2)

Magnesium + bromine → Magnesium bromide + Carbon dioxide

Results Plus: Examiner Comments

An otherwise correct answer spoilt by the addition of carbon dioxide as an extra product.

Q37.

ai

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

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

Results Plus: Examiner Comments

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



Results Plus: Examiner Comments

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

Results Plus: Examiner Tip

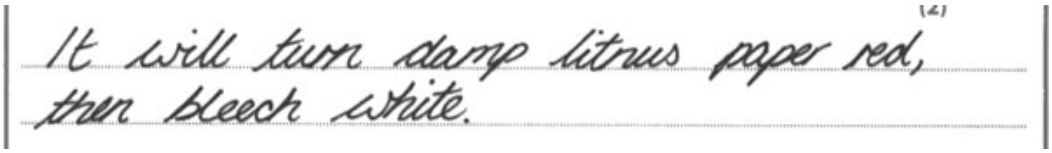
When thinking about electrolysis remember

electro– electricity

lysis– splitting.

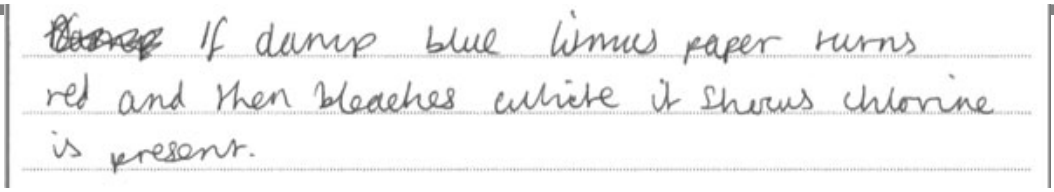
aii

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



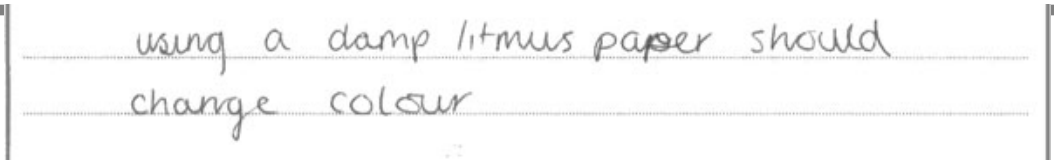
Results Plus: Examiner Comments

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



Results Plus: Examiner Comments

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



Results Plus: Examiner Comments

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

Results Plus: Examiner Tip

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

aiii

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



Results Plus: Examiner Comments

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



Results Plus: Examiner Comments

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

Results Plus: Examiner Tip

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

poly– to show that it is a polymer

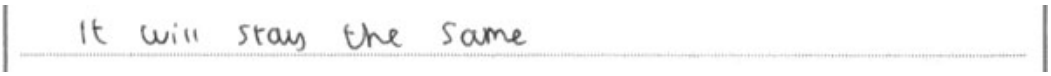
chloro– it contains chlorine

eth– from ethane

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

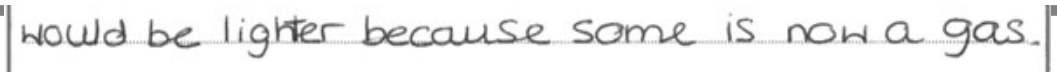
bii

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



Results Plus: Examiner Comments

Fine, scores one mark.



Results Plus: Examiner Comments

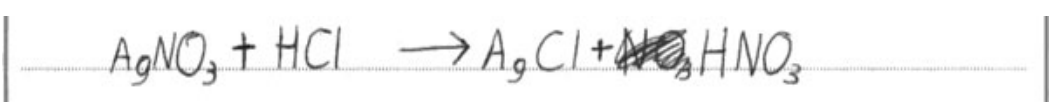
The candidate has not read the question and realised that no gas has been made or seen that there was a bung on top of the conical flask.

