PEARSON EDEXCEL GCSE CHEMISTRY · 1CH0

CHEMISTRY



MARK SCHEME

TOPIC 6: GROUPS IN THE PERIODIC TABLE (PACK 2)

SCORE	PERCENTAGE
/84	%

STEMUP

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Q3.

There were a few blank responses here, but most candidates achieved at least one mark as they made an attempt at deciding which reaction took place based on the results given. There was a variety of ways that the candidates carried out the calculation; these are detailed in the mark scheme. Consequently, there was good number that scored full marks. Many worked out the mass of chlorine that had combined with the iron, but some then made errors in calculating the number of moles of atoms. Several went down the route of calculating the formula mass of $FeCl_2$, which was fine, but again some made errors in calculating the number of moles of atoms. It would help greatly if candidates could state their steps in a calculation eg 'mass of chlorine = ...'. This helps the candidate to clarify their thoughts and it enables the marker to understand the candidate's process of calculation rather trying to interpret often random numbers.

Q4.

Generally well answered with most candidates able to score 1 or 2 of the 2 marks available.

A large majority of candidates managed to score the first marking point in one of the many ways possible, 'more shells' being the most commonly seen. A few gave correct electron configurations which was acceptable for the first marking point. The second mark was less frequently scored.

Common errors, omissions, misconceptions:

Many candidates referred to simply losing electrons rather than the vital '**outer**' electron. Some candidates simply asserted that electrons being further from the nucleus meant that the element was more reactive. There were fewer references to multiple outer shells than seen by examiners in equivalent questions in previous series, nor were there many references to intermolecular forces between electron and nucleus.

Explain, in terms of electronic configurations, the increase in reactivity from lithium to sodium to potassium.

(2)

there are more outer shells as electrons as you travel srom lithium to sodium to potassium. This makes potassium more reactive than the others as it is more willing to take other electrons

Results Plus: Examiner Comments

This is a typical example of a response which did not score.

The incorrect reference to 'more outer shells' is rejected for the first marking point. The second marking point is not scored since there is no mention of the ease of loss of outer electrons.

Other points to note regarding this response: the number of outer shells does not increase and potassium does not take electrons.

Results Plus: Examiner Tip

Remember to discuss the **outer** electron or outer electron shell - avoid the use of the incorrect 'more outer electron shells'.

Learn the explanations, in terms of electron configurations, for the trend in reactivity for the main groups asked for in the specification, namely Group 1 and Group 7.

Explain, in terms of electronic configurations, the increase in reactivity from lithium to sodium to potassium.

(2)

Potassium is the most reactive as it has the largest atomic radius so it's 1 outer electron has a lower force of attraction to the positive nucleus so is more easily lost in reactions compared to litium which has the shortest atomic radius of the three so its outer electron is more strongly attracted to the nucleus and is less easily lost to react.

Results Plus: Examiner Comments

This response scored 2 marks - a very good response.

All the marking points have been adequately covered. The correct references to potassium having the largest atomic radius and the correct idea of a decreased force of attraction between the outer electron and nucleus are clearly mentioned. The correct idea of the outer electron being more easily lost is also mentioned.

Q5. No Examiner's Report available for this question

Q6.

(i)

The vast majority of candidates were able to estimate the melting point of iodine to gain the mark.

(ii)

Fewer candidates than in (i) were able to name a halogen that would react with the iron more vigorously with bromine.

A common error was where candidates again did not read the question carefully and gave the name of a reactive element such as sodium or potassium rather than a more reactive halogen.

Q7. No Examiner's Report available for this question

Q8.

(a) (ii)

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

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

State why a high temperature has to be used.

(1)

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

Results Plus: Examiner Comments

An acceptable way of answering the question worth the mark.

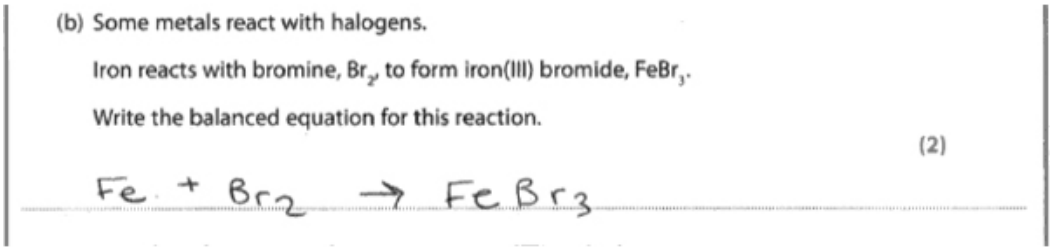
(a) (iii)

Many candidates gained one mark by correctly stating that argon is inert or unreactive or a

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

(b)

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



(b) Some metals react with halogens.

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

Write the balanced equation for this reaction.

(2)

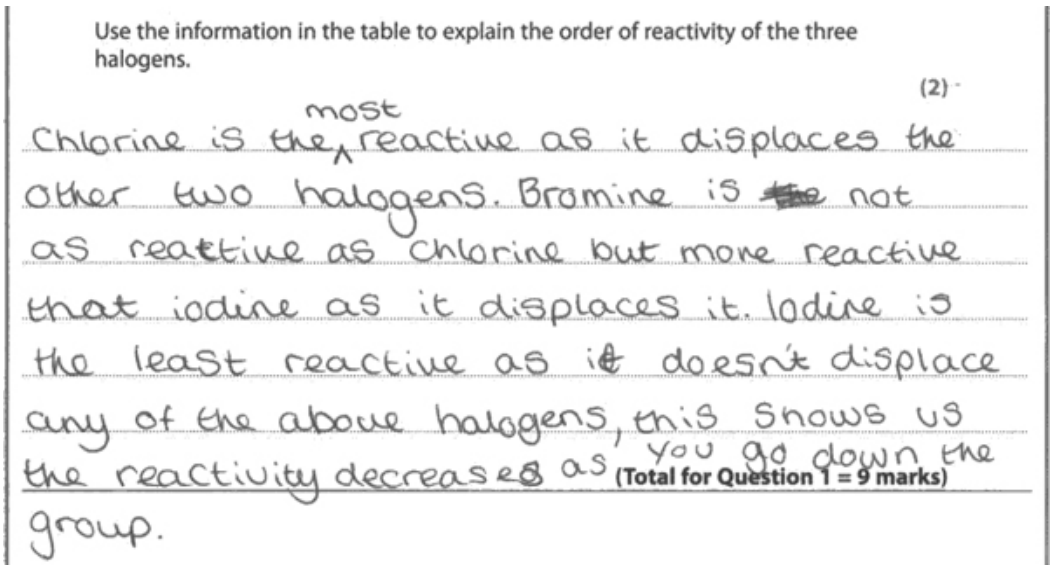
$Fe + Br_2 \rightarrow FeBr_3$

Results Plus: Examiner Comments

Correct formulae but not balanced so worth 1 mark.

