PEARSON EDEXCEL GCSE CHEMISTRY · 1CH0

CHEMISTRY



MARK SCHEME

TOPIC 1: KEY CONCEPTS IN CHEMISTRY (PACK 5)

SCORE	PERCENTAGE
/147	%

STEMUP

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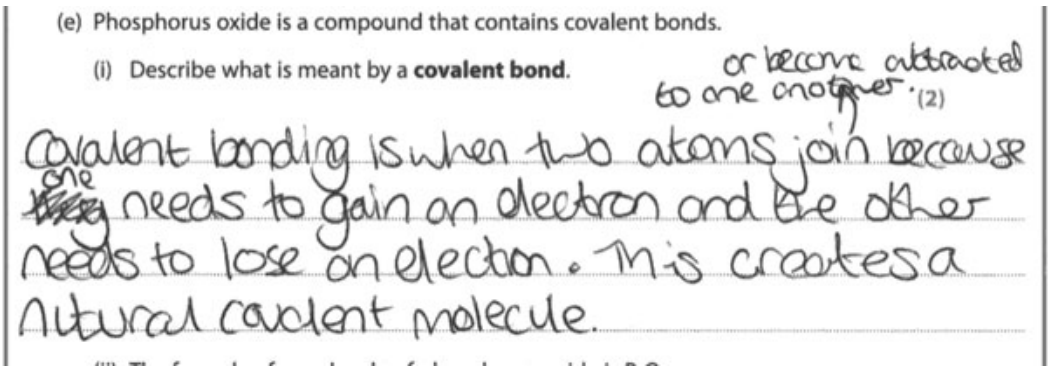
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Q3.

(i)

Of the candidates who scored at least one mark for this question, the greater majority obtained 1 mark for the idea of sharing electrons between two atoms. Only a few indicated that a pair of / two electrons were shared. Many others had indicated a sharing of electrons, but between elements rather than between atoms and so could not be given that mark. A number of candidates had confused ionic with covalent bonding and wrote about electrons being transferred.



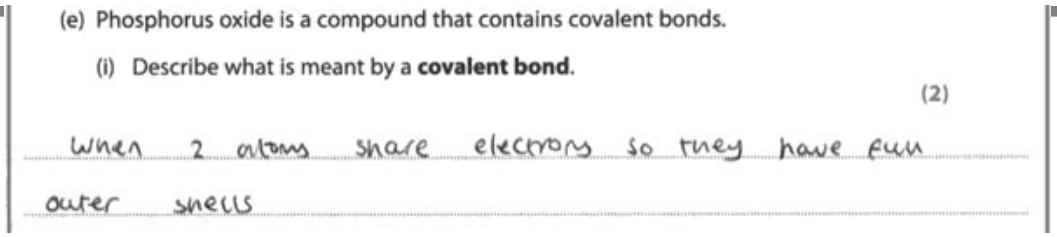
(e) Phosphorus oxide is a compound that contains covalent bonds.

(i) Describe what is meant by a **covalent bond**. or become attracted to one another. (2)

Covalent bonding is when two atoms join because one needs to gain an electron and the other needs to lose an electon. This creates a natural covalent molecule.

Results Plus: Examiner Comments

There is confusion here between ionic and covalent bonding. This answer was given 0 marks.



(e) Phosphorus oxide is a compound that contains covalent bonds.

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When 2 atoms share electrons so they have full outer shells

Results Plus: Examiner Comments

One mark was given for the sharing of electrons. No mention was made of the number of electrons in the covalent bond.

Results Plus: Examiner Tip

Know the difference between covalent and ionic bonding and how the two types of bonding are formed.

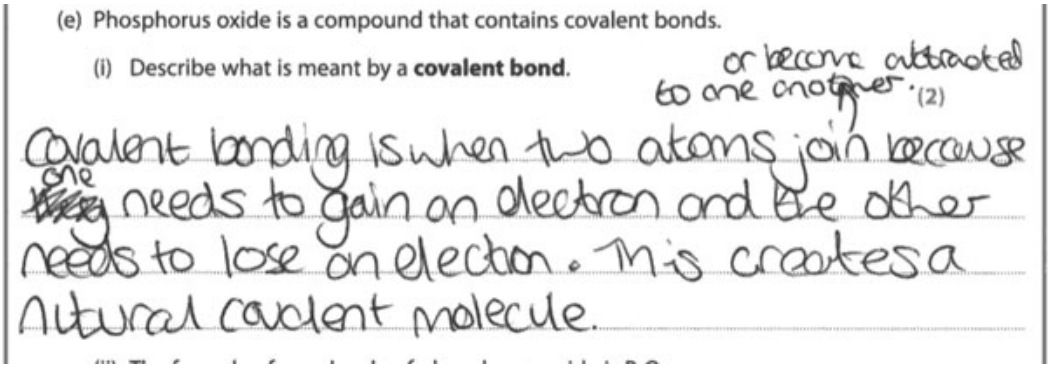
(ii)

Only a small number of candidates knew that the empirical formula meant the simplest ratio of the atoms in the formula of a substance. Many calculated the formula mass or contrived some other form of response, but most left this question unanswered.

Q4.

(i)

Of the candidates who scored at least one mark for this question, the greater majority obtained 1 mark for the idea of sharing electrons between two atoms. Only a few indicated that a pair of / two electrons were shared. Many others had indicated a sharing of electrons, but between elements rather than between atoms and so could not be given that mark. A number of candidates had confused ionic with covalent bonding and wrote about electrons being transferred.



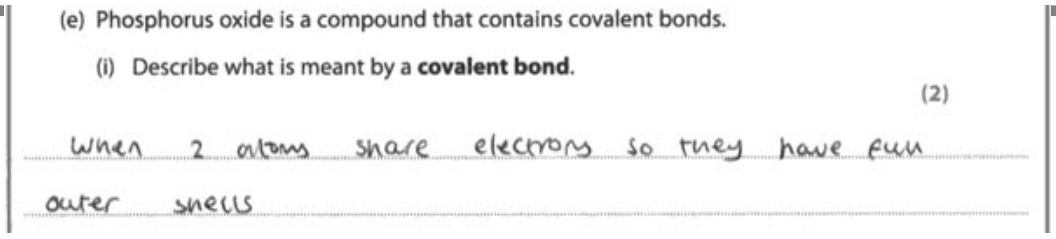
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Results Plus: Examiner Tip

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(ii)

Only a small number of candidates knew that the empirical formula meant the simplest ratio of the atoms in the formula of a substance. Many calculated the formula mass or contrived some other form of response, but most left this question unanswered.

Q5.

(i)

This first question on the paper was generally well answered with candidates referring to the higher melting point or boiling point of ionic solids.

(i) Titanium(IV) oxide is an ionic solid.
Many ionic solids are soluble in water.

Titanium(IV) oxide is not soluble in water.
Its other physical properties are typical of ionic solids.

Predict **one** other physical property of titanium(IV) oxide that would be typical of ionic solids.

(1)

High melting point

Results Plus: Examiner Comments

The most common correct answer that scored.

Lattice structure (strong electrostatic bonds)

Results Plus: Examiner Comments

A common mistake which caused candidates not to score was where they did not read the question carefully and talked about the structure of ionic solids rather than its properties.

This example gained no marks.

Results Plus: Examiner Tip

You should read the question carefully and if you have time at the end, reread through your answers alongside the question to ensure that your answer answers the question set.

Boiling point / melting point

Results Plus: Examiner Comments

In some cases, candidates were not precise with their answers and just stated boiling point or melting point but did not state whether it was high or low. This therefore did not gain credit.

(ii)

Candidates found deducing the charge of the titanium ion quite difficult with the majority not scoring on this question.

Q6. No Examiner's Report available for this question

Q7. No Examiner's Report available for this question

Q8. No Examiner's Report available for this question

Q9.

The majority of candidates scored at least one mark in this question with many scoring the two marks available for giving two characteristic properties of metals.

Where candidates did not score, it was often because they did not understand the meaning of 'property'. In some cases candidates simply named two metals.

Candidates often confused strong with hard thinking that they are synonymous.

State **two** characteristic properties of metals.

(2)

property 1 malubla

property 2 ductile

Results Plus: Examiner Comments

A good answer that scored both marks.

State **two** characteristic properties of metals.

(2)

property 1 solid

property 2 tensile strength

Results Plus: Examiner Comments

This answer scored no marks.

If the candidate had stated high tensile strength a mark could have been awarded.

State **two** characteristic properties of metals.

(2)

property 1 have strong bonds

property 2 all atoms structured in rows

Results Plus: Examiner Comments

In others, candidates tried to describe the structure of a metal rather than a property, this gained no marks.

State **two** characteristic properties of metals.

(2)

property 1 Iron

property 2 Aluminium

Results Plus: Examiner Comments

In some cases candidates simply named two metals, this did not score.

Q10. No Examiner's Report available for this question

Q11.

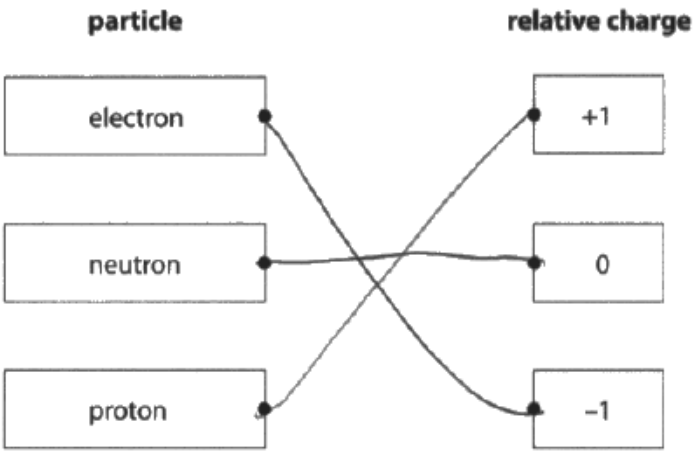
(i)

In general, candidates were able to select the correct charges of sub-atomic particles, where full marks were not scored, it was often because they had reversed the charges on the electron and the neutron.

Atoms contain electrons, neutrons and protons.

(i) Draw one line to **link** each particle to its correct relative charge.

(2)



Results Plus: Examiner Comments

The correct answer that scored 2 marks.

Q12.

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

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

Water

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

11.1 g of calcium chloride are dissolved in water.

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

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

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

(3)

conc. = moles / vol.

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

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

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

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

concentration = 0.2 mol dm^{-3}

Results Plus: Examiner Comments

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

This example is ideally set out.

Q13.

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concentration = 0.2 mol dm^{-3}

Results Plus: Examiner Comments

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

This example is ideally set out.

Q14.

About half the candidates managed to score marks here. A variety of approaches were seen to answer this question correctly and identify that equation A represented the reaction taking place. Some worked out the number of moles of iron and copper and showed that since these amounts were equal, so equation A was the correct one.

Other successful approaches included: starting with 10.00 g iron, they calculated the mass of copper produced using both equations – the mass obtained from equation A matched the mass of copper given in the question. Others had a similar approach but started with 11.34 g of copper and calculated the mass of iron that would be required to produce that mass of copper by each equation.

When iron reacts with copper sulfate solution, solid copper is formed.

Two possible equations for this reaction are

A $CuSO_4 + Fe \rightarrow Cu + FeSO_4$
B $3CuSO_4 + 2Fe \rightarrow 3Cu + Fe_2(SO_4)_3$

It was found that 10.00 g of iron powder reacted with excess copper sulfate solution to produce 11.34 g of copper.

Carry out a calculation to decide which equation, **A** or **B**, represents the reaction taking place.
(relative atomic masses: Fe = 56.0, Cu = 63.5)

(2)

A Fe=56 $\frac{10}{56}$ = 0.17857142 Moles

A takes place 0.17857142 x 63.5 = 11.34g of copper

$\frac{10}{56+2} > \frac{5}{56}$ $\frac{5}{56} \times (63.5 \times 3) = 17.$ $17 \neq 11.34$

∴

Reaction A takes place

Results Plus: Examiner Comments

This method was frequently seen. The candidate has calculated the mass of copper formed in equation A (1st marking point) then linked this to the correct equation (2nd marking point). There was little explanation however the sign for 'therefore' indicated that the candidate used this calculation to making their judgement.

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Carry out a calculation to decide which equation, **A** or **B**, represents the reaction taking place.
(relative atomic masses: Fe = 56.0, Cu = 63.5)

(2)

B = − + 112 → 190.5 ÷112 ×10 ÷10 17.0

A = − + 56 → 63.5 ÷56 ×10 ÷10 11.34

A represents the reaction.

Results Plus: Examiner Comments

The candidate has used an alternative method for this calculation.
For equation B 2 mol Fe gives 3 mol Cu ie 112 (g) Fe gives 190.5 (g) Cu. This was then scaled down to 10(.00) g of iron to give 17.0 g Cu. Similar treatment for equation A then gave 11.34 g Cu from 10.00 g Fe. So the candidate has clearly calculated mass of copper formed in both equations (1st marking point), this was then linked to equation A (2nd marking point).