Results Plus: Examiner Tip

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

biii

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



Results Plus: Examiner Comments

Fine, 2 marks awarded.



Results Plus: Examiner Comments

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

Results Plus: Examiner Tip

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

Q38. No Examiner's Report available for this question

Mark Scheme

Q1.

Question Number	Answer	Acceptable answers	Mark
(a)	magnesium nitrate water carbon dioxide all three correct (2) magnesium nitrate + one other correct (1)	allow correct formulae	**(2)**

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

Question Number	Answer	Acceptable answers	Mark
(b)(ii)	$ZnO + 2HCl \rightarrow ZnCl_2 + H_2O$ (3) LHS (1) RHS (1) balancing of correct formula (1)	correct multiples ignore state symbols	**(3)**

Question Number		Indicative Content	Mark
QWC	*** (c)**	A description including some of the following points experiment set up • hydrochloric acid in container • carbon rods in acid • attach rods to electrical supply • d.c. supply(or reference to positive and negative) • test tubes to collect gases test hydrogen • lighted splint • squeaky pop (with air)/burns test chlorine • (damp blue) litmus paper • (turns red then) bleaches/white	**(6)**
Level	**0**	No rewardable content	
1	**1 – 2**	• a limited description e.g. simple description/diagram of electrolysis set up OR description of test for one of the gases. • 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 full description of electrolysis OR test for both gases OR simple description of electrolysis and the test for one of the gases. • 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. description of electrolysis and test for both gases OR a full description of electrolysis and of one gas test. • The answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Q2.

Question Number	Answer	Acceptable answers	Mark
(a)	$H_2 + Cl_2 \rightarrow 2HCl$ M1 correct formulae on LHS and RHS **(1)** M2 correctly balanced **(1)**	In M1 do not allow incorrect use of upper/lower case/subscripts but M2 can be awarded for correct balancing dependent on M1 being awarded (but note special case above) accept multiples	**(2)**

Question Number	Answer	Acceptable answers	Mark
(b)	M1 shared pair of electrons between one H and one Cl **(1)** M2 remaining outer electrons correct **(1)**	Accept all permutations of dots and crosses for electrons If any indication of ionic bonding including charges 0/2 symbols not required ignore incorrect symbols eg C/CL M2 dependent on M1 electrons do not need to be in pairs ignore inner shells electrons can be on/in ring or no ring	**(2)**

Q3.

Question number	Answer	Additional guidance	Mark
	$2\ Na + F_2 \rightarrow 2\ NaF$ (2) F_2 (1) 2 (1)		**(2)**

Q4.

Question number	Answer	Additional guidance	Mark
	2 Na + F_2 → 2 NaF (2) F_2 (1) 2 (1)		(2)

Q5.

Question number	Answer	Additional guidance	Mark
	$\frac{1.19}{119}$ and $\frac{1.42}{35.5}$ (1) 0.01 : 0.04 (1) $SnCl_4$ (1)	allow ECF	(3) AO2

Q6.

Question number	Answer	Additional guidance	Mark
(i)	(liquid changes from colourless to) yellow / orange/ brown / red		(1)

Question number	Answer	Additional guidance	Mark
(ii)	$Cl_2 + 2I^- \rightarrow 2Cl^- + I_2$ LHS (1) RHS (1) balancing of correct species (1)		(3)

Question number	Answer	Additional guidance	Mark
(iii)	An explanation that combines identification - understanding (1 mark) and reasoning/justification - understanding (1 mark): • when chlorine and iodine react, their atoms gain an electron (1) • electron attracted into chlorine atom more strongly than into an iodine atom (1) • because chlorine atom is smaller / outer electrons in chlorine atom closer to the nucleus / more shielding between nucleus of iodine atom and outer electrons (1)		(2)

Question number	Answer	Additional guidance	Mark
(iv)	An explanation that combines identification - understanding (1 mark) and reasoning/justification - understanding (1 mark): • iodide ion loses an electron (1) • oxidation is loss of electrons / iodine is oxidised (1) • chlorine atom gains an electron (1) • reduction is gain of electrons / chlorine is reduced (1)	if no reference made to gain or loss of electrons, allow (1) for redox reaction involves both oxidation and reduction	(4)

Q7.