(d)

The majority of candidates seemed to know the order of the reactivity of the halogens. However there was a good deal of confusion as to when to use the name of the halogen and when to use the name of the halide ion e.g. candidates referred to bromide and iodide being displaced. Some failed to score marks as they referred to the order of reactivity of the halide ions instead of the halogens. Some weaker candidates thought chlorine was the least reactive giving the reason that chloride would not react with any of the halogens.



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

(2)

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

(Total for Question 1 = 9 marks)

Results Plus: Examiner Comments

An answer worth two marks.

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

(2)

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

Results Plus: Examiner Comments

A good answer for two marks.

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

(2)

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

Results Plus: Examiner Comments

A good answer for 2 marks.

Q9.

(b)(i)

The concept of delocalised electrons was quite common but a considerable numbers of candidates failed to mention cations or positive ions when answering this question. Some candidates thought metals contained positive and negative ions. Others mentioned protons instead of positive ions. Many candidates described the arrangement of particles in a metal and went on to describe how the arrangement explained the physical properties of a metal, but

without mentioning that the particles are positive ions.

(b) (i) Describe the structure of metals in terms of the particles present in their structures.

(2)

within metals there are protons which are sourrounded by a sea of delocalised electrons



Results Plus: Examiner Comments

This candidate gained one mark for a correct reference to delocalised electrons but, like many others, wrote protons rather than cations/positive ions.

(b) (i) Describe the structure of metals in terms of the particles present in their structures.

(2)

metals are made up of positive ions surrounded by a 'sea' of delocalised electrons

Results Plus: Examiner Comments

This is the type of answer which earned two marks.

(b)(ii)

Most students were able to identify electrons as being involved in metals conducting electricity. Many were also able to explain that this was because the electrons were free to move and so gained both marks. However a proportion of candidates referred to "charged particles" instead of electrons.

Others confused the conductivity of metals with that of ionic substances with references made to ions or that the metal had to be molten to conduct.

(ii) Explain how metals conduct electricity.

(2)

Metals conduct electricity through the delocalised electrons which create a "sea" around the metal, meaning a current can be carried.

Results Plus: Examiner Comments

This gained one mark for correctly identifying the involvement of electrons, but unfortunately did not mention the idea of them moving so did not gain the second mark.

(ii) Explain how metals conduct electricity.

(2)

There is space between the positively charged ions for the electrons to move about, and due to the fact they are free to move, they conduct electricity.

Results Plus: Examiner Comments

An example of a response indicating that electrons are free to move and so worth both marks.

(c)(i)

The reaction between sodium and water was very well described by most candidates indicating the value of teacher demonstrations, however some candidates did not appreciate that the question was asking for things that can be seen during the reaction. Comments on the reactivity of sodium or explaining its reactivity in terms of electron arrangement are not required. Candidates should realise that "fizzing" and "bubbling" are really the same observation and that "hydrogen is given off" is not an observation. A few candidates included observations made after adding universal indicator, which were not credited.

(c)(ii)

About 30% of candidates produced a fully correct balanced equation. Most commonly candidates scored just one mark for the formulae on the left hand side of the equation, which was meant to be a straightforward mark. Given that the products were also named in the question, it was very disappointing that so few candidates were able to score the second mark. H for hydrogen was common as was sodium hydroxide being given as $Na(OH)_2$

It was also very surprising to see the introduction of substances not mentioned in the question.

(ii) Write the balanced equation for the reaction of sodium with water to form sodium hydroxide and hydrogen.

(3)

$Na + H_2O \rightarrow NaOH + H_2$

(Total for Question 3 = 10 marks)

Results Plus: Examiner Comments

This candidate was awarded two marks as the symbols and formulae are correct on both sides of the equation but the equation has not been balanced.

(ii) Write the balanced equation for the reaction of sodium with water to form sodium hydroxide and hydrogen.

(3)

$2Na + 2H_2O \longrightarrow 2Na(OH)_2 + H_2$

(Total for Question 3 = 10 marks)

Results Plus: Examiner Comments

Although it should obviously not be encouraged the use of brackets around OH was not penalised. Candidates who wrote NaHO were treated in a similar way.

Q10. No Examiner's Report available for this question

Q11.

Generally poorly answered with majority of the candidates unable to score either of the 2 marks available.

A minority of candidates scored only 1 mark on the second marking point for recognising that colour of bromine in solution. Very few identified the colourless state of the solution at the start.

Common errors, omissions, misconceptions:

Many candidates clearly confused this with the test for alkenes and gave the colour change the wrong way round. Many candidates added incorrect observations, usually either referring to a precipitate of some colour, often cream or buff – presumably thinking of silver bromide – or to effervescence, the default observation. Many candidates, though, either missed the word 'seen' in the question, even though it was emboldened, or were just so unused to practical work that they could only talk in terms of chlorine displacing bromine.

Describe what is **seen** when chlorine water is added to potassium bromide solution and the mixture shaken.

(2)

Ok You will see a change in colour as potassium chloride is formed. You will also see a slight fizzing.

Results Plus: Examiner Comments

This response was not creditworthy.

No starting colour is mentioned, so the first marking point is not awarded. Likewise, neither is a final colour mentioned, so the second marking point is not awarded. Even if a correct final colour had been given, the second marking point would not be awarded as there is an additional incorrect observation, namely 'fizzing'.

Describe what is **seen** when chlorine water is added to potassium bromide solution and the mixture shaken.

(2)

The Chlorine displaces the potassium bromide solution turning the solution to ~~colourless~~ orange as a result to show a reaction has occured.

Results Plus: Examiner Comments

This response scored only 1 of the 2 marks available.

The starting colour has not been given in the response, just a correct final colour, namely 'orange', so this scores 1 mark only.

Results Plus: Examiner Tip

In questions requiring observations involving a change in colour, always state both the starting and final colours.

Q12.

The majority of candidates seemed to know the order of the reactivity of the halogens. However there was a good deal of confusion as to when to use the name of the halogen and when to use the name of the halide ion e.g. candidates referred to bromide and iodide being displaced. Some

failed to score marks as they referred to the order of reactivity of the halide ions instead of the halogens. Some weaker candidates thought chlorine was the least reactive giving the reason that chloride would not react with any of the halogens.