Q15.

(ii)

The marks here were for the formulae of both nitrogen and hydrogen, and for the balancing of the equation. Many candidates scored both marks with slightly more scoring 0 marks for this question. Only a few candidates wrote an unbalanced equation. A common mistake was the formula of nitrogen given as 2N in the equation. Candidates do need to know the formulae of the elements and simple compounds given in the specification.

(ii) Ammonia, NH_3, is made by reacting nitrogen with hydrogen.

Write the balanced equation for this reaction.

(2)

$2N + 3H_2 \rightarrow 2NH_3$

Results Plus: Examiner Comments

Incorrect formula on left hand side (2N) - 0 marks. Balancing was dependent on correct formulae being used. 0 marks.

(ii) Ammonia, NH_3, is made by reacting nitrogen with hydrogen.

Write the balanced equation for this reaction.

(2)

$N_2 + H_2 \longrightarrow NH_3$

Results Plus: Examiner Comments

1 mark for the correct formulae, but no balancing.
1 mark overall.

Results Plus: Examiner Tip

Practice writing and balancing equations from word equations.

Q16.

ii

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

It will stay the same

Results Plus: Examiner Comments

Fine, scores one mark.

would be lighter because some is now a gas.

Results Plus: Examiner Comments

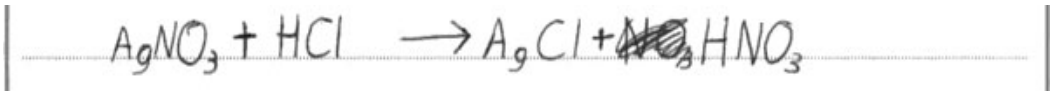
The candidate has not read the question and realised that no gas has been made or seen that there was a bung on top of the conical flask.

Results Plus: Examiner Tip

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

iii

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



Results Plus: Examiner Comments

Fine, 2 marks awarded.



Results Plus: Examiner Comments

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

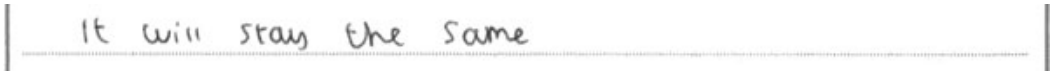
Results Plus: Examiner Tip

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

Q17.

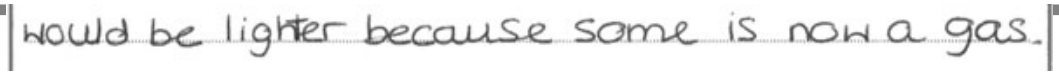
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Results Plus: Examiner Comments

Fine, scores one mark.



Results Plus: Examiner Comments

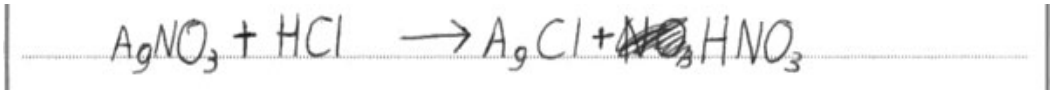
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Candidates showed that they could write equations and many scored here. However candidates that had not learnt the formulae of the common laboratory acids did not score here.



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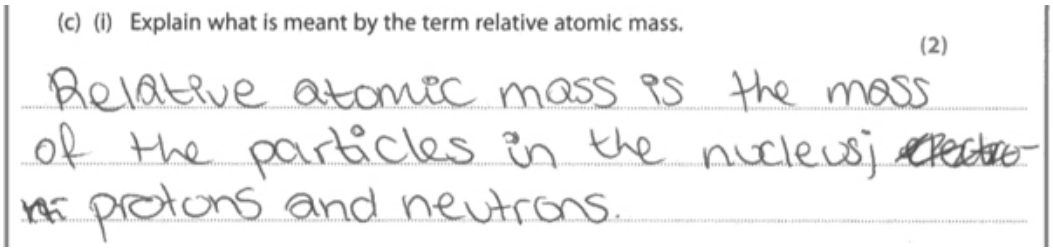
Results Plus: Examiner Tip

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

Q18.

(i)

This proved to be a very difficult question for all except the very strongest candidates. Even of those, very few candidates scored both marks. Most answers seen referred to "the number of protons and neutrons added together" without any mention of relative atomic mass being an average. Very few referred to carbon-12. A quite frequently seen incorrect answer was a reference to "the top number on the symbol in the periodic table".


(c) (i) Explain what is meant by the term relative atomic mass.

(2)

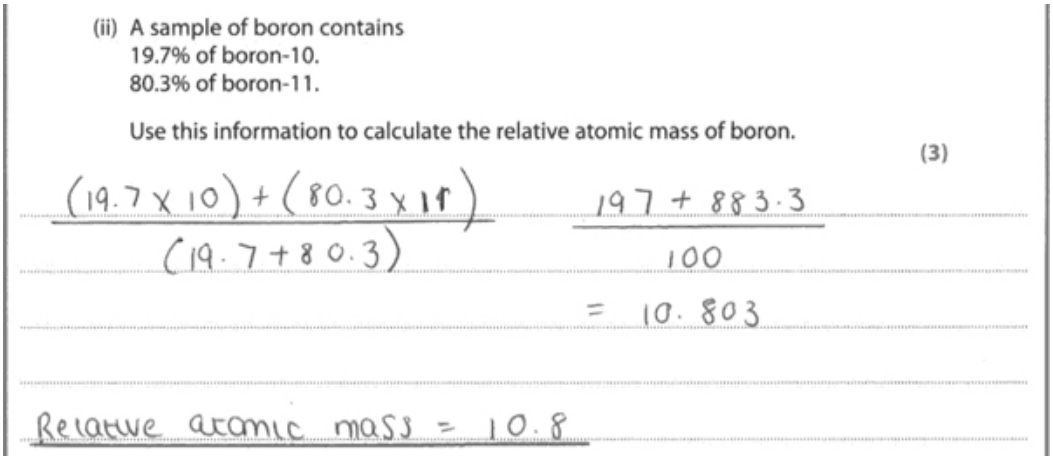
Relative atomic mass is the mass of the particles in the nucleus; ~~electro~~ protons and neutrons.

Results Plus: Examiner Comments

An all too common answer which did not gain any marks.

(ii)

Many of the stronger candidates knew how to do this calculation and scored full marks with ease. A few scored the first two method marks but then failed to divide by 100 or divided by 21 so lost the third mark. Those who did not know the method required, either used the numbers in a random manner or did not attempt the question at all.


(ii) A sample of boron contains
19.7% of boron-10.
80.3% of boron-11.

Use this information to calculate the relative atomic mass of boron. (3)

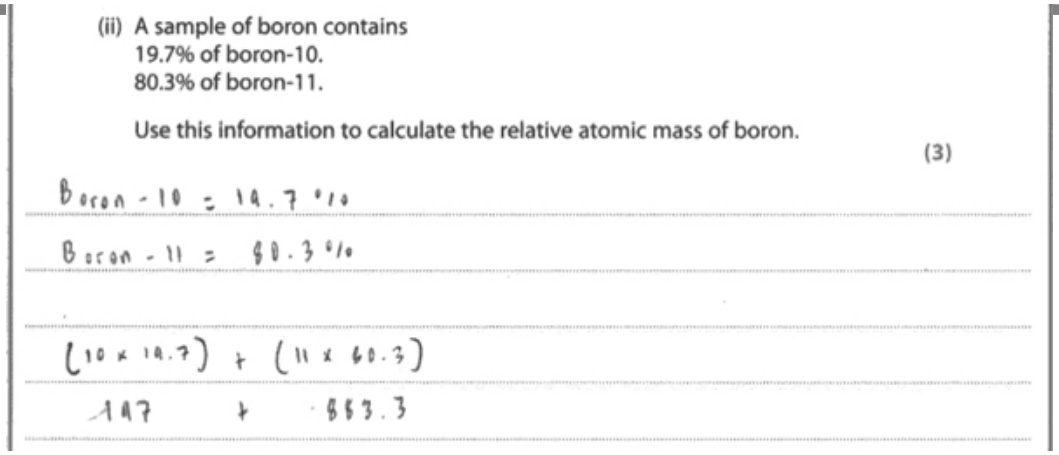
$\frac{(19.7 \times 10) + (80.3 \times 11)}{(19.7 + 80.3)}$ $\frac{197 + 883.3}{100}$

$= 10.803$

Relative atomic mass = 10.8

Results Plus: Examiner Comments

A well-presented answer for full marks.


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19.7% of boron-10.
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Use this information to calculate the relative atomic mass of boron. (3)

Boron-10 = 19.7 %

Boron-11 = 80.3 %

(10 × 19.7) + (11 × 80.3)

197 + 883.3

Results Plus: Examiner Comments

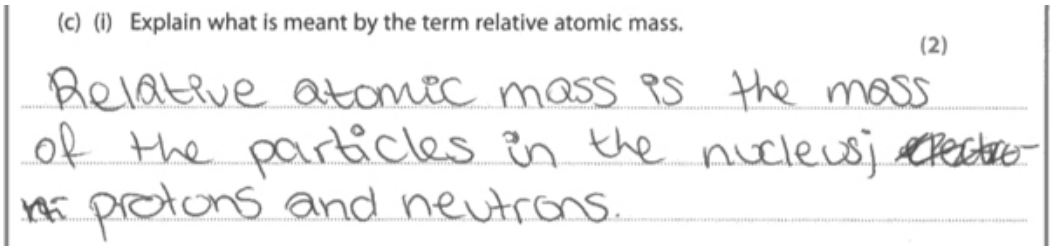
This candidate gained the first two marks but did not divide by 100 so did not gain the third mark.

Q19.

(i)

This proved to be a very difficult question for all except the very strongest candidates. Even of those, very few candidates scored both marks. Most answers seen referred to "the number of

protons and neutrons added together" without any mention of relative atomic mass being an average. Very few referred to carbon-12. A quite frequently seen incorrect answer was a reference to "the top number on the symbol in the periodic table".


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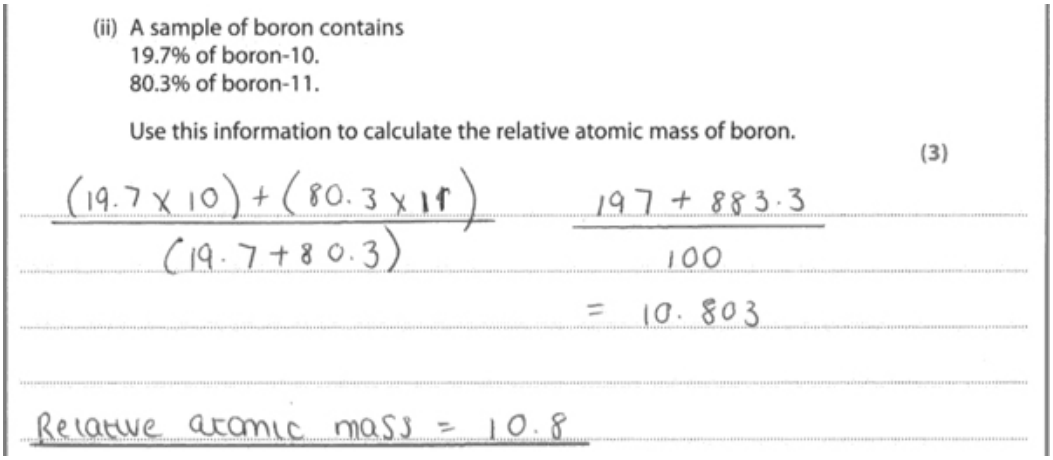
Relative atomic mass is the mass of the particles in the nucleus; ~~electro~~ protons and neutrons.

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$\frac{(19.7 \times 10) + (80.3 \times 11)}{(19.7 + 80.3)}$ $\frac{197 + 883.3}{100}$

$= 10.803$

Relative atomic mass = 10.8

Results Plus: Examiner Comments

A well-presented answer for full marks.

(ii) A sample of boron contains
19.7% of boron-10.
80.3% of boron-11.

Use this information to calculate the relative atomic mass of boron.

(3)

Boron - 10 = 19.7 %

Boron - 11 = 80.3 %

(10 × 19.7) + (11 × 80.3)

197 + 883.3

Results Plus: Examiner Comments

This candidate gained the first two marks but did not divide by 100 so did not gain the third mark.

Q20.

A good proportion of candidates were able to correctly calculate the relative formula mass of butene as 56 to gain both marks.

In some cases, only a final, incorrect answer was given which scores 0. Candidates are strongly advised to show working, even in a simple calculation, as they may then receive part marks if they make an error.

Calculate the relative formula mass of butene, C_4H_8.

(relative atomic masses: H = 1, C = 12)

(2)

48

(12 × 4) + (1 × 8) = 48 + 8 = 56

relative formula mass 56

Results Plus: Examiner Comments

A good answer that scored both marks.

Calculate the relative formula mass of butene, C_4H_8.