Question number	Answer	Additional guidance	Mark
	$2K(s) + F_2(g) \rightarrow 2KF(s)$ **2 K (1)** **2 KF (1)** **s, s (1)**	ignore words	**(3)**

Q8.

Question number	Answer	Additional guidance	Mark
	$2K\ (s) + F_2\ (g) \rightarrow 2KF\ (s)$ **2**K**(1)** **2** KF **(1)** **s**, **s (1)**	ignore words	**(3)**

Q9.

Question number	Answer	Additional guidance	Mark
(i)	neon bar correct (1) argon bar correct (1)	 if no other mark scored, allow 1 for neon -252 **and** argon -192	**(2)** **AO2**

Question number	Answer	Mark
(ii)	allow any value from -152 to -90	**(1)** **AO1**

Q10.

Question number	Answer	Additional guidance	Mark
(i)	halogens or halogen	reject halide	**(1)**
(ii)	**noble** gases or **inert** gases or **rare** gases	Do not allow gases alone	**(1)**

Q11.

Question Number	Answer	Acceptable answers	Mark
(a)(i)	**2** Na **(1)** + Cl_2 → **2** NaCl (1) Ignore + in front of the 2s	maximum 1 mark if any balancing number is added in front of Cl_2 or if any of the formulae are changed eg 4Na + $2Cl_2$ → 4NaCl or Na + 1/2 Cl_2 → NaCl score (1) do not allow negative signs in front of balancing numbers	**(2)**

Question Number	Answer	Acceptable answers	Mark
(a)(ii)	$\frac{2.5}{4.0}$ (1) their fraction x 100 (1) (=62.5)	0.625 or 5/8 62.5/63 with {no/incorrect} working correct working with {no/wrong}	**(2)**

Question Number	Answer	Acceptable answers	Mark
(a)(iii)	A ionic		**(1)**

Question Number	Answer	Acceptable answers	Mark
(a)(iv)	23 + 35.5 (=58.5) Ignore g	58.5 with {no/incorrect} working 23 + 35.5 with {no/wrong} answer do not allow 58/59 without working	**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)	$\frac{24}{120}$ (1) their fraction x 100 (1) (=20%)	1/5 or 0.2 20 with {no/incorrect} working correct working with {no/wrong} answer	**(2)**

Question Number	Answer	Acceptable answers	Mark
(c)(i)	CH_3	2 CH_3 / C_1H_3 / H_3C do not allow just 1:3	**(1)**

Question Number	Answer	Acceptable answers	Mark
(c)(ii)	An explanation linking any **two** from weak {forces/attractions} (1) between {molecules/particles/them}/ intermolecular (1) little {heat/energy} needed {to separate the molecules/overcome force(s) between molecules} (1)	maximum **1** mark if breaking bonds between atoms/breaking down {molecules/ particles}/breaking covalent bonds specific weak forces eg Van der Waals/London weak bonds do not allow covalent bonds are weak /weak bonds between atoms ignore weak hydrogen bonds weak bonds between {molecules / particles} do not allow intramolecular 'little energy is needed to break the bonds' only if it is clear that {covalent/single} bonds are not being broken	**(2)**

(Total for Question = 11 marks)

Q12.

Question number	Answer	Additional guidance	Mark
	A description to include (damp) litmus / indicator paper bleaches / goes white (1)	 allow dip litmus into solution reject bleaches then goes red MP2 dependent on MP1	**(2)**

Q13.