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

(2)

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

(Total for Question 1 = 9 marks)

Results Plus: Examiner Comments

An answer worth two marks.

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

(2)

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

Results Plus: Examiner Comments

A good answer for two marks.

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

(2)

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

Results Plus: Examiner Comments

A good answer for 2 marks.

Q13.

The result of the test for chlorine was not well recalled. Many candidtes could state the paper went red or white, but few could fully describe what would be seen to gain both marks.

Some candidates lost marks as they were not specific with their answers, simply stating that the colour would change without describing to what colour it would change.

Q14.

Generally very well answered with most candidates able to score 1 or 2 of the 2 marks available.

The complete result of the test for chlorine in that 'the indicator paper would turn red first then be bleached' was given by just less than half of the candidates.

However, many responses scored just 1 mark for either stating 'the indicator paper turning red' or 'being bleached' only. Those who had the order the wrong way round were not credited with the marks.

Describe what you would **see** if damp, blue litmus paper is placed into chlorine gas.

(2)

The damp blue litmus paper will turn red then eventually bleach at the presence of chlorine gas.

Results Plus: Examiner Comments

A typical correct response scoring 2 marks.

There are correct references to the damp blue litmus turning red and then being bleached.

Describe what you would **see** if damp, blue litmus paper is placed into chlorine gas.

(2)

The damp blue litmus paper would change into a pink colour and then finally a red colour.

Results Plus: Examiner Comments

A typical response which scored 1 mark only.

The correct reference to damp blue litmus turning red scored the first marking point. The initial reference to 'pink' on its own would also have scored this point. However, there is no mention of 'bleaching', so this limited the score to 1 mark.

Results Plus: Examiner Tip

The tests for gases mentioned in the specification, such as the test for chlorine, are frequently asked for in examination - learn the tests and the observations for these tests.

Describe what you would **see** if damp, blue litmus paper is placed into chlorine gas.

(2)

The colour would change from a blue to a more red - green colour

Results Plus: Examiner Comments

This response was not creditworthy.

The colour change to 'red-green' cannot be accepted.

Results Plus: Examiner Tip

Learn the colour changes for the indicators in the specification and the test for chlorine (and the correct observations for this test).

Q15.

It was surprising that relatively few candidates scored this mark.

Some did not read the question carefully or were not careful with their language and stated that chlorine is acidic which is incorrect and therefore not accepted.

Some stated that it turned red due to the presence of hydrogen rather than hydrogen ions which did not gain the mark.

Q16.

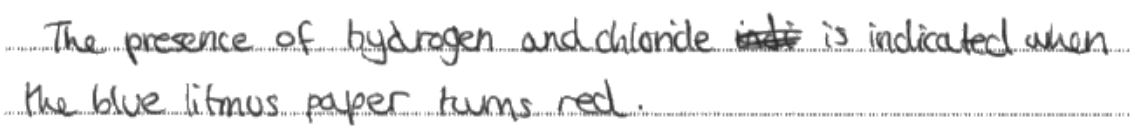
Generally very well answered with most candidates able to score the 1 mark available with answers expressed in variety of ways.

A common error seen in some responses was for candidates to correctly discuss the solution being 'acidic', but to then incorrectly ascribe the acidity to chlorine or chloride ions. Consequently this did not score. Surprisingly, in a very few cases, candidates thought the solution was alkaline.

When the gas hydrogen chloride, HCl, is dissolved in water, a solution forms.
Blue litmus paper dipped in this solution turns red.

State why the litmus paper turns red.

(1)



Results Plus: Examiner Comments

This response was not creditworthy.

There is no mention of 'acidic' or 'hydrogen ions'. 'Chloride' (ions) is also an incorrect reason for the observation.

When the gas hydrogen chloride, HCl, is dissolved in water, a solution forms.
Blue litmus paper dipped in this solution turns red.

State why the litmus paper turns red.

(1)

Hydrochloric acid forms and litmus turns red in acidic conditions.

Results Plus: Examiner Comments

A typically seen correct response for 1 mark.

The correct reference to 'hydrochloric acid forms' and/or 'acidic' are creditworthy.

Q17. No Examiner's Report available for this question

Q18.

(i) Candidates were able to make sensible predictions about the observations of the reaction of rubidium with water.

(iii) This calculation was quite well answered. Most candidates could calculate the moles of rubidium and they usually went on to state, or imply, that this was also the moles of rubidium hydroxide. (Some usefully arranged their answer under an equation so the 1:1 ratio was clear, with 0.1 written under each substance). The next stage was less well understood, with the need to convert moles to grams. The final stage, dividing by the volume, was also well done (even when earlier stages had not been).

Q19.

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.

Q20.

Generally very poorly answered, with few candidates scoring any of the 4 marks in either of the two parts to this question.

Similar to the previous question, 7(a), only a small number could give an appropriate explanation in part (i) and a correct half equation in part (ii). The most frequent mark awarded was for explaining that chlorine has been reduced by gaining electrons, but this was not awarded if this was incorrectly qualified by saying that the electron came from the potassium. Very few candidates stated that the product of the reduction was the chloride ion.

Overall, the ionic equation was very poorly attempted. In most cases, where attempted, the bromide ion had no charge, the electrons were being added to the bromide ions or some form of equation was written in reverse. It would seem that many candidates were not familiar with half equations.

Chlorine reacts with potassium bromide to form potassium chloride and bromine.
In this reaction chlorine forms chloride ions

$$Cl_2 + 2KBr \rightarrow 2KCl + Br_2$$

(i) In this reaction, chlorine has been reduced.

Explain, using the equation, how you know that chlorine has been reduced.

(2)

Reduction is the gain of electrons therefore as chlorine is a non-metal it aquires electrons to have a full stable electron structure when it molecule (Cl_2) compound therefore the chlorine atom gains electrons to become a chloride ion as a compound with potassium (2KCl)

(ii) Write the half equation for the formation of bromine from bromide ions.

$2Br^- \rightarrow Br_2 + 2e$ **(2)**

$2Br^- \rightarrow Br_2 + 2e$

Results Plus: Examiner Comments

This response scored 1 of the 2 marks available for part (i):

There is a reference to 'chlorine gains electrons' which scores on the first marking point. However, the incorrect reference to the formation of a 'chlorine ion', as opposed to the correct species, 'a chloride ion' means that the second marking point is not scored.

This response scored the 2 marks available for part (ii):

The half equation for the formation of bromine from bromide ions is correctly constructed and balanced.

Q21. No Examiner's Report available for this question

Q22. No Examiner's Report available for this question

Q23. No Examiner's Report available for this question

Q24. No Examiner's Report available for this question

Q25.