(relative atomic masses: H = 1, C = 12)

(2)

1 x 4 + 12 x 8 = 4 + 96

relative formula mass 100

Results Plus: Examiner Comments

Sometimes the atomic masses were transposed 8 x 12 + 4 x 1 = 100. With this one error carried forward a mark of 1 was awarded.

Calculate the relative formula mass of butene, C_4H_8.

(relative atomic masses: H = 1, C = 12)

(2)

H = 8 C = 48 C 48 H 8

relative formula mass $C_{48}H_8$

Results Plus: Examiner Comments

A number of candidates seemed to be unsure of what was expected as they gave the correct calculation i.e. (4 x 12) and (8 x 1) but then did not do the addition, or wrote answer of $C_{48}H_8$

Q21.

(b)

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

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

Explain why barium chloride has a high melting point.

(2)

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

Results Plus: Examiner Comments

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

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

Explain why barium chloride has a high melting point.

(2)

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

Results Plus: Examiner Comments

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

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

Explain why barium chloride has a high melting point.

(2)

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

Results Plus: Examiner Comments

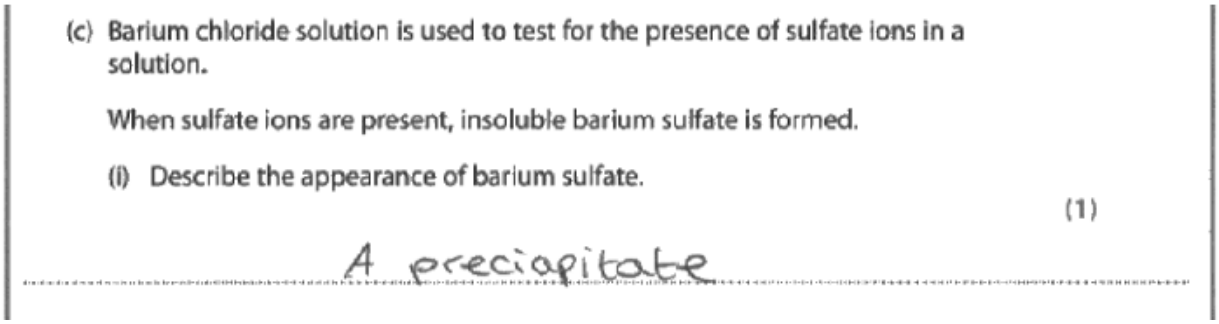
This is an example of a very good answer giving a full explanation of the high melting point of an

ionic compound.

(c)(i)

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

Some candidates, unfortunately, simply answered "white" and so did not gain the mark because they did not add precipitate or solid. It appeared that others simply guessed or got confused with other tests and so there were wide ranging suggestions including yellow precipitate, orange solid, brown liquid/precipitate.



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

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

(i) Describe the appearance of barium sulfate.

(1)

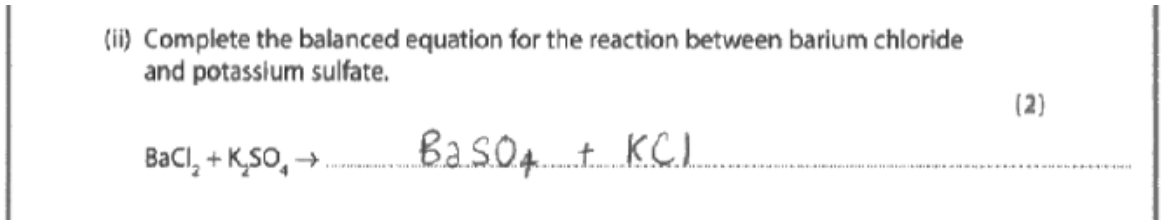
A precipitate

Results Plus: Examiner Comments

No mention of white so no mark awarded.

(c)(ii)

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



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

(2)

$BaCl_2 + K_2SO_4 \rightarrow$ $BaSO_4 + KCl$

Results Plus: Examiner Comments

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

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

(2)

$BaCl_2 + K_2SO_4 \rightarrow$ $BaSO_4 + K_2Cl_2$

Results Plus: Examiner Comments

Answers like this were the most common of all.

(d)(ii)

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

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

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

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

(ii) Lead carbonate is an insoluble salt.

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

(3)

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

(Total for Question = 10 marks)

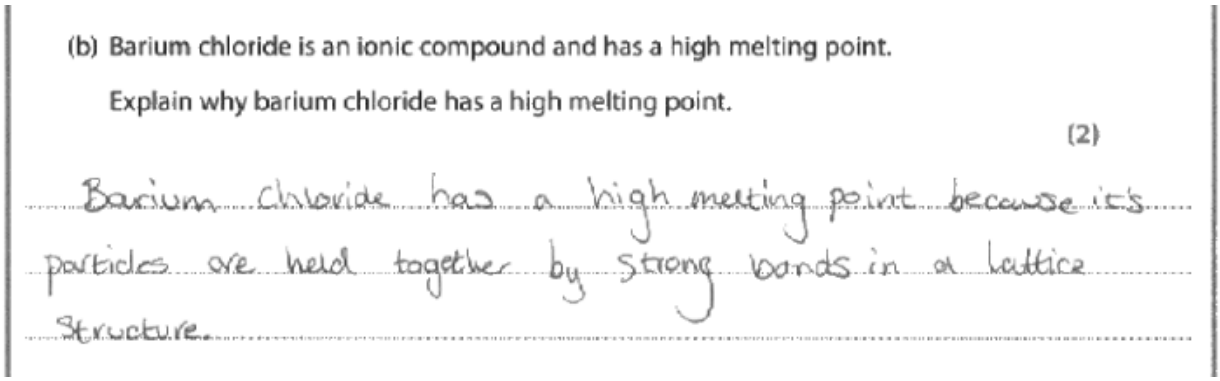
Results Plus: Examiner Comments

A response worth all three marks.

Q22.

(b)

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



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

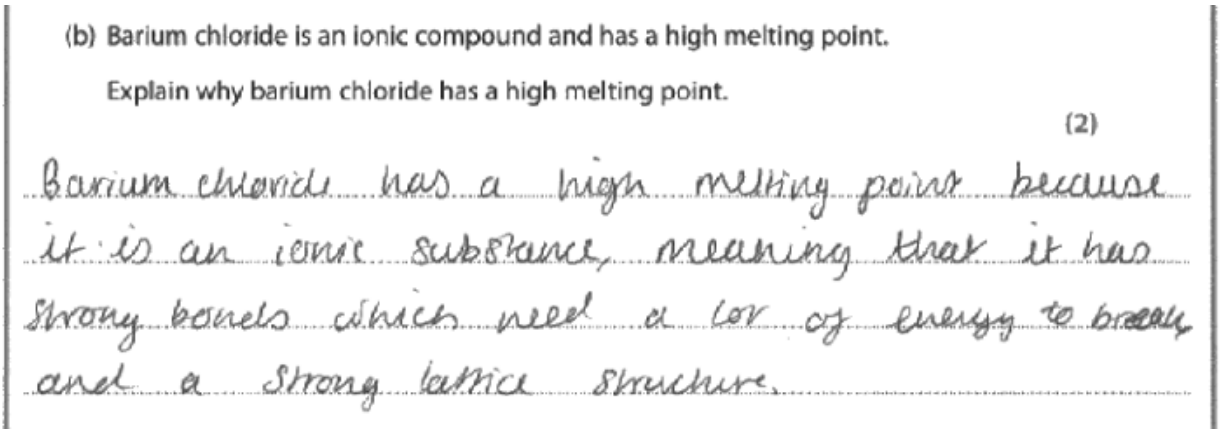
Explain why barium chloride has a high melting point.

(2)

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

Results Plus: Examiner Comments

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



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

Explain why barium chloride has a high melting point.

(2)

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

Results Plus: Examiner Comments

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

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

Explain why barium chloride has a high melting point.

(2)

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

Results Plus: Examiner Comments

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

(c)(i)

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

Some candidates, unfortunately, simply answered "white" and so did not gain the mark because they did not add precipitate or solid. It appeared that others simply guessed or got confused with other tests and so there were wide ranging suggestions including yellow precipitate, orange solid, brown liquid/precipitate.

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

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

(i) Describe the appearance of barium sulfate.

(1)

A precipitate

Results Plus: Examiner Comments

No mention of white so no mark awarded.

(c)(ii)

It is very disappointing to report that only about a quarter of candidates gained any credit here, especially given that they already had the left hand side of the equation.
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(3)

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

(Total for Question = 10 marks)

Results Plus: Examiner Comments

A response worth all three marks.

Q23.

(a)

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

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

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

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

mass of watch glass + magnesium sulfate = 18.50 g

mass of watch glass = 18.20 g

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

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

(1000 cm^3 = 1 dm^3)

(2)

18.50 - 18.20 = 0.3g (500cm^3 = 0.5dm^3)

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

concentration = 0.15gdm g dm^{-3}

Results Plus: Examiner Comments

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

(b)(i)

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

(b)(ii)

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

(c)

There was a lot of confusion in this question, either because the candidates did not grasp at all the idea of salt preparation, or because they apparently did not read the information provided. Hence, although candidates were told a soluble salt is formed, they proceeded to describe precipitate collection, filtering the mixture to collect the residue which was washed and dried. Others mixed up the correct answer with a titration method. The most common answer was to react the substances and then evaporate water with no filtration stage. Having said this, there were some excellent answers scoring 6 marks.

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

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

(6)

The copper oxide and the dilute sulfuric acid will be mixed until a product, begins to form at the bottom of the flask, Once this occures then the solution will be filtered so there is only the solution containing the salt ad water. This solution should the be boilded leaving behind a pure sample of the salt. The water level should be continusly checked to make sure it is all evaported before re weighing the salt crystals left behind.

Results Plus: Examiner Comments

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

Results Plus: Examiner Tip

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

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

(6)

- add the dilute sulfuric acid with the copper oxide.
- wait till the solution is ~~a~~equal and filter any undissolved copper oxide.
- ~~B~~evaporate all the solution on a bunsen ~~b~~erner in a ~~b~~eaker until the solution has crystalised.
- Then you have pure, dry crystals of copper oxide.

Results Plus: Examiner Comments

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

Results Plus: Examiner Tip

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

Q24.

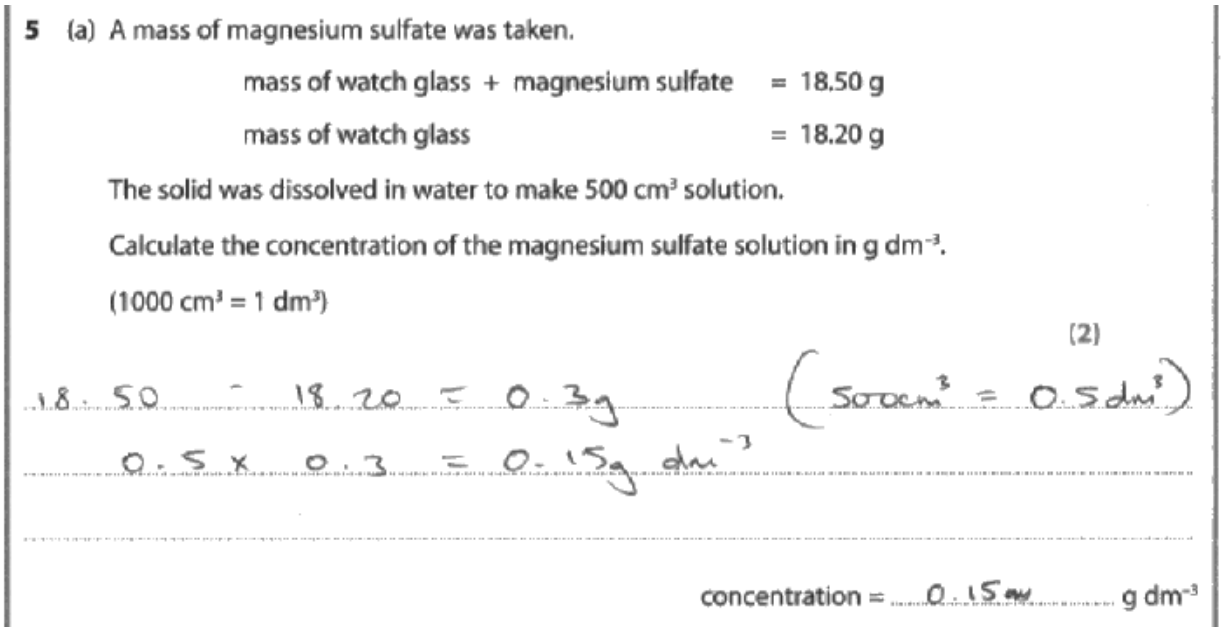
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Results Plus: Examiner Comments

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

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- Then you have pure, dry crystals of copper oxide.

Results Plus: Examiner Comments

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

Results Plus: Examiner Tip

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

Q25.