Question Number	Answer	Acceptable answers	Mark
(i)	An explanation including • decomposing / breaking down of (compounds) (1) • using electrical energy / electricity /direct current /d.c. supply (1)	 allow 'splitting up' ignore 'separate' reject breaking down of elements	**(2)**

Question Number	Answer	Acceptable answers	Mark
(ii)	A description including • (damp blue) litmus • turns (red then) white / bleached	use of any suitable indicator (1) with correct result (1) eg universal indicator paper is bleached (2)	**(2)**

Question Number	Answer	Acceptable answers	Mark
(iii)	An explanation including any two of • (chlorine) could escape/leak (1) • (chlorine is) toxic / corrosive / poisonous (1) • an effect on people eg death / injury / damage lungs /damage eye	 Ignore 'chlorine is dangerous' Allow harmful to people	**(2)**

Question Number	Answer	Acceptable answers	Mark
(iv)	Any one of • (to make) plastics / PVC / bleach • to purify / sterilise water	 Ignore '(cleans) swimming pools'	**(1)**

Q14.

	Answer	Acceptable answers	Mark
	an explanation linking the following • decomposition (of compound/substance /electrolyte)(1) • using (direct) current (1)	 splitting up/breaking down/breaking up ignore separating reject splitting of atoms/elements/molecules for M1 using {electrical energy /electricity} reject alternating current/ac	(2)
	• (damp blue) litmus (paper) (1) • (turns red then) {bleaches / goes white} (1)	 allow bleaches indicator for 1 mark ignore indicator goes lighter ignore smells of chlorine/swimming pools ignore any incorrect middle colour mentioned use of suitable named indicator with correct result e.g. (damp) universal indicator paper (1) (turns red then) bleaches (1) starch-iodide paper(1) turns blue-black(1)	(2)
	poly(chloroethene)	PVC/polyvinylchloride/ polychloroethene/poly(chlorethene)	(1)

Q15.

Question Number	Answer	Acceptable answers	Mark
(a)(i)	D the transition metals		**(1)**

Question Number	Answer	Acceptable answers	Mark
(a)(ii)	D malleable		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)(i)	non-flammable		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)(ii)	has a low density		**(1)**

Question Number	Answer	Acceptable answers	Mark
(c)(i)	A description including (yellow-) green (1) gas (1)	 any shade of green do not allow just 'yellow' do not allow green in combination with other colours eg blue-green	 **(2)**

Question Number	Answer	Acceptable answers	Mark
(c)(ii)	hydrogen + chlorine → hydrogen chloride lhs (1) rhs (1) Ignore formulae in addition to all of the names	if formulae are used, do not allow h or CL or superscripts $H_2 + Cl_2$ on lhs 2HCl on rhs reactants in either order do not allow a mixture of words and formulae for both marks eg $H_2 + Cl_2$ → hydrogen chloride scores 1 mark for rhs do not allow hydrochloric acid /hydrochloride/hydrogen chlorine	 **(2)**

(Total for Question = 8 marks)

Q16.

Question Number	Answer	Additional guidance	Mark
	$2Al + 3Cl_2 \rightarrow 2AlCl_3$ (3) LHS (1) RHS (1) balancing of correct formulae (1)	penalise the use of 'CL' or 'AL' once only ignore state symbols allow multiples ignore use of capital L for MP3	**(3)** AO 2 1

Q17.

Question Number	Answer	Additional guidance	Mark
	$2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$ 2Na (1) 2NaOH (1) s, l, aq, g (1)	 allow S, L, AQ, G ignore words	**(3)** AO 2 1

Q18.

Question Number	Answer	Additional guidance	Mark
	$2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$ 2 Na (1) 2 NaOH (1) s, l, aq, g (1)	 allow S, L, AQ, G ignore words	**(3)** AO 2 1

Q19.