Candidates found stating the name of the solution formed when hydrogen bromide dissolves in water very difficult, with only the best candidates scoring this mark.

Bromine reacts with hydrogen to form hydrogen bromide.
Hydrogen bromide dissolves in water to form a solution.

State the name of the solution formed.

(1)

hydrobromic acid.

Results Plus: Examiner Comments

The correct answer gained 1 mark.

~~hydrogen~~ bromine hydroxide

Results Plus: Examiner Comments

A very common incorrect answer was that bromine hydroxide was formed.

Q26. No Examiner's Report available for this question

Q27. No Examiner's Report available for this question

Q28. No Examiner's Report available for this question

Q29.

It was very pleasing to see so many good responses with nearly half of the candidates reaching Level 2. The basic structure of the periodic table was generally well known with many correctly identifying and naming some groups. There was however a lot of confusion evident from weaker candidates with groups being described as being rows, and the stepped line on the diagram was sometimes thought to be separating solids and liquids or gases.

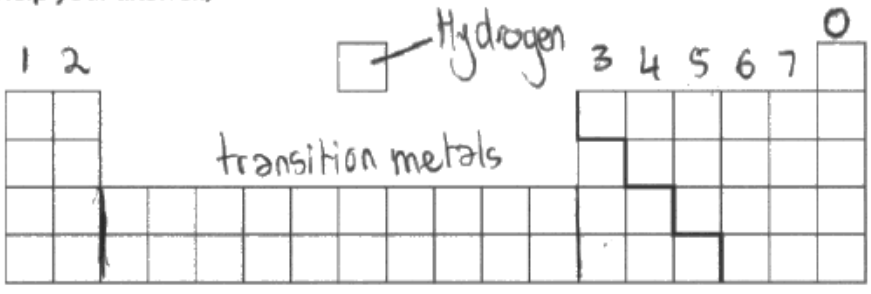
Good information about the atomic structure and chemical properties aspects was much less common than information about parts of the periodic table. The increasing reactivity down group 1 and the inertness of the noble gases were the most frequently mentioned points about chemical properties. A number of candidates failed to gain much credit as they mainly wrote about Mendeleev and the history of the periodic table. Only the best candidates described the elements as being arranged in order of increasing atomic number and the link between the period number and the number of shells.

*(d) Here is some information about the periodic table.

In the periodic table elements are arranged in rows and columns.
The position of an element in the periodic table depends on its atomic structure.
Elements with similar chemical properties are found in the same parts of the periodic table.

Identify different parts of the periodic table and explain how the position of an element in the periodic table is linked to its chemical properties and atomic structure.

(You are provided with an outline of the periodic table below and you may use this to help your answer.)



(6)

On the left hand side of the periodic table the it is all metals on the right hand side it is gases, now in group elements in Group 1 all contain 1 electron in there outer shell, furthermore also Group 1 elements are called alkali metals, so as you go down the group the more reactive they are. In Group 2, elements have 2 electrons there outer shell. In Group 3 they all contain 3 electrons in there outer shell, Group 4 have 4 electrons in there outer shells. Group 5 contain 5 electrons in the outer shell, as well as Group 6 have 6 electrons in there outer shells. In Group 7, the elements are called Halogens, and as you go down the group the reactivity decreases as well as the softness, furthermore they have 7 electrons in there outer shell. In Group 0 the elements are called Noble Gases, and they are inert which means that they have a full outer shell, which means the atoms are stable compared to the others.

Results Plus: Examiner Comments

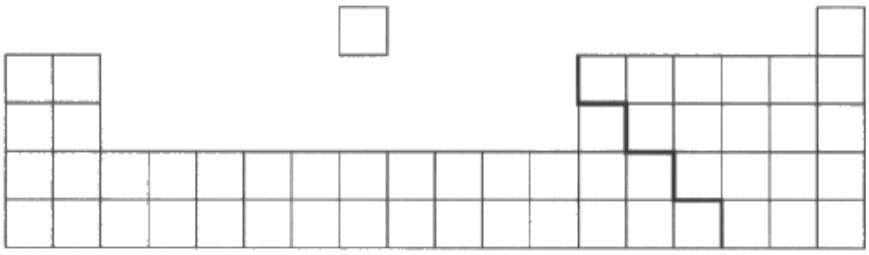
There is a lot of correct information in this answer with reference to different parts of the periodic table, including on the diagram. Also the link between the position of an element in a group and its electronic configuration was very well made as was a link to trends in chemical reactivity. Hence the candidate was awarded a Level 3 and 6 marks.

*(d) Here is some information about the periodic table.

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Identify different parts of the periodic table and explain how the position of an element in the periodic table is linked to its chemical properties and atomic structure.

(You are provided with an outline of the periodic table below and you may use this to help your answer.)



(6)

Group 7 of the periodic table contains the halogens, for example, iodine and bromine.
The vertical columns are known as groups, and the horizontal rows are known as periods.
The elements included in the periodic table are ordered by atomic number.
The metals are placed to the left of the periodic table.

Results Plus: Examiner Comments

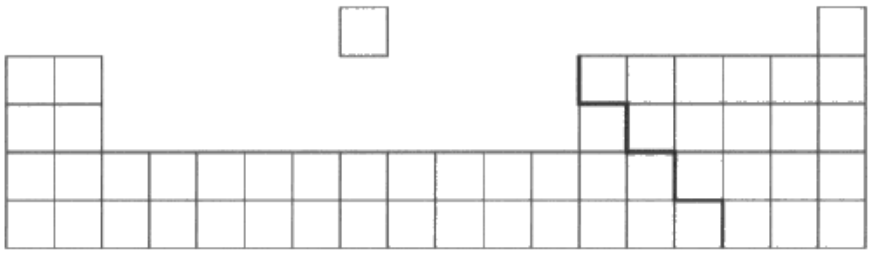
This answer contains references to several parts of the periodic table but in addition only one other relevant aspect i.e. elements ordered by atomic number. It was worthy of Level 2 and awarded 4 marks.

*(d) Here is some information about the periodic table.

In the periodic table elements are arranged in rows and columns.
The position of an element in the periodic table depends on its atomic structure.
Elements with similar chemical properties are found in the same parts of the periodic table.

Identify different parts of the periodic table and explain how the position of an element in the periodic table is linked to its chemical properties and atomic structure.

(You are provided with an outline of the periodic table below and you may use this to help your answer.)



(6)

The numbers on the side of periodic table tells us how many ~~shells~~ electrons each element has. ~~The numbers on the top of the periodic table show us how many~~ the outer shell. The group numbers on the top of the periodic table show us how many shells each element has.