(b)

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

(c)

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



Results Plus: Examiner Comments

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

Results Plus: Examiner Tip

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



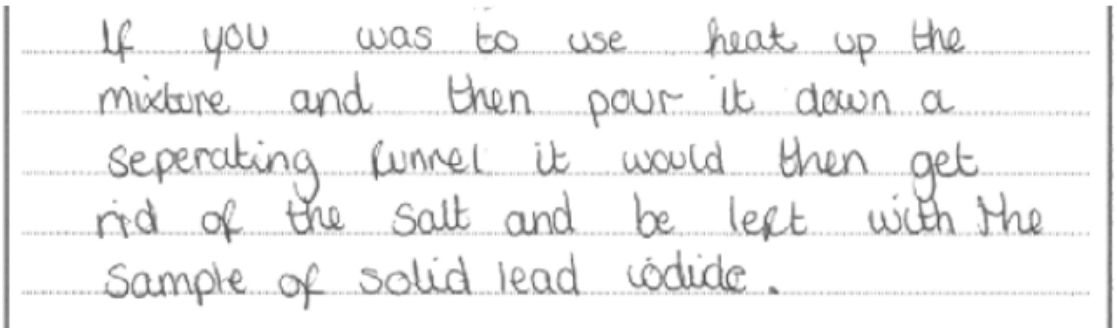
Results Plus: Examiner Comments

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

(d)

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

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


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

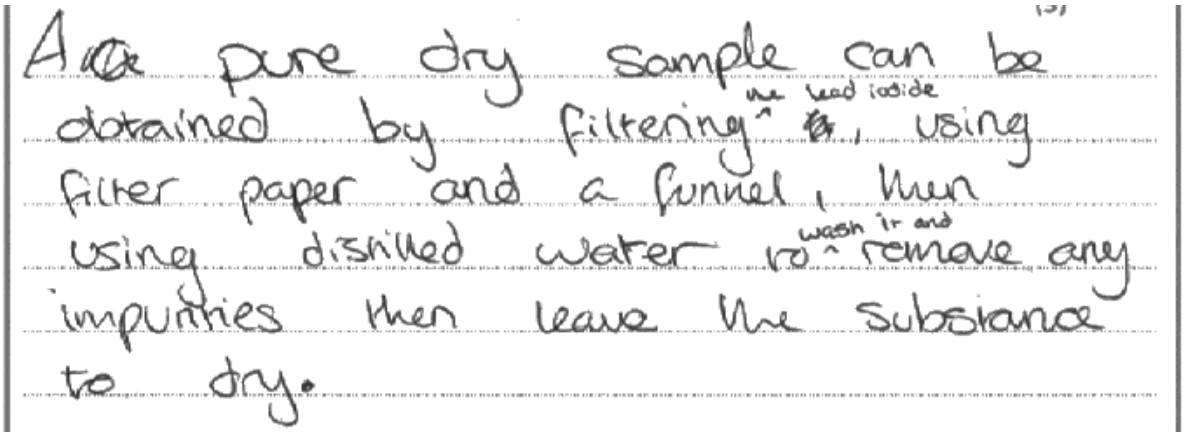
Results Plus: Examiner Comments

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

Results Plus: Examiner Tip

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

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


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

Results Plus: Examiner Comments

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

(e)(i)

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

Candidates should learn the flame test colours in the specification.

(e)(ii)

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



Results Plus: Examiner Comments

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



Results Plus: Examiner Comments

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

Results Plus: Examiner Tip

Learn the tests for the ions in the specification.

Q26.

(b)

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

(c)

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



Results Plus: Examiner Comments

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

Results Plus: Examiner Tip

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



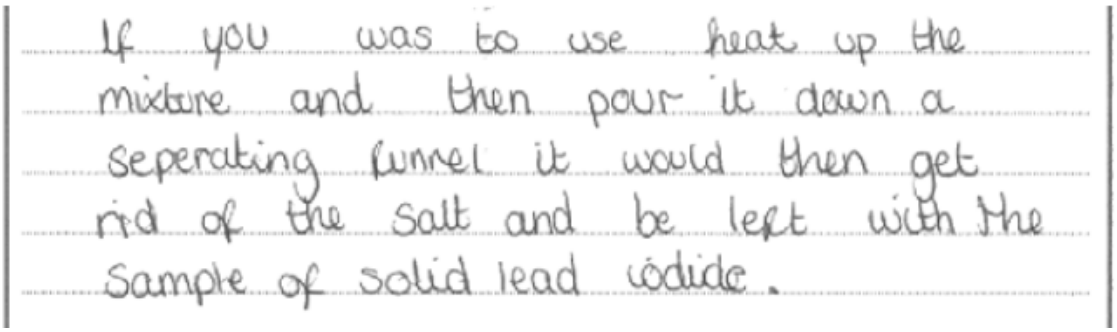
Results Plus: Examiner Comments

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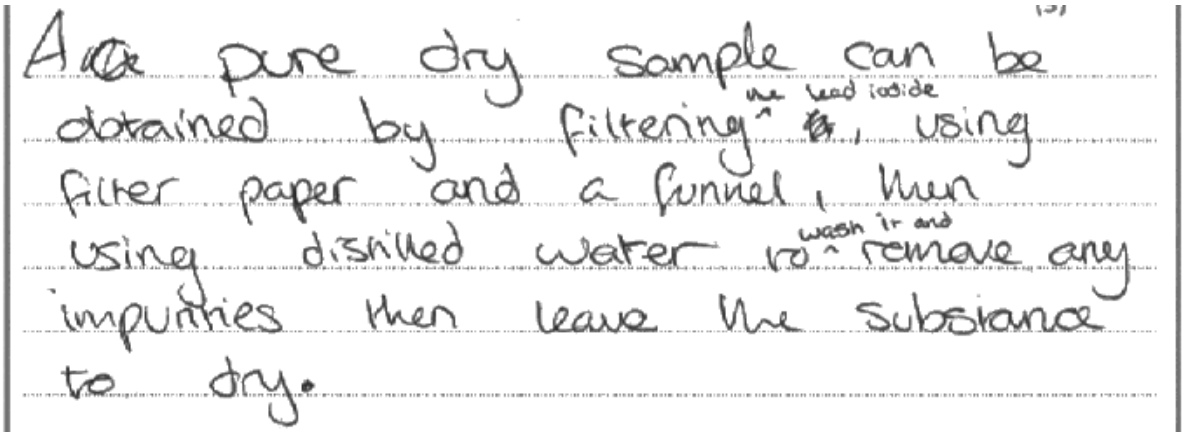
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Results Plus: Examiner Tip

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Candidates should learn the flame test colours in the specification.

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



Results Plus: Examiner Comments

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



Results Plus: Examiner Comments

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

Results Plus: Examiner Tip

Learn the tests for the ions in the specification.

Q27.

(ii)

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

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

Explain why the melting point of sodium chloride is high.

(2)

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

Results Plus: Examiner Comments

A typical way in which both marks were gained.

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

Explain why the melting point of sodium chloride is high.

(2)

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

Results Plus: Examiner Comments

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

(iii)

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

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

(3)

flame test would show chloride ions as lilac.

Results Plus: Examiner Comments

This sort of answer was surprisingly seen quite often.

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

(3)

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

Results Plus: Examiner Comments

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

Q28.

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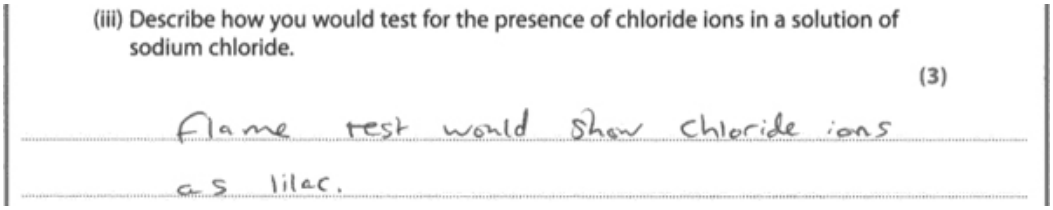
Sodium chloride has a high melting point due to its strong Lattice structure where there are strong electrostatic forces of attraction

Results Plus: Examiner Comments

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

(iii)

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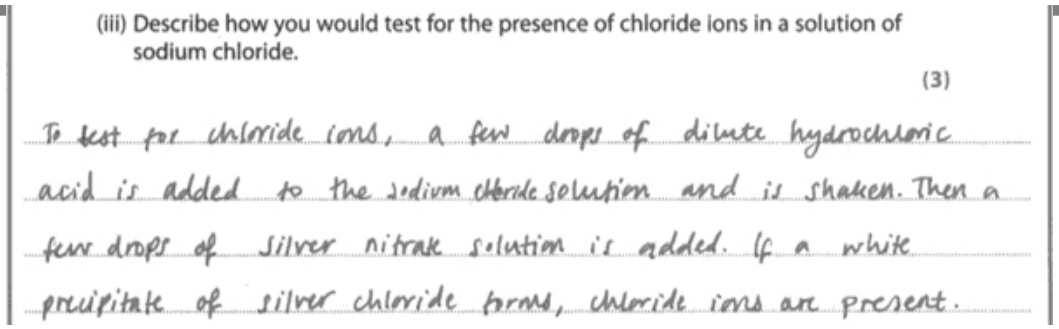
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Results Plus: Examiner Comments

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

Q29.

(i) Overall, this question was well answered, although the majority of answers stated 'same

number of protons and electrons' rather than just protons. Where candidates were wrong it was because they stated that isotopes have the same number of protons and neutrons.

(ii) Most candidates who attempted this question scored both marks, although there were a number of blank responses for this question. Sometimes a mark was lost because the candidate rounded the correct answer to 28. A few responses looked as though they may be attempting to carry out empirical formula calculations and scored zero.

Q30. No Examiner's Report available for this question

Q31. No Examiner's Report available for this question

Q32. No Examiner's Report available for this question

Q33.

This question was well answered on the whole, with about two thirds of the responses scoring the 1 mark available.

Most candidates gave the correct electronic configuration as 2.8.8. A small minority of these drew a correct electron shell diagram, instead of writing out the electron configuration in figures, so were credited with the mark.

Q34.

This question was very well done.

Q35.

(i)

Candidates found this question quite difficult with only the best being able to state the mass number of the carbon atom. Many candidates added all three values to give an answer of 19.

A carbon atom contains 6 electrons, 7 neutrons and 6 protons.

(i) State the mass number of this carbon atom.

(1)

19

Results Plus: Examiner Comments

This example shows a very common incorrect answer.

A carbon atom contains 6 electrons, 7 neutrons and 6 protons.

(i) State the mass number of this carbon atom.

(1)

13

Results Plus: Examiner Comments

This example shows the correct answer that was awarded 1 mark.

(ii)

As with part (i), candidates found giving the electronic configuration of the carbon atom quite difficult. Many gave the number of electrons rather than the electronic configuration.

(ii) Give the electronic configuration of this carbon atom.

(1)

6

Results Plus: Examiner Comments

Many candidates gave the number of electrons in the carbon atom rather than the electronic configuration of the atom.

(ii) Give the electronic configuration of this carbon atom.

(1)

2,4

Results Plus: Examiner Comments

This example of the correct answer was awarded 1 mark.

Q36.

(i)

Most of the candidates were able to calculate the mass number of this carbon from the information provided. However, there were many candidates giving answers of 6 and 12, presumably from the number of protons and the number of protons and electrons respectively. Other incorrect answers seen were 19 (adding together all three numbers) and 42 (from 6 × 7 for some reason).

(ii)

Many candidates answered this question correctly showing they could write the electronic configuration for a given element. Most used numbers to show the number of electrons in the different shells, such as '2, 4,' but a few used a diagram. One examiner reported seeing the notation involving electron shells identified by letter (K, L etc.). This is not required at this level, but errors using this notation will be penalised.

(ii) Give the electronic configuration of this carbon atom.

(1)

2, 8, 8, 1

Results Plus: Examiner Comments

The candidate totalled the number of subatomic particles in the carbon as 19, and then attempted to write the electronic configuration based on that number. No mark was given here.

Results Plus: Examiner Tip

Practice writing the electronic configurations for the first 20 elements.
Make use of the periodic table, which will always be available in the examinations, to help with writing electronic configurations.

(ii) Give the electronic configuration of this carbon atom.

(1)



Results Plus: Examiner Comments

An electronic configuration diagram was equally acceptable in the question, but candidates should know how present electronic configurations in both written and diagrammatic formats.

Q37. No Examiner's Report available for this question

Q38. No Examiner's Report available for this question

Q39. No Examiner's Report available for this question

Q40. No Examiner's Report available for this question

Q41. No Examiner's Report available for this question

Q42. No Examiner's Report available for this question

Q43.

(ii)

Many could give the formula for the molecule of ammonia, where learners did not score, it was often because they had not used the correct scientific conventions.

(ii) Give the formula for the molecule of ammonia.

(1)

Nh$_3$

Results Plus: Examiner Comments

In some cases, candidates lost marks as they did not write the formula using the correct conventions and used lower case rather than upper case letters in their formula or used a superscript number rather than subscript.

Results Plus: Examiner Comments

Candidates should be taught to write formula using the correct scientific conventions.