Question Number	Answer	Mark
(i)	C is the most reactive **The only correct answer is C** ***A*** *is not correct because this is irrelevant* ***B*** *is not correct because this is irrelevant* ***D*** *is not correct because this is irrelevant*	**(1)** AO 2 1

Question Number	Indicative content	Mark
* (ii)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlines in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. **Aspect one: METHOD** • trough/large container of water • equal volumes of water for each experiment • remove metal from container with tongs • remove oil • cut small piece • add metal with tongs/tweezers etc. to water • teacher wears safety glasses • gloves • use of safety screen • class well back • class wear goggles ignore general safety ideas – hair tied back, lab coat etc. ignore equal sized pieces of metal **Aspect 2: ANALYSIS** • most vigorous effervescence of hydrogen with potassium and least with lithium • fastest movement with potassium and slowest with lithium • potassium is most reactive, then sodium, then lithium ignore copying of results from table e.g potassium bubbles very fast ignore writing up of results/ put in table etc	**(6)** AO 2 2 AO 3 1a AO 3 1b

Level	Descriptor
	No rewardable material.
Level 1	• Demonstrates elements of biological understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. • Presents an explanation with some structure and coherence.
Level 2	• Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. • Presents an explanation that has a structure which is mostly clear, coherent and logical.
Level 3	• Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas is detailed and fully developed. • Presents an explanation that has a well-developed structure which is clear, coherent and logical.

Q20.

Question Number	Answer	Mark
	C is the most reactive **The only correct answer is C** ***A*** *is not correct because this is irrelevant* ***B*** *is not correct because this is irrelevant* ***D*** *is not correct because this is irrelevant*	**(1)** AO 2 1

Q21.

Question number	Answer	Additional guidance	Mark
	an explanation linking 4 of the following • {chlorine / bromine} are more reactive than iodine / iodine is the least reactive (1) • (in the reaction of chlorine with potassium iodide) chlorine displaces iodine / iodine formed / iodide ions oxidised (1) • (in the reaction of bromine with potassium iodide) bromine displaces iodine / iodine formed / iodide ions oxidised (1) • brown colour of final mixture is due to iodine (1) • iodine with KI has no reaction / iodine cannot displace iodine from its compound (1)	ignore iodide in MP1 In MP2 and MP3: allow 'iodide displaced' mark(s) could be scored in word or symbol equations (symbol equations do not have to be balanced and allow I for I_2) allow iodine cannot displace itself	**(4)**

Q22.

Question number	Answer	Additional guidance	Mark
	An explanation linking the points in one of the pairs **EITHER** • argon is {inert / a noble gas} OR **argon** has /atoms have) {full / 8 electrons in} outer shell (1) • so (it) does not react (with metal filament) OR (argon/atoms) do not {gain / lose / share electrons} **OR** • **oxygen** is reactive (1) • (air/oxygen) reacts with metal filament / forms metal oxide (1)	so metal does not burn/ combust (in argon) so (argon) does not {burn / combust} with metal (filament) so (argon) {is unreactive / less reactive / not very reactive / inactive } (with metal filament) ignore air for MP1 here allow metal burns	**(2)**

Q23.

Question number	Answer	Additional guidance	Mark
	An explanation linking fluorine has fewer electron shells (1) (so) electron more easily attracted to nucleus (1)	 allow less shielding (1) ignore fewer electrons ignore fewer outer electron shells	**(2)** **AO1**

Q24.

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. • group 1 metals form positive ions • outer electron lost • further down the group outer electron more easily lost • due to electron shell further from nucleus OR greater electron shielding • so lower nuclear attraction • group 1 metal becomes more reactive • order of reactivity Li < K < Rb • group 7 elements form negative ions • gains electron to complete outer shell • further down the group electron is less easily gained • due to outer electron shell further from nucleus OR greater electron shielding • so lower nuclear attraction • group 7 element becomes less reactive • order of reactivity F > Br > I • most reactive pair likely to be potassium + fluorine with suitable justification (K low in group 1 and F is at the top of group 7) • allow rubidium +iodine with justification (Rb lower in group 1 than K and so more reactive)	**(6)** **AO1** **AO2**