Between group 2 and 3, the periodic table shows us the transition metals, giving us an insight into how they relate to each other when it comes to chemical properties.

From group 7, the periodic table shows the non metals, ~~gro~~ giving people the ability to compare the non-metals to the metals and the different properties.

This is also the case for the gases, which are found from group 1 to just over group 2. This also allows us to compare different properties to the metals and non-metals.

Results Plus: Examiner Comments

This candidate correctly identified the position of transition metals but unfortunately mixed up groups and periods. The identification of non-metals as only group 7 is not totally correct.

It was awarded Level 1 and 2 marks.

Q30.

(i)

Candidates seem familiar with the reactions of the alkali metals and were able to apply their knowledge to rubidium to gain credit.

Most gained credit for stating that there would be an explosion or a flame and that there would be bubbling or effervescence.

Lithium, potassium and rubidium are alkali metals.

(i) Describe what you would see when a small piece of rubidium is dropped on to water.

(2)

Effervescence & extreme fizzing.

Results Plus: Examiner Comments

Effervescence and fizzing are the same marking point so this answer gained just 1 mark.

Results Plus: Examiner Tip

Avoid giving synonyms of the same word as credit will only be awarded once.

(i) Describe what you would see when a small piece of rubidium is dropped on to water.

(2)

Rapid fizzing. The rubidium would appear to be disappearing.

Results Plus: Examiner Comments

Fizzing and the rubidium appearing to disappear both gain credit and 2 marks were awarded here.

(ii)

In this second question on the alkali metals, again candidates performed well with many candidates being able to explain, in terms of their electronic configurations why lithium is less reactive than potassium.

(ii) The electronic configuration of lithium is 2.1
The electronic configuration of potassium is 2.8.8.1
Lithium is less reactive than potassium.

Explain, in terms of their electronic configurations, why lithium is less reactive than potassium.

(3)

Because ~~not~~ the 1 electron on the outer shell of potassium, is very far away from the ~~nu~~ nucleaus and doesn't have a strong attraction ~~th~~ to the positive nucleaus, so it can loose its ~~the~~ outer electron very quickly ~~and~~ so is very reactive, whereas The outer shell electon on lithium is very close the nucleaus So is not lost as easily.

Results Plus: Examiner Comments

A good answer that scored all 3 marks.

Explain, in terms of their electronic configurations, why lithium is less reactive than potassium.

(3)

lithium is less reactive as it has less electrons and less outter shells so there are less electrons to react with as they cant move around as much.

Results Plus: Examiner Comments

Where marks were lost in this question, it was because candidates were not specific with their answers and referred to electrons in general rather than the electron in the outer shell, or where candidates referred to the potassium having more outer shells rather than having more shells.

Q31.

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

The majority of candidates were able to use the table of data to suggest a value for the density of krypton in the accepted range, greater than 1.4 and less than 3.5 g cm^{-3}.

Q32.

(i) The calculation of density was well done by many candidates. Inevitably, some tried to

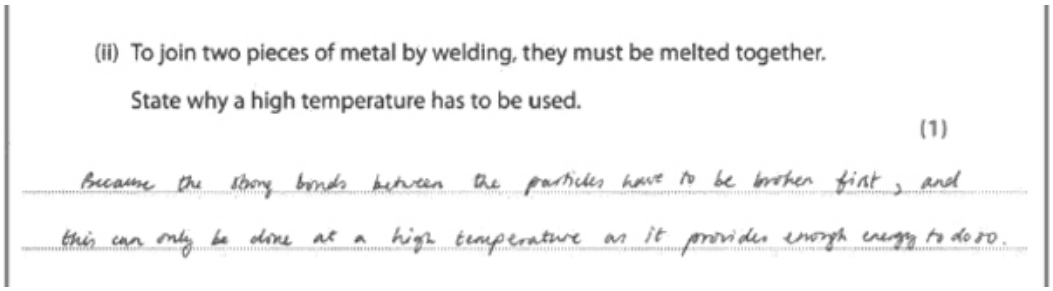
change the volume units.

(ii) Despite being told that argon is a gas, and that the container was "completely filled" many candidates treated argon as a liquid and talked about the meniscus. Not many recognised that as argon is gas the line on the volumetric flask serves no purpose in this experiment. Some did read and understand the question and knew that the volume of the gas was more than 250cm^3 and most of these candidates made sensible suggestions for alternative apparatus or for measuring the whole volume of the volumetric flask.

Q33.

(ii)

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



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

State why a high temperature has to be used.

(1)

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

Results Plus: Examiner Comments

An acceptable way of answering the question worth the mark.

(iii)

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

Q34. No Examiner's Report available for this question

Q35.

This question was not well answered with just over half of the responses scoring, mainly 1 mark out of the 3 marks available.

Of those candidates who attempted this equation, the most commonly scoring attempts showed HCl (or ClH) as the product. It was evident from the majority of responses that very few candidates knew that both chlorine and hydrogen were diatomic, with most responses showing both reactants as monatomic. Generally, in a very few responses seen, if the formulae of both the reactants and products were correct, the balancing was also correct.

Chlorine reacts with hydrogen to form hydrogen chloride.

Write the balanced equation for this reaction.

(3)

$Cl_2 + H_2 \rightarrow 2HCl$

Results Plus: Examiner Comments

A good example of a fully correct response.

The formulae of all the correct species have been given and are all correctly balanced.

$2Cl + H_2 \rightarrow 2HCl$

Results Plus: Examiner Comments

This response scored 1 mark only.

The formula for the product, namely HCl, is correct. However, the formula for chlorine is incorrectly shown, i.e. the candidate has not recognised that chlorine exists as a diatomic molecule.

Q36.

Although most candidates could write the formula of hydrochloric acid correctly on the right hand side of the equation, a large number were not able to write the correct formula of one or both of the diatomic molecules on the left hand side, therefore losing the second and the third marking point. On this question candidates were not penalised for letters in the formulae that had been written too small.

Chlorine reacts with hydrogen to form hydrogen chloride.

Write the balanced equation for this reaction.

(3)

$2Cl_2 + H_2 \rightarrow 2HCl_2$

Results Plus: Examiner Comments

Another common error was to write the formula of hydrochloric acid as HCl_2, since the formula on the right hand side was incorrect the balancing mark could not be awarded.

Write the balanced equation for this reaction.

(3)

$Cl_2 + H_2 \rightarrow 2HCl$

Results Plus: Examiner Comments

Those that were able to write the correct formula on both sides of the equation were often then able to balance these formulae to gain the third mark so few scored a mark of 2.