(ii) Give the formula for the molecule of ammonia.

(1)

N^3H

Results Plus: Examiner Comments

Candidates should be taught that numbers in formula should be subscript not superscript. This response did not score the mark.

(ii) Give the formula for the molecule of ammonia.

(1)

NH_3

Results Plus: Examiner Comments

Thsi response gained the mark.

(ii) Give the formula for the molecule of ammonia.

(1)

NH_3^+

Results Plus: Examiner Comments

In some cases, candidates added a charge to the ammonia, this did not score.

Q44.

Most candidates scored a mark for stating that it took a lot of energy to separate the ions/atoms in the metal structure. Fewer than half gave a correct comment about the structure of metals with several candidates losing marks for the use of 'covalent' or 'intermolecular forces'. Some also described the structure and bonding arrangement as for an ionic solid.

Metals have high melting points.

Explain, in terms of their structure and bonding, why metals have high melting points.

(2)

They are bonded with ~~not~~ metallic bonding which are held together by strong electrostatic bonds and have a lattice structure which needs a lot of energy to brake these strong bonds.

Results Plus: Examiner Comments

A good answer where idea of strong electrostatic bonds in a lattice structure scored the 2nd marking point and the idea of lots of energy needed to break the strong bonds for the 3rd marking point.

2 marks overall

Results Plus: Examiner Tip

Ensure that the type of bond is matches the question. Here metallic bonding is correct but covalent or ionic bonding would be incorrect and would lose the mark.

Metals have high melting points.

Explain, in terms of their structure and bonding, why metals have high melting points.

(2)

Metals have high melting points due to their strong intermolecular forces of attraction. This is caused by the metal's delocalised electrons.

Results Plus: Examiner Comments

Intermolecular forces is incorrect and was rejected. The second sentence did not go far enough to score a mark. This answer scored 0 marks.

Results Plus: Examiner Tip

Intermolecular forces are between molecules. There are no molecules in metals or giant ionic solids, so it is not correct to use that term when describing the structure of metals or giant ionic solids.

Q45.

This question proved quite difficult, the better answers clearly described the structure of the two atoms.Where candidates lost marks, it was often because they gave a generalized description of what an isotope was, rather than using the data given in the stem to calculate the number of subatomic particles.

Figure 4 shows the atomic number and mass number of two isotopes of argon.

isotope	atomic number	mass number
argon-38	18	38
argon-40	18	40

Figure 4

Describe the structure of an atom of argon-38 and of an atom of argon-40.

(3)

argon-38 has 18 protons, 18 electrons and 20 neutrons. whereas argon-40 has 18 protons, 18 electrons but this time has an additional two neutrons meaning it has 22 neutrons. So argon-40 has more neutrons than argon-38

Results Plus: Examiner Comments

A correct answer that scored all three marks available.

Figure 4 shows the atomic number and mass number of two isotopes of argon.

isotope	atomic number	mass number
argon-38	18	38
argon-40	18	40

Figure 4

Describe the structure of an atom of argon-38 and of an atom of argon-40.

(3)

Argon-38 has an electronic configuration of 2·8·8 and argon-40 has an electronic configuration of 2·8·8 aswell. The mass number shows how many protons the atom has and in this case argon-40 has 2 more protons than argon-38.

Results Plus: Examiner Comments

Some candidates gave the electronic configuration of the atom rather than the number of electrons, this was accepted.

Q46.

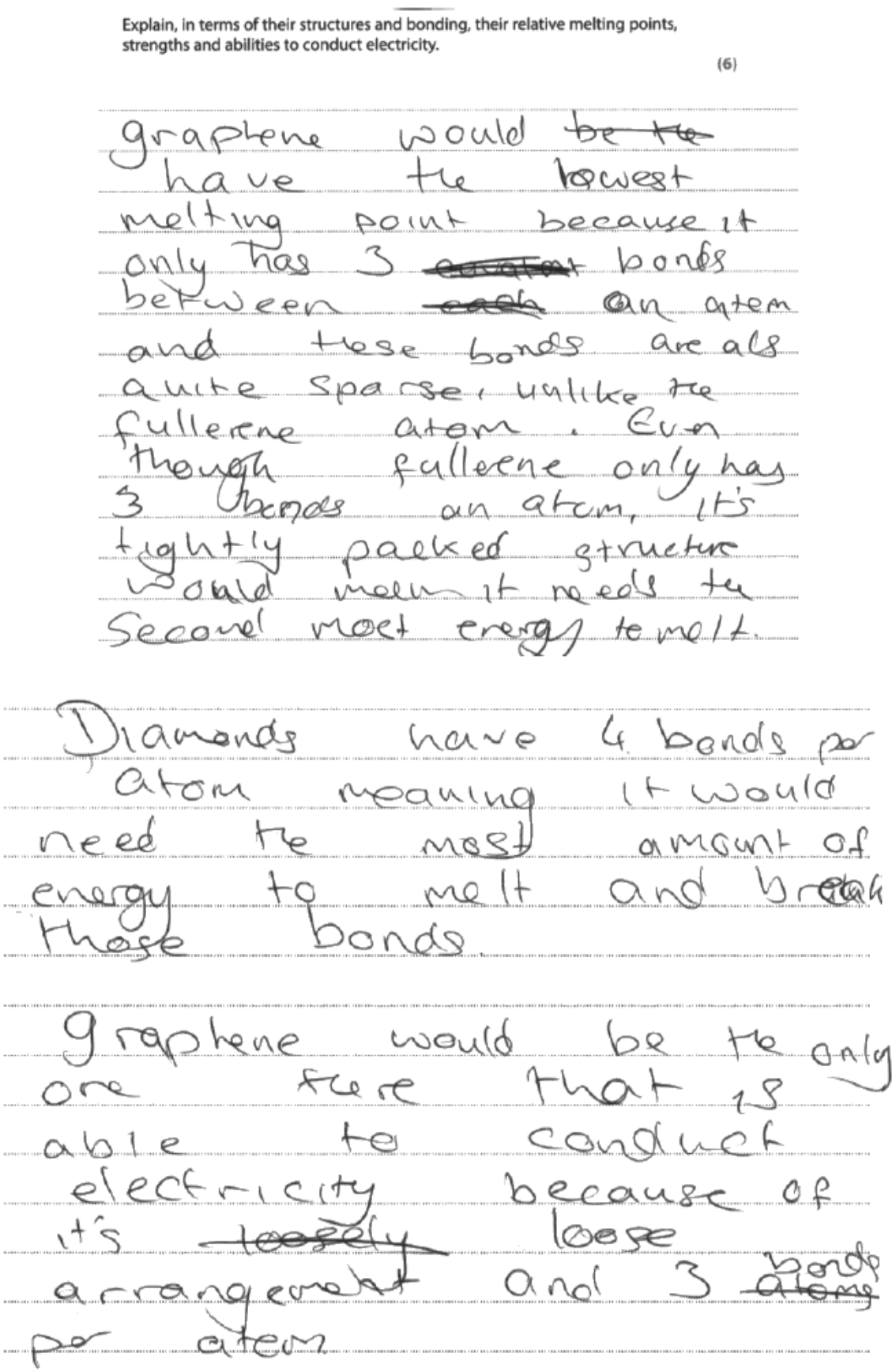
This open response question proved to be very accessible even for the weakest candidates with only small number scoring 0 as for many this would feel like familiar territory. Level 2 was achieved by the highest number of candidates and over a third of the candidates achieved level 3.

In general, the melting points of the allotropes were explained quite well, but sometimes the conductivity was stated rather than explained.Most managed to justify the melting point of diamond as being extremely high due to the large number of bonds that needed to be broken, but some had flawed arguments when writing weak intermolecular forces. Graphene was frequently read as graphite judging by the number of candidates that wrote about layers sliding etc, suggesting that they had not read the question properly.

The more able candidates could explain conductivity in terms of delocalised electrons in graphene and no delocalised electrons in diamond based on the electrons in carbon involved in

bonding. However, for the fullerene, arguments were a little more shaky here as many were not certain about the ability of fullerene to conduct electricity.

It was noticed that the weaker candidates tended to wasted time and space referring to either uses of each allotrope, which were not wanted.



Explain, in terms of their structures and bonding, their relative melting points, strengths and abilities to conduct electricity.

(6)

graphene would ~~be the~~ have the lowest melting point because it only has 3 ~~covalent~~ bonds between ~~each~~ an atom and these bonds are als quite sparse, unlike the fullerene atom. Even though fullerene only has 3 bonds an atom, it's tightly packed structure would mean it needs the second most energy to melt.

Diamonds have 4 bonds per atom meaning it would need the most amount of energy to melt and break those bonds

graphene would be the only one here that is able to conduct electricity because of it's ~~loosely~~ loose arrangement and 3 ~~atoms~~ bonds per atom

Results Plus: Examiner Comments

There were some valid points but these were not really linked to make a coherent argument. However, the answer linked diamond needing the most amount of energy to melt it and break those bonds with it containing 4 bonds per atom, so giving this some lines of reasoning. Also it noted that graphene conducts electricity without a real explanation. This was in between a 'good answer' (Level 3) and a weak answer (Level 1) with just enough to put this into Level 2, but as it was a weak Level 2, so given 3 marks.

Explain, in terms of their structures and bonding, their relative melting points, strengths and abilities to conduct electricity.

(6)

Diamond has a very complex structure, diamond also is very strong, has a very high melting point, also has the ability to conduct electricity

Graphene has a simple covalent bond structure, graphene has a low Melting point, Graphene is not very strong, graphene is able to conduct electricity

fullerene, C_{60} has a complex ball structure, fullerene would be very strong because of its structure. Also would have a high melting point, fullerene would not conduct electricity.

Results Plus: Examiner Comments

This answer contained a series of random facts, some of which were correct. The incorrect statements need to be ignored when looking at 6-mark questions as here they were not contradictory. These statements were not related with no lines of reasoning. Overall a weak answer and was Level 1 - 2 marks.

Q47. No Examiner's Report available for this question

Q48.

The responses to this question seemed to achieve either full marks or nothing in general. Candidates who understood what the question was asking explained very clearly about heating to a constant mass to ensure that the reaction was complete. Others suggested looking for things that they would not be able to see – for example, carbon dioxide being released or looking to see if all of the zinc carbonate had gone.

There was also some misunderstanding in the reading of the question for a number of candidates, in that they interpreted the term 'complete' to mean that the reaction had happened at all rather than that the reaction had finished.

Q49.

(i)

Candidates could recall the test for hydrogen more easily than the earlier test for carbon dioxide. However, some did still leave out the method of the test.

Candidates should be taught that in every test, two components are required: what you do and what you observe for a positive result. Some did not say that they splint had to be lit or that it was glowing and so gained no credit.

In some cases, candidates simply stated the 'squeaky pop test' this was not sufficient for marks and did not gain credit.

Salts of metals can be prepared by reacting the metal with an acid to produce the salt and hydrogen.

(i) Describe the test to show that the gas is hydrogen.

(2)

Squeaky pop with a lit splint.

Results Plus: Examiner Comments

A correct response which gained both marks.

Salts of metals can be prepared by reacting the metal with an acid to produce the salt and hydrogen.

(i) Describe the test to show that the gas is hydrogen.

(2)

When there is hyarogen, when let off in air there will be a loud squeaky pop due to it reacting with the elements in the air.

Results Plus: Examiner Comments

A fair few stated that a pop would spontaneously be heard, e.g. after taking the bung out the test tube.

Salts of metals can be prepared by reacting the metal with an acid to produce the salt and hydrogen.

(i) Describe the test to show that the gas is hydrogen.

(2)

place a metal & acid in a closed flask using a tube at the top to ~~,~~ hold produced hydrogen. Simmular to simple distilation

Results Plus: Examiner Comments

In some cases, candidates described how to produce the hydrogen, by reacting an acid and a metal, rather than stating the test for the hydrogen.

(ii)

Candidates found this part quite difficult with few scoring the full two marks available.

A common misconception seen was where candidates knew that two electrons were involved in the transfer but thought that the electrons were gained rather than lost. In these cases, one mark was awarded for showing an understanding that two electrons were involved.

In other cases, candidates knew that the ion has lost electrons but did not mention how many and so did not gain the second mark.

(ii) Nickel is a metal.

Explain how the structure of a nickel atom, Ni, changes when it forms a nickel ion, Ni^{2+}.

(2)

The nickel atom loses two electrons when it creates a nickel ion ~~or~~ therefore it becomes positive.

Results Plus: Examiner Comments

A good answer that scored 2 marks.

(ii) Nickel is a metal.

Explain how the structure of a nickel atom, Ni, changes when it forms a nickel ion, Ni^{2+}.

(2)

gains 2 electrons so it has full outer shells. ~~So therefore~~

Results Plus: Examiner Comments

In this example. one mark was awarded for showing an understanding that two electrons were involved.

(ii) Nickel is a metal.

Explain how the structure of a nickel atom, Ni, changes when it forms a nickel ion, Ni^{2+}.