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 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 States some simple facts about group 1 OR group 7 elements OR Correctly identifies most violent reaction(s) with simple reasoning	Possible candidate responses • Group 1 elements lose 1 electron from outer shell. • Group 7 elements are more reactive up the group. • The most violent reaction could be potassium with fluorine as fluorine is the most reactive group 7 element (2)
Level 2	3–4	Additional guidance Correctly identifies most violent reaction(s) with a simple justification OR A simple explanation of the reactivity of group 1 AND group 7 elements. OR A detailed explanation of the reactivity of group 1 OR group 7 elements.	Possible candidate responses • The most violent reaction could be rubidium with iodine as rubidium is the most reactive of the group 1 elements given. Rubidium is so reactive because it loses its outer electron easily. • Group 1 elements are more reactive down the group as the distance between the nucleus and the outer electron is further, so the force of attraction between them is weaker and the electron is more easily lost. • Fluorine is the most reactive halogen because its outer electron shell is closer to the nucleus. Group 1 elements are more reactive down the group as their outer shell gets further from the nucleus.

Level 3	5–6	Additional guidance Correctly identifies the most violent reaction with a detailed justification. OR A detailed explanation of the reactivity of group 1 AND group 7 elements.	Possible candidate responses • The most violent reaction is potassium and fluorine as fluorine is the most reactive element in group 7. Potassium loses its outer electron easily as there is a weak nuclear attraction, and fluorine gains this electron easily as it has a strong nuclear attraction. • Group 1 elements become more reactive down the group. They lose 1 electron to form cations and the larger the distance between the nucleus and the outer shell, the more easily the electron is lost. Group 7 elements gain 1 electron to form anions and the smaller elements gain this electron more easily. This is because the force between the nucleus and the outer shell is stronger.

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• Demonstrates elements of chemical understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • Lines of reasoning are unsupported or unclear. (AO2)
Level 2	3–4	• Demonstrates chemical understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) • Lines of reasoning mostly supported through the application of relevant evidence. (AO2)
Level 3	5–6	• Demonstrates accurate and relevant chemical understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) • Lines of reasoning are supported by sustained application of relevant evidence. (AO2)

Q25.

	Answer	Acceptable answers	Mark
(i) 1	any value in range 1.45 to 2.99	any answer which, to 1 sf, is in the range	**(1)**
(i) 2	Kr	Reject KR, kr	**(1)**
(i) 3	no reaction	'nothing'	**(1)**
(ii)	An explanation linking any two of:	ignore noble gas doesn't react with anything argon	**(2)**

	• argon is {inert / unreactive} (1) • argon does not react with {metal/filament}/{metal/ filament} would react with air or oxygen / ORA (1) • atom has {eight electrons in outer shell / full (outer) shell} (1)	does not corrode the metal ignore references to electrical conductivity	

Q26.

Question number	*Answer*	Additional guidance	Mark
	chlorine is more reactive than bromine / chlorine can displace bromine	ignore "chlorine is more reactive" alone	**(1)**

Q27.

Question number	Answer	Mark
(i)	any value between 51 (°C) and 70 (°C)	**(1)**

Question number	Answer	Mark
(ii)	iodine **and** astatine	**(1)**

Q28.

Question number	Answer	Additional guidance	Mark
(i)	iodine	reject iodide; ignore formulae	(1)

Question number	Answer	Additional guidance	Mark
(ii)	An explanation to include: • bromine **(1)** • because electrons are gained **(1)**	Mark independently allow any number of electrons	**(2)**

Q29.

Question number	Answer	Additional guidance	Mark
	helium, neon, argon, krypton (2)	krypton, argon, neon, helium (1) if order correct except that two adjacent elements transposed allow 1 allow formulae	**(2)**

Q30.

	Answer	Acceptable answers	Mark
	D alkali metals		**(1)**

Q31.