Write the balanced equation for this reaction.

(3)

$2H^+ + Cl_2^- \rightarrow 2HCl$

Results Plus: Examiner Comments

A noticeable number of candidates wrote hydrogen and chlorine as ions. This was not allowed, however if the formula were otherwise correct the balancing mark could have still be awarded. In this example, just 1 mark was scored.

Q37.

Candidates gain lost marks in this balanced equation as they did not seem to be aware that fluorine is a diatomic element and therefore gave the formula as F rather than F_2, therefore

losing the first mark. As all formula had to be correct for the balancing mark, the second mark was often then lost too.

Fluorine reacts vigorously with iron to produce iron(III) fluoride, FeF_3.

Write the balanced equation for this reaction.

(2)



Results Plus: Examiner Comments

The most common incorrect answer that scored no marks.



Results Plus: Examiner Comments

A good answer that scored both marks.

Q38. No Examiner's Report available for this question

Mark Scheme

Q1.

Question number	Answer	Mark
	D iodine: dark-grey solid bromine: red-brown liquid Is the only correct answer **A**, **B** and **C** all contain at least one incorrect piece of information	**(1)** **AO1**

Q2.

Question number	Answer	Mark
	D liquid solid is the only correct answer **A, B** and **C** are incorrect because bromine is a liquid and iodine is a solid at 50 °C	**(1)**

Q3.

Question number	Answer	Additional guidance	Mark
	mass of chlorine = 19.05 – 8.40 (1) (= 10.65 g) **EITHER** moles iron = $\frac{8.40}{56}$ and moles chlorine (= 0.15) = $\frac{10.65}{35.5 \times 2}$ (1) (= 0.15) ratio 1:1 so equation **A** represents reaction (1) **OR** moles iron = $\frac{8.40}{56}$ and moles chlorine (=0.15) atoms = $\frac{10.65\ (1)}{35.5}$ (=0.30) **OR** formula mass $FeCl_2$ = 56 + 2x35.5 (=127) (1) moles Fe = $\frac{8.4}{56}$ and moles (=0.15) $FeCl_2$ = $\frac{19.05}{127}$ (1) (=0.15) ratio 1:1 so equation **A** represents reaction (1)	allow not finding mass of chlorine initially: moles iron = $\frac{8.40}{56}$ (=0.15) and moles chlorine atoms = $\frac{19.05}{35.5}$ (=0.537) (1) simplest ratio: $\frac{0.15}{0.15}$: $\frac{0.537}{0.15}$ or 1 : 3.58 allow: mass of chlorine = 19.05 – 8.40 (1) (= 10.65 g) for reaction A, mass of chlorine needed $\frac{2x35.5}{56} \times 8.4 = 10.65$ (g) (1) mass of chlorine needed = mass of chlorine reacted,so equation **A** represents reaction (1) accept calculations based on expected mass of $FeCl_2$ or mass of $FeCl_3$ to show which reaction is taking place	**(3)** **AO3**

Q4.

Question Number	Answer	Additional guidance	Mark
	An explanation linking • atoms become larger/ **outer** electron becomes further from the nucleus / ORA (1) • so **outer** electron more easily **lost** / less energy needed to **lose outer** electron / ORA (1)	allow atomic radius increases / increased shielding effect (by inner complete(electron) shells)/ more (inner) shells/ decreased force of attraction between outer shell electron and nucleus / correct electronic configuration**s** (at least two) reject 'more outer shells' / incorrect forces such as intermolecular	**(2)** AO 1 1

Q5.

	Answer	Acceptable answers	Mark
	C – grey solid		**(1)**

Q6.

Question Number	Answer	Additional guidance	Mark
(i)	any value from 20 to 301	allow a range within these numbers e.g. 25 to 45 answer may be given in the table. if values are given on the answer line and the table mark only the answer on the answer line	**(1)** AO 1 1

Question Number	Answer	Additional guidance	Mark
(ii)	fluorine/ chlorine	reject iodine / astatine allow $F/F_2/Cl/Cl_2$	**(1)** AO 2 1

Q7.

Question number	Answer	Mark
(i)	any value between 30 (°C) and 63 (°C)	(1)

Question number	Answer	Mark
(ii)	potassium / rubidium / caesium / francium	(1)

Q8.

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

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

Q9.

Question Number	Answer	Acceptable answers	Mark
(a)	B potassium and caesium, copper and iron		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)(i)	A description linking (regular arrangement of) positive ions /cations (1) (surrounded by) {delocalised/sea of} electrons (1)	Any reference to molecules/molecular/intermolecular/covalent scores 0 marks overall metal ions reject "negative and positive particles" / positive atoms / protons ignore descriptions of atoms in rows/ layers of particles etc cloud of electrons ignore free	**(2)**

Question Number	Answer	Acceptable answers	Mark
(b)(ii)	An explanation linking M1 electrons (1) M2 move/flow (1) M2 dep on M1	 pass through / travel For M2: ignore free/delocalised (electrons) ignore electricity flows ignore (electrons) vibrate ignore carry/pass the current/charge	**(2)**

Question Number	Answer	Acceptable answers	Mark
(c)(i)	A description including any two from floats (1) moves (around) (1) effervescence / fizzing / bubbles (1) melts/changes to a ball shape (1) becomes smaller /disappears (1)	moves (around) on the surface (2) white smoke formed ignore gas/hydrogen given off dissolves / explodes Ignore: burns/catches fire/ignites/flame/sparks ignore addition of indicators	**(2)**

Question Number	Answer	Acceptable answers	Mark
(c)(ii)	$2Na + 2H_2O \rightarrow 2NaOH + H_2$ LHS (1) RHS (1) balancing of correct formulae(1)	NaHO ignore brackets around OH Use of lower case h, upper case A, lower case o, or use of superscripts or large numbers inside the formulae loses 1 mark only ignore state symbols	**(3)**

Q10.

Question number	Answer	Mark
	C hydrogen	**(1)**

Q11.

Question Number	Answer	Additional guidance	Mark
	A description including the following points : • (potassium bromide solution) colourless (1) • (mixture) turns yellow / brown / orange / red (1)	 ignore clear ignore reference to colour of chlorine water /change in colour allow colour combinations *e.g.* yellow-orange reject additional incorrect observations for MP2 but ignore yellow/orange/red/ brown vapours	**(2)** AO 1 2

Q12.