(2)

The structure of a nickel atom changes when it forms a nickel ion is, the nickel ion has ~~lots~~ lost an electron so it has become positive.

Results Plus: Examiner Comments

This candidate knew that the ion has lost electrons but did not mention how many and so gained just 1 mark.

Q50.

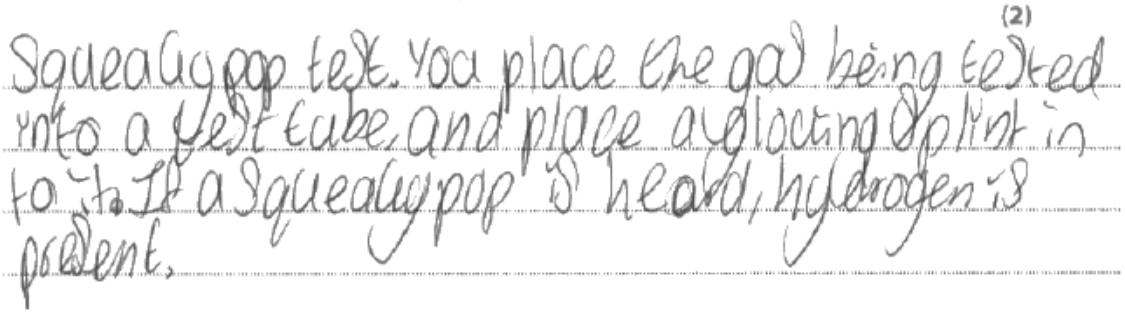
(i)

Although the overwhelming majority of candidates scored marks for a correctly described test for hydrogen, a small number wrote about using a lighted splint and hydrogen extinguishing the flame. A significant minority of candidates lost both marks for using a 'glowing' splint or describing the test for carbon dioxide. Many candidates described how to produce the hydrogen but that wasted candidates' time and answer space.

Salts of metals can be prepared by reacting the metal with an acid to produce the salt and hydrogen.

(i) Describe the test to show the gas is hydrogen.

(2)



Results Plus: Examiner Comments

Use of a glowing splint in the test was seen on many occassions. This is not the test for hydrogen and so did not score. The second marking point was dependent on the first being correct, so here 'a squeaky pop is heard' did not score. The response scored 0 marks.

Results Plus: Examiner Tip

Wrting 'Squeaky pop test' does not gain any credit. When describing the test for a gas marks are given for:

(a) how to carry out the test

(b) the positive result of the test

Salts of metals can be prepared by reacting the metal with an acid to produce the salt and hydrogen.

(i) Describe the test to show the gas is hydrogen.

(2)

the test for hydrogen is the squeaky pop test where a splint which has been in contact with hydrogen is put into a test tube if hydrogen gas is present a pop noise will occur.

Results Plus: Examiner Comments

Unfortunately there was no mention of the splint being lit so the first mark could not be awarded. Second mark was dependent on the first so no second mark either.

Results Plus: Examiner Tip

Learn the tests for all the following gases : hydrogen, oxygen, chlorine, carbon dioxide and ammonia

(ii)

This was another well-answered question with the greater majority of candidates scoring both marks, with only a few candidates failing to mention that there were two electrons lost. Just a few mentioned electrons gained or in some cases electrons being shared.

(ii) Nickel is a metal.

Explain how the structure of a nickel atom, Ni, changes when it forms a nickel ion, Ni^{2+}.

(2)

It gains 2 positive electrons on the outer shell making it 2,8,8,14

Results Plus: Examiner Comments

'Gains' and 'positive' electrons caused the loss of both marks in this answer.

Results Plus: Examiner Tip

Formation of positive ions involves loss of electrons and electrons have a negative charge.

(ii) Nickel is a metal.

Explain how the structure of a nickel atom, Ni, changes when it forms a nickel ion, Ni^{2+}.

(2)

The Nickel atom gains electrons of the outer shell. Therefore it becomes Ni^{2+} due to added electrons.

Results Plus: Examiner Comments

No marks here as electrons are not gained, and no number of electrons is stated.

Q51.

The answers given to this question were quite varied. The more successful candidates started their answer by stating what would happen to the light bulb when each solution was tested and then went on to explain the observations. The examiners reported seeing very answers of this type. Quite a few candidates stated what happened to the light bulb in each case, but did not go on to account for the observations. A similar number gave the explanation correctly that the sodium chloride solution does conduct and the sucrose solution does not conduct but did not include how they knew this (i.e. whether the light bulb was glowing or not).

Common misconceptions included that the sucrose solution conducted, the correct observation about the bulb with the explanation that sodium chloride was covalent and the sucrose was ionic as well as the bulb not lighting because the sodium chloride was ionic. A significant number talked of delocalised electrons here when trying to explain conductivity; very few mentioned the presence of mobile ions. Some responses didn't refer to the specific solutions and gave a generic answer e.g. if it conducts the bulb will light, if it doesn't conduct it won't. Occasionally examiners saw answers of the type 'the sodium chloride lit the bulb brighter than sucrose' - a comparison of brightness so both were conducting. Some cited sodium chloride conducting electricity as it has a metal in it.

Explain what happens when each solution is tested in the circuit shown.

(3)

The sodium chloride will be found to not conduct electricity, This is due to it being an ionic compand. The sucrose will be found to conduct electricity, this is because Covalent compands conduct electricity when molten or dissolved.

Results Plus: Examiner Comments

This candidate had confused the properties of ionic compounds with those of covalent, molecular compounds. Nothing was given in terms of observations and so this answer was given 0 marks.

Explain what happens when each solution is tested in the circuit shown.

(3)

~~when the mixture is~~ when the two solutions are mixed and poured into the beaker if ~~the~~ they conduct electricity the circuit will be complete and the bulb will light up. ~~this~~

Results Plus: Examiner Comments

The question had asked for what happened when each solution was tested; so mixing the solutions does not score. Although the answer indicates that the bulb lights, it is not clear which component would cause the bulb to light up. So this answer could not be awarded any marks.

Explain what happens when each solution is tested in the circuit shown.

(3)

As sodium chloride is tested, the bulb would illuminate yet as sucrose is tested the bulb would not.

Results Plus: Examiner Comments

Here the candidate had just given the observation and had not given an explanation of what happened. Only one mark could be given here.

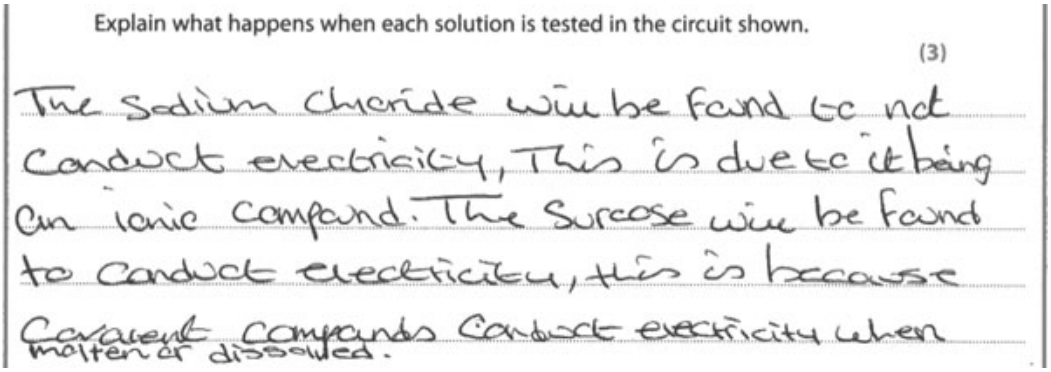
Results Plus: Examiner Tip

Learn the characteristic properties of ionic and molecular, covalent compounds.

Q52.

The answers given to this question were quite varied. The more successful candidates started their answer by stating what would happen to the light bulb when each solution was tested and then went on to explain the observations. The examiners reported seeing very answers of this type. Quite a few candidates stated what happened to the light bulb in each case, but did not go on to account for the observations. A similar number gave the explanation correctly that the sodium chloride solution does conduct and the sucrose solution does not conduct but did not include how they knew this (i.e. whether the light bulb was glowing or not).

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Explain what happens when each solution is tested in the circuit shown.

(3)

The sodium chloride will be found to not conduct electricity, This is due to it being an ionic compound. The Sucrose will be found to conduct electricity, this is because Covalent compounds Conduct electricity when molten or dissolved.

Results Plus: Examiner Comments

This candidate had confused the properties of ionic compounds with those of covalent, molecular compounds. Nothing was given in terms of observations and so this answer was given 0 marks.

Explain what happens when each solution is tested in the circuit shown.

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when the mixture is when the two solutions are mixed and poured into the beaker if they conduct electricity the circuit will be complete and the bulb will light up.

Results Plus: Examiner Comments

The question had asked for what happened when each solution was tested; so mixing the solutions does not score. Although the answer indicates that the bulb lights, it is not clear which component would cause the bulb to light up. So this answer could not be awarded any marks.

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(3)

As sodium chloride is tested, the bulb would illuminate yet as sucrose is tested the bulb would not.

Results Plus: Examiner Comments

Here the candidate had just given the observation and had not given an explanation of what happened. Only one mark could be given here.

Results Plus: Examiner Tip

Learn the characteristic properties of ionic and molecular, covalent compounds.

Q53. No Examiner's Report available for this question

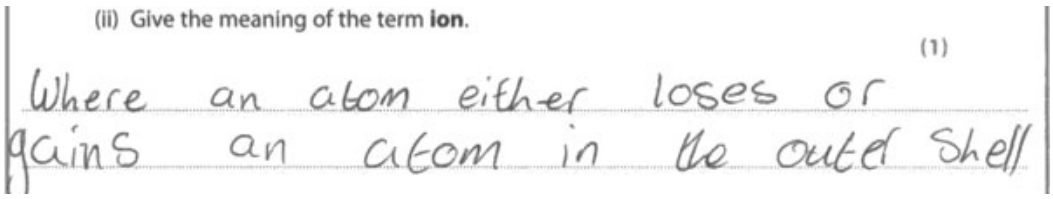
Q54.

(i)

It was clear where candidates had been given practice in working out the formula of ionic compounds from the ions present. About half of the candidates achieved the correct formula; many of those who did not score left it blank presumably because they did not know what to do. Errors seen included multiplying the symbols of the elements by the magnitude of the charge in some way, for example Ba_2SO_4 and $Ba_2S_2O_8$. Also penalised was not giving the 4 as a subscript as in BaSO4.

(ii)

There were some good and valiant attempts at this, but many poor attempts were seen. The majority of candidates missed the point about atoms having lost or gained electrons. There was much confusion with metals and alloy-type descriptions. In addition, many described loss / gain of electrons but lost the mark by putting the answer in terms of 'an element that loses/gains electrons'.

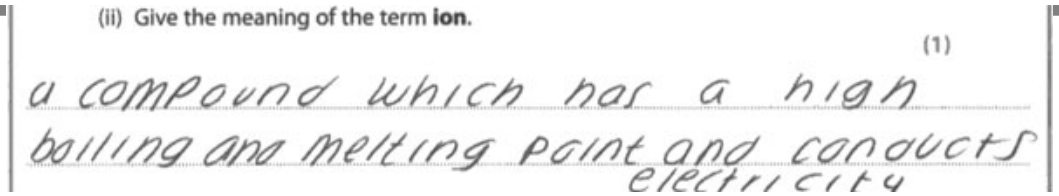

(ii) Give the meaning of the term **ion**.

(1)

Where an atom either loses or gains an atom in the outer shell

Results Plus: Examiner Comments

A careless mistake has cost this candidate the mark. This answer was given 0 marks.

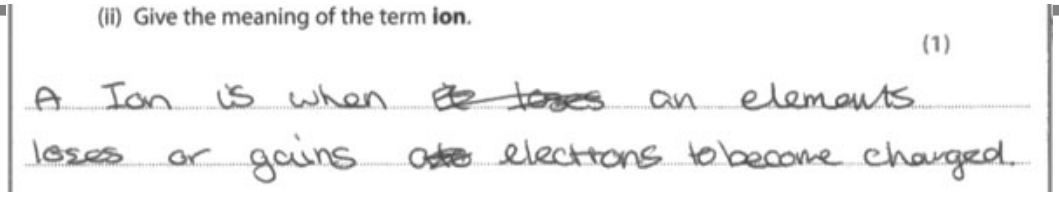

(ii) Give the meaning of the term **ion**.

(1)

a compound which has a high boiling and melting point and conducts electricity

Results Plus: Examiner Comments

It looks like this candidate was trying to describe an ionic compound rather than an ion. 0 marks given.


(ii) Give the meaning of the term **ion**.

(1)

A Ion is when ~~it loses~~ an elements loses or gains ~~ato~~ electrons to become charged.

Results Plus: Examiner Comments

Another careless mistake has cost this candidate the mark. The answer had to be in terms of an atom losing or gaining electrons. 0 marks given.

Results Plus: Examiner Tip

Know how ions are formed and know how to use the formulae of ions to be able to work out the formula of an ionic compound.