Question number	Answer	Mark
	alkali metals	(1)

Q32.

Question Number	Answer	Acceptable answers	Mark
(a)	Fe Cl 2.8/56 3.55/35.5 (1) 0.05 0.1 or 1 2 (1) $FeCl_2$ (1)	Cl_2Fe $FeCl_2$ with no working (3) Consequential errors: if "upside down" ie 56 / 2.8 and 35.5 / 3.55 ratio 20 : 10 or 2 : 1 (1) empirical formula Fe_2Cl (1) allow 3 marks for 2.8 / 56 and 3.55 / 71 ratio 0.05: 0.05 or 1 : 1 empirical formula $FeCl_2$ allow 2 marks for 2.8 / 56 and 3.55 / 71 ratio 0.05: 0.05 or 1 : 1 empirical formula FeCl allow 2 marks for Fe Cl 2.8/56 3.55/35.5 (1) 0.5 0.1 (0) Fe_5Cl (1) - ECF	**(3)**

Question Number	Answer	Acceptable answers	Mark
(b)	**EITHER** 2x23 (1) g Na makes 2x58.5 (1) g NaCl 9.2 g Na makes $\frac{(2\times58.5)\times9.2}{46}$ g NaCl (1) (= 23.4 g) **OR** 23 g Na makes 58.5 (1) g NaCl 9.2 g Na makes $\frac{(58.5)\times9.2(1)}{23(1)}$ g NaCl (1) (= 23.4 g) mark consequentially eg 46 (1) g Na makes (2x23+35.5) (0) g NaCl 9.2 g Na makes $\frac{(2\times23+35.5)\times9.2}{46}$ (1) g NaCl (= 16.3 g)	23.4 g with no working (3) 23.4 g from any method (3) do not accept 23(.0) mol Na used = 9.2/23 (1) (= 0.4) mol NaCl = 0.4 (1) mass NaCl = 0.4 x 58.5 (1) (= 23.4 g) Ignore units throughout unless incorrect mark consequentially awarding 2 marks for 46.8 g,11.7 g and 16.3 g (see last example opposite).	**(3)**

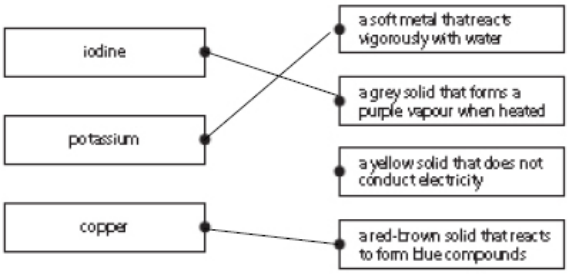
Question Number		Indicative Content	Mark
	* **(c)**	A description, comparison and explanation including some of the following points Order of reactivity: chlorine > bromine > iodine Experiment • add (aqueous) chlorine to a solution of potassium bromide • the solution turns orange/yellow • bromine is produced Conclusion/Explanation and equation: (so) chlorine is more reactive than / displaces bromine $Cl_2 + 2KBr \rightarrow Br_2 + 2KCl$ / $Cl_2 + 2Br^- \rightarrow Br_2 + 2Cl^-$ Experiment • add (aqueous) bromine to a solution of potassium iodide • the solution turns brown • iodine is produced Conclusion/Explanation and equation: (so) bromine is more reactive than / displaces iodine $Br_2 + 2KI \rightarrow I_2 + 2KBr$ / $Br_2 + 2I^- \rightarrow I_2 + 2Br^-$	