	Answer	Acceptable answers	Mark
	A explanation including M1 order of reactivity chlorine > bromine > iodine (1) and M2 one of the following points • chlorine displaces bromine (from bromide) AND chlorine displaces iodine (from iodide) (1) • bromine displaces iodine (from iodide) AND bromine does not displace chlorine (from chloride) (1) • iodine does not displace chlorine(from chloride) AND iodine does not displace bromine (from bromide) (1)	For M1 reject reference to reactivity of halide ions eg chlorine more reactive than bromide halogens/they decrease in reactivity down the group/table chlorine is most reactive and iodine is least reactive Ignore reference to displacement of halide ions eg chlorine displaces bromide Ignore "replaces" chlorine reacts with bromide AND iodide chlorine takes part in two (displacement) reactions bromine reacts with iodide AND does not react with chloride bromine takes part in one (displacement) reactions iodine does not react with chloride or bromide iodine does not take part in any (displacement) reactions	**(2)**

Q13.

Question Number	Answer	Additional guidance	Mark
	A description to include • (blue litmus) (first turns) red (1) • (then) bleaches / turns white (1)	 allow shades of red and pink but not other colours e.g. red-purple allow colour disappears/goes colourless ignore yellow/ colour fades /discolours white then red = 0; just 'goes white' = 1	**(2)** AO 1 2

Q14.

Question Number	Answer	Additional guidance	Mark
	A description to include • (blue litmus) (first turns) red (1) • (then) bleaches / turns white (1)	 allow shades of red and pink but not other colours *e.g.* red-purple allow colour disappears/goes colourless ignore yellow/colour fades/discolours white then red = 0; just 'goes white' = 1	**(2)** AO 1 2

Q15.

Question Number	Answer	Additional guidance	Mark
	(the solution is) acid(ic) / contains {hydrogen ions/ H^+}	allow pH < 7 allow hydrogen chloride is acidic If incorrect identity of acidic solution then 0 marks (e.g. chlorine is acidic = 0)	**(1)** AO 2 1

Q16.

Question Number	Answer	Additional guidance	Mark
	(the solution is) acid(ic) / contains {hydrogen ions/ H^+}	allow pH < 7 allow hydrogen chloride is acidic if incorrect identity of acidic solution then 0 marks (*e.g.* chlorine is acidic = 0)	**(1)** AO 2 1

Q17.

Question number	Answer	Additional guidance	Mark
	colour: grey/ black (1) state: solid (1) black/grey (1)	Allow any shade of grey/ gray	**(2)**

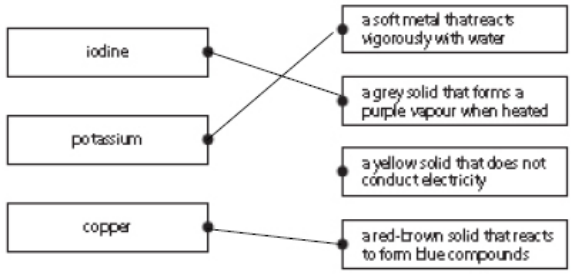
Q18.

Question number	Answer		Mark
(i)	A description to include any three from • metal disappears **(1)** • metal moves around **(1)** • fizzing/ effervescence/ bubbling **(1)** • (any colour) flame **(1)** • explodes/reacts violently **(1)**	ignore floats/ sinks/ on surface of water allow dissolves/gets smaller ignore gas / smoke / steam / water vapour / hydrogen allow forms a ball / melts	**(3)**

Question number	Answer	Mark
(ii)	**C** rubidium atoms outer electrons are further from the nucleus than potassium atoms is the only correct answer. **A**, **B** and **D** are true but does not affect the reactivity	**(1)**

Question number	Answer	Additional guidance	Mark
(iii)	4.08 as final answer with or without working scores 4 • moles Rb = 8.5/85 (= 0.1 mol) **(1)** • moles RbOH = 0.1 mol **(1)** • mass RbOH = 0.1 x 102 (=10.2 g) **(1)** • conc = 10.2/2.5 (= 4.08 gdm^{-3}) **(1)** **OR** • 2Rb → 2 RbOH/ 1:1 ratio **(1)** • 85 (x2) (g) → 102 (x2) (g) **(1)** • 8.5 (g) → 10.2 (g) **(1)** • conc = 10.2/2.5 (= 4.08 gdm^{-3}) **(1)**	allow 8.5/ 2.5 (=3.4) to score MP4 working leading to 10.2 will score 3	**(4)**

Q19.

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

Q20.

Question Number	Answer	Additional guidance	Mark
(i)	An explanation linking • (chlorine) gains (an) electron(s) (1) • to form {a chloride (ion) / Cl^- / negative ion} (1) MP2 dependent on MP1	reject chlorine gains an electron from potassium reject sharing of electrons allow $Cl_2 + 2e \rightarrow 2Cl^-$ even if unbalanced (2) ignore chlorine ion	**(2)** AO 1 1

Question Number	Answer	Additional guidance	Mark
(ii)	$2Br^- \rightarrow Br_2 + 2e$ (2) correct species (in correct place) (1) balancing of correct species (1)	allow $2Br^- - 2e \rightarrow Br_2$ (2) unbalanced 1 max allow multiples	**(2)** AO 2 1

Q21.

Question number	Answer	Mark
(i)	any value greater than 0 and less than 5 s	**(1)**

Question number	Answer	Additional guidance	Mark
(ii)	Any two from • effervesces (1) • melts (1) • catches fire (1) • explodes (1) • makes alkaline solution (1)	allow moves very quickly / moves about	**(2)**

Q22.

Question number	Answer	Additional guidance	Mark
	safety screen / eye protection / gloves	Ignore 'tie long hair back'	**(1)**

Q23.

Question number	Answer	Additional Guidance	Mark
	use of fume-cupboard / fume hood	allow adequate ventilation gloves (to prevent skin absorption) ignore breathing apparatus, gas mask, mask, PPE	**(1)**

Q24.

Question number	Answer	Mark
(i)	halogens	**(1)** **AO1**

Question number	Answer	Additional guidance	Mark
(ii)	astatine	allow At / At_2	**(1)** **AO1**

Question number	Answer	Mark
(iii)	**C** bromine **A** and **B** are not correct as they are gases at room temperature and pressure **D** is not correct as iodine is a solid at room temperature and pressure	**(1)** **AO1**

Question number	Answer	Mark
(iv)	**D** iodine **A** is not correct as fluorine is pale yellow at room temperature and pressure **B** is not correct as chlorine is green at room temperature and pressure **C** is not correct as bromine is red-brown liquid at room temperature and pressure	**(1)** **AO1**

Q25.

Question number	Answer	Additional guidance	Mark
	hydrobromic acid (1)	Ignore hydrogen bromide solution Ignore HBr(aq)	**(1)**

Q26.