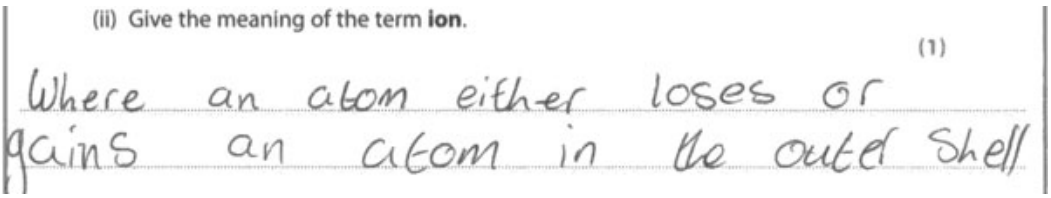
Q55.

(i)

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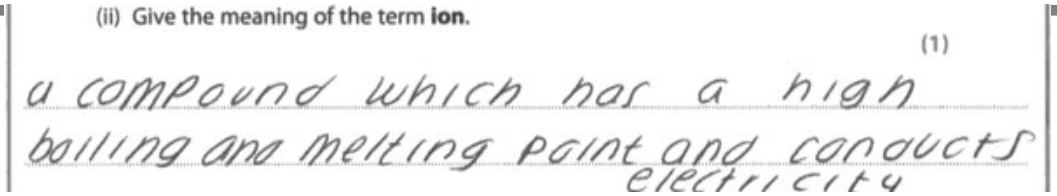

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(1)

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Results Plus: Examiner Comments

A careless mistake has cost this candidate the mark. This answer was given 0 marks.


(ii) Give the meaning of the term **ion**.

(1)

a compound which has a high boiling and melting point and conducts electricity

Results Plus: Examiner Comments

It looks like this candidate was trying to describe an ionic compound rather than an ion. 0 marks given.

(ii) Give the meaning of the term **ion**.

(1)

A Ion is when ~~it loses~~ an elements loses or gains ~~atoms~~ electrons to become charged.

Results Plus: Examiner Comments

Another careless mistake has cost this candidate the mark. The answer had to be in terms of an atom losing or gaining electrons. 0 marks given.

Results Plus: Examiner Tip

Know how ions are formed and know how to use the formulae of ions to be able to work out the formula of an ionic compound.

Q56. No Examiner's Report available for this question

Q57. No Examiner's Report available for this question

Q58. No Examiner's Report available for this question

Q59.

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.

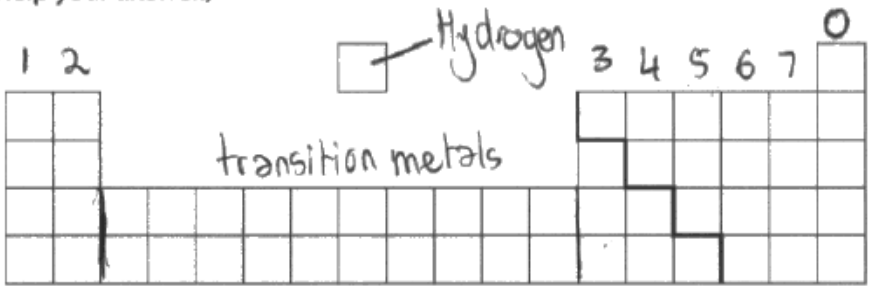
Good information about the atomic structure and chemical properties aspects was much less common than information about parts of the periodic table. The increasing reactivity down group 1 and the inertness of the noble gases were the most frequently mentioned points about chemical properties. A number 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.)



8-3=5

(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 soft 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

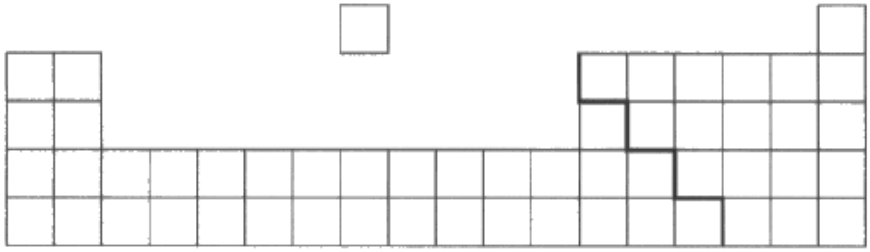
There is a lot of correct information in this answer with reference to different parts of the periodic table, including on the diagram. Also the link between the position of an element in a group and its electronic configuration was very well made as was a link to trends in chemical reactivity. Hence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

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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

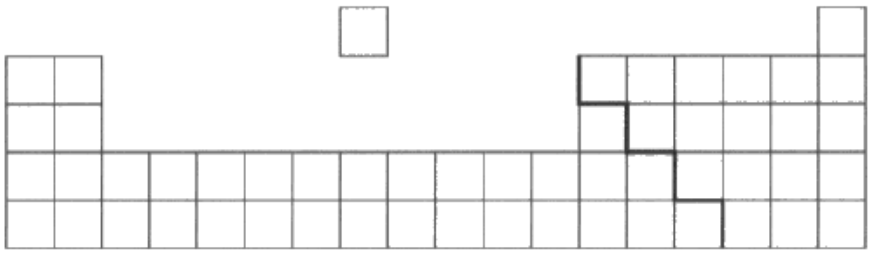
This answer contains references to several parts of the periodic table but in addition only one other relevant aspect i.e. elements ordered by atomic number. It was worthy of Level 2 and awarded 4 marks.

*(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.

Q60.

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.

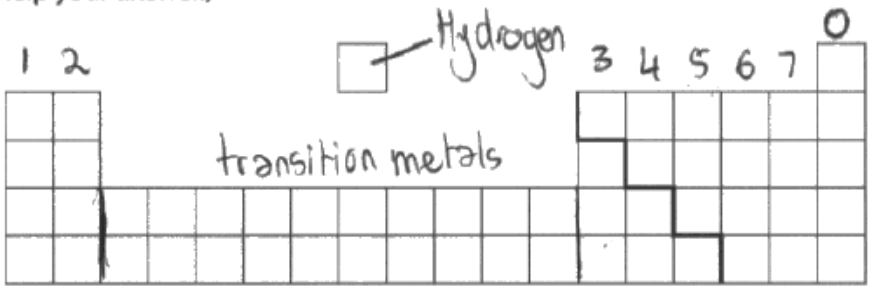
Good information about the atomic structure and chemical properties aspects was much less common than information about parts of the periodic table. The increasing reactivity down group 1 and the inertness of the noble gases were the most frequently mentioned points about chemical properties. A number 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.

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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.)



8-3=5

(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 soft 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

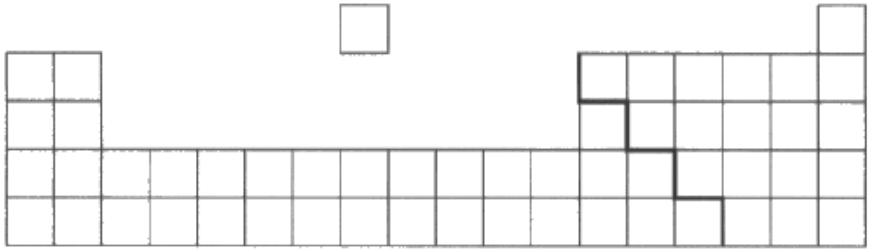
There is a lot of correct information in this answer with reference to different parts of the periodic table, including on the diagram. Also the link between the position of an element in a group and its electronic configuration was very well made as was a link to trends in chemical reactivity. Hence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

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In the periodic table elements are arranged in rows and columns.
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The vertical columns are known as groups, and the horizontal rows are known as periods.
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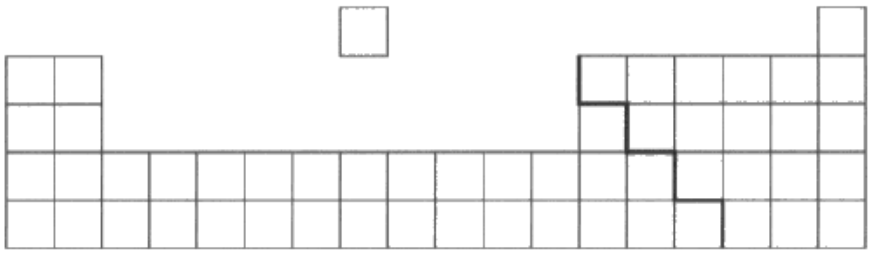
This answer contains references to several parts of the periodic table but in addition only one other relevant aspect i.e. elements ordered by atomic number. It was worthy of Level 2 and awarded 4 marks.

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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.

Mark Scheme

Q1.

	Answer	Acceptable answers	Mark
(i)	C T		**(1)**
(ii)	C Q and S		**(1)**

Q2.

	Answer	Acceptable answers	Mark
(i)	C T		**(1)**

(ii)	C Q and S		**(1)**

Q3.

	Answer	**Acceptable answers**	**Mark**
(i)	A description to include • electron(s) shared (1) • {**pair(s) of / two**} (electrons) (1)	 can be shown in a diagram of a covalent bond any mention of ions scores zero	**(2)**
(ii)	P_2O_5	Reject P2O5 / P^2O^5	**(1)**

Q4.

	Answer	**Acceptable answers**	**Mark**
(i)	A description to include • electron(s) shared (1) • {**pair(s) of / two**} (electrons) (1)	 can be shown in a diagram of a covalent bond any mention of ions scores zero	**(2)**
(ii)	P_2O_5	Reject P2O5 / P^2O^5	**(1)**

Q5.

Question number	Answer	Additional guidance	Mark
(i)	high melting point / high boiling point / conducts (electricity) **when molten** (1)	ignore conducts (electricity) when in solution allow does not conduct (electricity) (when solid) ignore strong / shiny allow brittle / hard	**(1)**
(ii)	+4 / 4+ / Ti^{+4} / Ti^{4+}	reject 4- allow 4 plus	**(1)**

Q6.

Question number	Answer	Additional guidance	Mark
(i)	Ga_2O_3	allow Ga_2O_3 / GA_2O_3 reject Ga^2O^3	**(1)**

Question number	Answer	Mark
(ii)	**B** ionic **A** giant covalent structures do not conduct electricity at all **C** metallic structures conduct when solid **D** simple molecular structures do not conduct electricity when molten and have low melting points	**(1)**

Q7.

Question Number	Answer	Acceptable answers	Mark
	C low poor		**(1)**

Q8.

Question Number	Answer	Acceptable answers	Mark
	C low poor		**(1)**

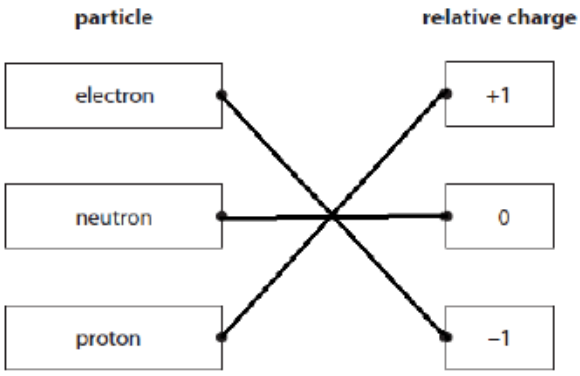
Q9.

Question Number	Answer	Additional guidance	Mark
	any two of the following • high melting points (1) • high boiling points (1) • malleable (1) • conduct electricity (1) • conduct heat (1) • high density (1) • shiny (1) • ductile (1) • strong (1) • sonorous (1)	 allow bendy as alternative to malleable ignore solid ignore hard allow good conductor for 1 mark	**(2)** AO 1 2

Q10.

Question number	Answer	Additional guidance	Mark
	malleable/shiny	allow (relatively) unreactive metal ignore references to cost	**(1)**

Q11.

Question Number	Answer	Additional guidance	Mark
(i)	 3 correct = 2 marks 1 correct = 1 mark	do not allow more than 1 line from any particle	**(2)** AO 1 1

Question Number	Answer	Mark
(ii)	**C** 1 **1. The only correct answer is C** ***A** is not correct because mass is 1* ***B** is not correct because this is relative mass of electron* ***D** is not correct because mass cannot be negative*	**(1)** AO 1 1

Q12.

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

Q13.

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

Q14.

Question Number	Answer	Additional guidance	Mark
	iron $\frac{10.00}{56}$ = 0.179 / 0.18 / 0.2 and copper $\frac{11.34}{63.5}$ = 0.179 / 0.18 / 0.2 (1) (ratio 1:1) so reaction A (1)	allow max 1 mark for Fe : $\frac{56}{10.00}$ = 5.6 Cu : $\frac{63.5}{11.34}$ = 5.6 so reaction A other methods of calculation include 10.00 g Fe forms $\frac{10.00 \times 63.5}{56}$ (1) g copper = 11.34 g copper so reaction A (1) second mark dependent on first	**(2)** AO 3 2a AO 3 2b

Q15.