		Experiment • add (aqueous) bromine to a solution of potassium iodide • the solution turns brown • iodine is produced Conclusion/Explanation and equation: (so) bromine is more reactive than / displaces iodine $Br_2 + 2KI \rightarrow I_2 + 2KBr$ / $Br_2 + 2I^- \rightarrow I_2 + 2Br^-$ Experiment • add (aqueous) chlorine to a solution of potassium iodide • the solution turns brown • iodine is produced Conclusion/Explanation and equation: (so) chlorine is more reactive than / displaces iodine $Cl_2 + 2KI \rightarrow I_2 + 2KCl$ / $Cl_2 + 2I^- \rightarrow I_2 + 2Cl^-$ ▪ Allow use of organic solvents to identify halogens ▪ Allow use of suggested reactions which do not produce a displacement reaction eg add (aqueous) bromine to a solution of a potassium chloride with suitable conclusion/explanation ▪ Allow use of table of suggested experiments	**(6)**

Level	0	No rewardable content
1	1 - 2	• a limited description of at least one experiment in which any halogen solution is added to any halide solution (not of the same halogen) **OR** describes order of reactivity as Cl > Br > I • 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 at least two displacement experiments AND • EITHER at least one correct explanation/conclusion OR • at least one correct observation of a displacement reaction that works/balanced equation. • 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 of at least two displacement experiments **AND** • (a total of) at least two correct explanations/conclusions **AND** • at least one correct observation of a displacement reaction that works/ balanced equation • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Q33.

	Answer	Acceptable answers	Mark
(a)	B elements		**(1)**
(b)	D alkali metals		**(1)**
(c)(i) 1	any value in range 1.45 to 2.99	any answer which, to 1 sf, is in the range	**(1)**
(c)(i) 2	Kr	Reject KR, kr	**(1)**
(c)(i) 3	no reaction	'nothing'	**(1)**
(c)(ii)	An explanation linking any two of: • argon is {inert / unreactive} (1) • argon does not react with {metal/filament}/{metal/ filament} would react with air or oxygen / ORA (1)	ignore noble gas doesn't react with anything argon does not corrode the metal ignore references to electrical conductivity	**(2)**

	• atom has {eight electrons in outer shell / full (outer) shell} (1)		
(d)	 all 3 correct – 2 marks any two correct – 1 mark one correct – 0 marks	if two answer lines from one element, then ignore	**(2)**

Q34.

Question Number	Answer	Acceptable answers	Mark
	A description linking any two of use fume cupboard (1) do not inhale/breathe in vapour (1) (use) gloves (1) do not spill on the skin (1)	 keep room well ventilated use gas mask ignore face mask/respirator goggles/safety glasses/safety spectacles /do not splash in the eyes Ignore wear protective clothing/equipment Ignore cover mouth Ignore do not spill it/drink it/eat it/swallow it/spill on surfaces/wash off spills Ignore burns skin	**(2)**

Q35.

Question Number	Answer	Acceptable answers	Mark
	<table><tr><th>colour</th><th>physical state</th></tr><tr><td>**(yellow-)green (1)**</td><td>gas</td></tr><tr><td>**red-brown (1)**</td><td>liquid</td></tr><tr><td>grey</td><td>**solid (1)**</td></tr></table>	chlorine: any shade of green eg light/pale do not allow any colour in combination with green except yellow do not allow yellow on its own bromine: accept brown or red alone OR any shade of red or brown eg light/dark brown reject orange/combinations with orange reject yellow/combinations with yellow	**(3)**

Q36.

Question Number	Answer	Acceptable answers	Mark
	magnesium + bromine → magnesium bromide LHS (1) RHS (1)	allow reactants in either order allow = instead of arrow if formulae are used, do not allow MG or BR or superscripts $Mg + Br_2$ $MgBr_2$ Ignore formulae if both names and formulae given for any substance do not allow a mixture of words and formulae for both marks eg magnesium + bromine → $MgBr_2$ scores 1 mark	**(2)**

Q37.

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

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

Q38.

Question number	Answer	Mark
	C yellow-green red-brown is the only correct answer **A** gives the colours for iodine vapour and chlorine gas **B** gives the colours for solid iodine and iodine vapour **D** gives the colours for bromine liquid and iodine vapour	**(1)**