Question number	Answer	Mark
	A alkali metals **A** is the only correct answer. **B** is incorrect because fullerenes are not a group in the periodic table **C** is incorrect because halogens are group 7 **D** is incorrect because noble gases are group 0	**(1)**

Q27.

Question number	Answer	Mark
(i)	(outer shell is) full/ complete	**(1)** **AO1**

Question number	Answer	Additional guidance	Mark
(ii)	An explanation linking • hydrogen is flammable / could ignite (1) • krypton is more dense than air (1) • (so krypton) air ship would not float (1)	 allow krypton has a high density	**(3)** **AO3**

Q28.

Question number	Answer	Additional guidance	Mark
	An answer that provides a description by making reference to: • (damp blue) litmus (1) • (turns red) then {bleaches/white} (1)	 second mark is dependent on first	**(2)**

Q29.

Question Number		Indicative Content	Mark
QWC	*	A description and explanation including some of the following points **CREDIT CAN BE GIVEN FOR LABELS/ANNOTATIONS ON DIAGRAM** **Parts of the periodic table** • periods • (periods) are (horizontal) rows • groups • (groups) are (vertical) columns • group 1 are alkali metals • group 7 are halogens • group 0 are noble gases • transition elements in the middle of the table • metals on the left (and centre) • non-metals on the right **Position of element/Atomic structure** • elements arranged in order of increasing atomic number/number of protons • group number is equal to number of electrons in outer shell • period number is equal to the number of shells **Position of element/Chemical properties** • elements in same group have similar chemical properties • eg elements in group 1 become more reactive with increasing atomic number/down group • eg elements in group 7 become less reactive with increasing atomic number /down group	**(6)**

Level	0	No rewardable content
1	1 - 2	• a limited description e.g. correctly identifies one part of the periodic table **OR** states one aspect of positioning/atomic structure **OR** one aspect of positioning/chemical property of elements • 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. identifies some/several parts of the periodic table **OR** identifies one part of the periodic table and attempts to link the position of an element(s) to either atomic structure or chemical properties • 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. identifies some/several parts of the periodic table **AND** attempts to link the position of an element(s) to at least two aspects of atomic structure and/or chemical properties • relate atomic structure to at least two aspects of positioning and/or chemical properties of the elements • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Q30.

Question number	Answer	Additional guidance	Mark
(i)	A description to include from • effervescence / bubbles / fizz (1) • disappears / gets smaller (1) • explodes / flame / ignites / sparks (1)	 ignore gas / smoke ignore hydrogen given off allow dissolves allow moves around very fast allow forms a ball / melts ignore floats /sinks ignore 'pops' / hydrogen	(2)

Question number	Answer	Additional guidance	Mark
(ii)	an explanation linking **outer** {electron /shell} closer to nucleus (1) so more attraction for {electron/shell} (1) (therefore) electron is harder to lose (1)	 allow smaller atomic radius / fewer shells reject less outer shells for MP1 allow less shielding allow more energy to lose electron ORA for potassium	**(3)**

Q31.

Question number	Answer	Additional guidance	Mark
	accept any number in the range **1.4 – 3.5** **accept value either on answer or in the space in the table**	Allow any number of decimal places Do not allow number below 1.4 Do not allow negative numbers Do not allow numbers greater than 3.5	**(1)**

Q32.

Question number	Answer	Additional guidance	Mark
(i)	mass argon = 79.120 – 78.639 (= 0.481 (g)) **(1)** density = 0.481/250 = 0.001924 (gcm^{-3}) **(1)**	 allow ECF allow 0.002, 0.0019, 0.00192, 0.001924..... for (2)	**(2)**

Question number	Answer	Additional guidance	Mark
(ii)	An explanation including • the volume of the flask is more than 250 cm^3 / more argon is in the flask than up to the line **(1)** • measure the whole volume of the flask (e.g. fill with water and measure volume of water) **(1)**	allow use a flask/ container of known volume	**(2)**

Q33.

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

Q34.

Question number	Answer	Mark
	C 63 °C Is the only answer. **A** would be a gas at room temperature **B** would be a liquid at room temperature **D** alkali metals have low melting points – this is too high	**(1)** **AO1**

Q35.

Question number	Answer	Additional guidance	Mark
	$Cl_2 + H_2 \rightarrow 2HCl$ (3) $Cl_2 + H_2 \rightarrow$ (1) $\rightarrow$ HCl (1) balancing of correct formulae (1)	do not penalise incorrect small/ capital letters for left hand side formulae, do not allow Cl^2 or Cl2, but allow MP3 if correctly balanced allow reactants in either order allow ClH for HCl allow = for → allow multiples ignore state symbols if molecules have a + or – charge do not allow mark for formulae but allow MP3 for correct balancing	**(3)**

Q36.

Question number	Answer	Additional guidance	Mark
	$Cl_2 + H_2 \rightarrow 2HCl$ (3) $Cl_2 + H_2 \rightarrow$ (1) $\rightarrow$ HCl (1) balancing of correct formulae (1)	do not penalise incorrect small/ capital letters for left hand side formulae, do not allow Cl^2 or Cl2, but allow MP3 if correctly balanced allow reactants in either order allow ClH for HCl allow = for → allow multiples ignore state symbols if molecules have a + or – charge do not allow mark for formulae but allow MP3 for correct balancing	**(3)**

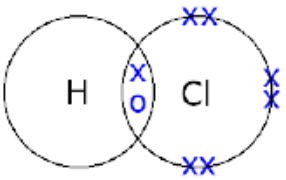
Q37.

Question number	Answer	Additional guidance	Mark
	$2Fe + 3F_2 \rightarrow 2FeF_3$ (2) correct formulae only (1) balancing of correct formulae (1)	allow multiples reject Fe(III) on LHS reject incorrect capitals and subscripts reject charges on LHS but ignore charges on RHS. allow = for →	**(2)**

Q38.

Question number	Answer	Additional guidance	Mark
(i)	hydrogen + chlorine → hydrogen chloride	answer must contain a "+" between reactants allow reactants on LHS in either order allow $H_2 + Cl_2 \rightarrow 2HCl$ allow multiples on balanced equation ignore state symbols	**(1)**

Question number	Answer	Mark
(ii)	(turns) red /pink	(1)

Question number	Answer	Additional guidance	Mark
(iii)		6 electrons drawn in outer shell of Cl (1) ignore inner shells of electrons even if incorrect	(1)

Question number	Answer	Additional guidance	Mark
(iv)	covalent	ignore other words reject ionic / metallic	(1)