Question Number	Answer	Mark
(i)	**B** -78 -33 does not conduct **The only correct answer is B** ***A*** *is not correct because simple molecular, covalent substances do not have high mpt and bpt* ***C*** *is not correct because ammonia is a gas at room temperature and does not conduct* ***D*** *is not correct because simple molecular, covalent substances do not have these properties*	**(1)** AO 2 1

Question Number	Answer	Additional guidance	Mark
(ii)	$N_2 + 3H_2 \rightarrow 2NH_3$ (2) left hand side formulae (1) balancing of correct formulae (1)	accept multiples allow = or ⇌ in place of → ignore state symbols even if incorrect do not allow N2, n2, etc	**(2)** AO 2 1

Q16.

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

Q17.

	Answer	Acceptable answers	Mark
	D AgCl(s)		(1)
	same/no change		(1)
	$HCl + AgNO_3 \rightarrow AgCl + HNO_3$	$Ag^+ + Cl^- \rightarrow AgCl$	(2)

	• reactant formulae (1) • product formulae (1)	max 1 if any incorrect attempt to balance reject incorrect use of cases and non-subscripts	

Q18.

	Answer	Acceptable answers	Mark
(i)	An explanation including the following • M1 {average/mean} mass (of atoms of an element) (1) • M2 compared to {1/12 mass carbon-12 (atom)/ (mass of) carbon-12 (atom) taken as 12} (1)	For M1 reject weight reject if mass of molecule reject if mass of neutrons and protons any reference to carbon-12 scores mark	**(2)**
(ii)	[19.7 × 10] (1) +[80.3 × 11] (1) /100 (1) (=10.8) [0.197 ×10] (1) + [0.803 ×11] (1) = [1.97 + 8.83] (1) (=10.8)	If no working shown 10.8(03) worth 3 marks	**(3)**

Q19.

	Answer	Acceptable answers	Mark
(i)	An explanation including the following • M1 {average/mean} mass (of atoms of an element) (1) • M2 compared to {1/12 mass	For M1 reject weight reject if mass of molecule reject if mass of neutrons and protons any reference to carbon-12 scores mark	**(2)**

	carbon-12 (atom)/ (mass of) carbon-12 (atom) taken as 12} (1)		
(ii)	[19.7 × 10] (1) +[80.3 × 11] (1) /100 (1) (=10.8) [0.197 ×10] (1) + [0.803 ×11] (1) = [1.97 + 8.83] (1) (=10.8)	If no working shown 10.8(03) worth 3 marks	**(3)**

Q20.

Question Number	Answer	Additional guidance	Mark
	56 with or without working (2) OR (4 x 12) + (8 x 1) = (1) = 56 (1)	 allow for ONE mark correctly evaluated expression of form: (4 x 12)+(Y x 1) = ... (X x 12)+(8 x 1) = ... OR (8 x 12) + (4 x 1) = 100 [In each case working and correctly evaluated answer required]	**(2)** AO 2 1

Q21.

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

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

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

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

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

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

Q22.

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

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

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

Question Number	Answers	Acceptable Answers	Mark
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Q23.

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

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

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

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

Q24.

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

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

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

Question Number		Indicative Content	Mark
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Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. add copper oxide to sulfuric acid in a beaker and mix/stir • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description e.g. add copper oxide to sulfuric acid in a beaker until no more reacts and filter off the unreacted copper oxide • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description e.g. add copper oxide to sulfuric acid, filter, allow filtrate to crystallise, dry crystals • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Q25.

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

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

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

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

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

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

(Total for Question = 9 marks)

Q26.

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

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

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

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

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

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

(Total for Question = 9 marks)

Q27.

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

Q28.

	Answer	Acceptable answers	Mark
(i)	B lead chloride		**(1)**
(ii)	An explanation linking two of • strong (electrostatic) forces of attraction • between oppositely charged ions • so requires lot of heat/energy to overcome	Any reference to molecules/molecular/intermolecular/covalent scores 0 marks strong (ionic) bonds positive and negative ions reject charged atoms for this mark ignore hard to melt/high	**(2)**

	forces/break bonds	temperature needed	
(iii)	A description including • M1 add (dilute) nitric acid • M2 add silver nitrate (solution) • M3 forms white ppt/solid	Accept correct formulae If use any other acid can score M2 and M3 dependent on use of silver nitrate Alternative method: Electrolyse (1) Chlorine formed (1) Bleaches litmus/pH paper (1) Ignore smell	**(3)**

Q29.

Question number	Answer	Additional guidance	Mark
(i)	(isotopes of same element) have the same number of protons	allow same number of electrons reject same number of neutrons	(1) AO1

Question number	Answer	Additional guidance	Mark
(ii)	total mass of 100 atoms = (28 x 92) + (29 x 5) + (30 x 3) (1) (= 2811) relative atomic mass = $\frac{2811}{100}$ (= 28.11) (1)	correct final answer without working (2) final answer must contain at least one decimal place	(2) AO2

Q30.

Question number	Answer	Additional guidance	Mark
(i)	potassium iodide + lead nitrate (1) → lead iodide + potassium nitrate (1) left hand side (1) right hand side (1)	ignore formulae	(2)

Question number	Answer	Additional guidance	Mark
(ii)	(mass conserved because) the numbers are the same/nothing is lost/nothing is gained	allow same mass / same weight / same amount	(1)

Q31.

Question number	Answer	Mark
	It is on left / in group 2 / column 2	(1) AO2

Q32.

Question number	Answer	Additional guidance	Mark
	arranged by order of (relative) atomic mass / (in Mendeleev's early periodic table) gaps / missing elements / fewer elements / noble gases were not present	assume answer refers to Mendeleev's table unless specifically referred to modern table so reverse arguments apply	(1)

Q33.

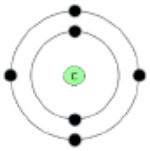
Question number	Answer	Additional guidance	Mark
	2.8.8	allow 2,8,8 2/8/8 2 8 8 or other separator allow correct electron shell diagram	(1)

Q34.

Question number	Answer	Additional guidance	Mark
	2.8.8	allow 2,8,8 2/8/8 2 8 8 or other separator allow correct electron shell diagram	**(1)**

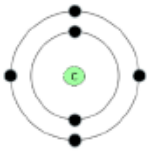
Q35.

Question number	Answer	Additional guidance	Mark
(i)	13/thirteen	allow 6 + 7	**(1)**

Question number	Answer	Additional guidance	Mark
(ii)	2.4 	allow commas allow 2.4.0. allow diagram	**(1)**

Q36.

Question number	Answer	Additional guidance	Mark
(i)	13/thirteen	allow 6 + 7	(1)

Question number	Answer	Additional guidance	Mark
(ii)	2.4 	allow commas allow 2.4.0. allow diagram	(1)

Q37.

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

Q38.

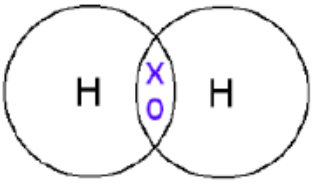
Question number	Answer	Mark
(i)	malleable / malleability	(1) AO2

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

Q39.

Question number	Answer	Additional guidance	Mark
(i)	sodium + hydrochloric acid (1) → sodium chloride + hydrogen (1)	allow reactants either way round allow products either way round reject 'sodium chlorine' allow $Na + HCl \rightarrow NaCl + H_2$ (1) $2Na + 2HCl \rightarrow 2NaCl + H_2$ (2)	(2)

Question number	Answer	Mark
(ii)	**B** flammable **A** corrosive has a different hazard symbol **C** oxidising has a different hazard symbol **D** toxic has a different hazard symbol	(1)

Question number	Answer	Additional guidance	Mark
(iii)		allow dots or crosses or mixture allow other suitable symbols	(1)

Q40.

Question number	Answer	Additional guidance	Mark
(i)	(lamp) does not light up / unlit / 'nothing'	ignore turn off / no reaction	(1)

Question number	Answer	Additional guidance	Mark
(ii)	(lamp) lights up / glows / works	ignore becomes brighter / dimmer	(1)

Q41.

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

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

Q42.

Question number	Answer	Mark
	had yet to be discovered / unknown / did not know about them	(1) AO1

Q43.

Question Number	Answer	Mark
(i)	**A** electrons **1. The only correct answer is A** ***B*** *is factually incorrect* ***C*** *is factually incorrect* ***D*** *is factually incorrect*	**(1)** AO 1 1

Question Number	Answer	Additional guidance	Mark
(ii)	NH_3	do not allow NH^3 / nh_3 / NH3 etc allow H_3N	**(1)** AO 3 2b

Q44.

Question Number	Answer	Additional guidance	Mark
	An explanation linking two of the following points • {metal ions / cations} surrounded by (delocalised) electrons (1) • strong {forces of attraction / bonding} (between (delocalised) electrons and {metal ions / cations}) (1) • needs lots of energy to {separate the particles / break bonds / break forces of attraction} (1)	 ignore metal nuclei allow electrostatic bonds / metallic bonds ignore separating electrons any mention of intermolecular forces / covalent bonding / molecules / ionic bonding / atoms – max 1 mark marking points independent	**(2)** AO 1 1

Q45.

Question Number	Answer	Additional guidance	Mark
	A description to include • both have 18 electrons/2.8.8 (in shells /orbits) (1) • both have 18 protons (in the nucleus) (1) • argon-38 has 20 neutrons AND argon-40 has 22 neutrons (in the nucleus) (1)	allow argon 40 has **two** more neutrons than argon 38 / ORA ignore generic definition of an isotope	**(3)** AO 3 1a AO 3 1b

Q46.

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 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. • in all structures the carbon atoms bonded by single covalent bonds • shared pair of electrons • strong bonds • in diamond each carbon atom joined to four others • diamond has a giant covalent {structure/lattice} • graphene has a giant covalent {structure/lattice} • fullerene has a molecular structure • in graphene and fullerene each carbon atom joined to three others • in diamond and graphene many bonds need to be broken to melt • need lots of energy • therefore very high melting / sublimation points • in fullerene weak forces between molecules • less energy needed to separate molecules • fullerene has the lowest melting / sublimation point • because diamond and graphene have lots of strong covalent bonds so both are very strong materials • because weak forces between fullerene molecules so its strength is very low • in diamond there are no free electrons • so diamond does not conduct • in graphene and fullerene each carbon atom has one free electron • hence delocalised electrons • graphene conducts electricity • fullerene only conducts electricity across the surface of the molecule • no/little movement of electrons between molecules • so fullerene is poor conductor of electricity (/ semi conductor)	**(6)** AO 1 1

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, enquiry, techniques and procedures lacks detail. (AO1) • Presents an explanation with some structure and coherence. (AO1)
Level 2	3–4	• Demonstrates chemical understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas, enquiry, techniques and procedures is not fully detailed and fully devolved. (AO1) • Presents an explanation that has a structure which is mostly clear, coherent and logical. (AO1)
Level 3	5–6	• Demonstrates accurate and relevant chemical understanding throughout. Understanding of the scientific ideas, enquiry, techniques and procedures is detailed and fully devolved. (AO1) • Presents an explanation that has a well-developed structure which is clear, coherent and logical. (AO1)

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Q47.

Question number	Answer	Mark
	particle **A** proton particle **B** neutron particle **C** electron all three correct 2 marks one or two correct 1 mark	(2)

Q48.

Question number	Answer	Additional guidance	Mark
	• heat remaining solid/ heat it for longer / heat it again (1) • and determine mass (1) • repeat until mass after heating stays the same (1)	allow heat to a constant mass (3) allow remove sample (1) add acid (1) no fizz (1)	(3) AO3

Q49.

Question Number	Answer	Additional guidance	Mark
(i)	A description including • apply lighted splint (1) • (squeaky) pop (1)	 allow flame / ignite gas / fire ignore 'squeaky pop test' / glowing splint second mark is dependent on first	(2) AO 1 1

Question Number	Answer	Additional guidance	Mark
(ii)	An explanation linking • loss of electron(s) (1) • two electrons (1)	 allow gains two electrons for 1 mark zero marks overall if sharing of electrons / gain or loss of protons / positive electrons marks can be awarded for suitably drawn diagram / half equation	(2) AO 1 1

Q50.

Question Number	Answer	Additional guidance	Mark
(i)	A description including • apply lighted splint (1) • (squeaky) pop (1)	 allow flame / ignite gas / fire ignore 'squeaky pop test' / glowing splint second mark is dependent on first	(2) AO 2 2

Question Number	Answer		Mark
(ii)	An explanation linking • loss of electron(s) (1) • two electrons (1)	allow gains two electrons for 1 mark zero marks overall if sharing of electrons / gain or loss of protons / positive electrons marks can be awarded for suitably drawn diagram / half equation	(2) AO 1 1

Q51.

	Answer	Acceptable answers	Mark
	An explanation to include three from • {sodium chloride / ionic compound} – bulb lights / {sucrose / covalent compound} – bulb does not light up (1) • sodium chloride (solution) {conducts / ions present} (1) • sucrose (solution) {does not conduct / no ions present (1)	ignore references to electrolytic processes circuit will work (in place of bulb lights) / ORA	(3)

Q52.

	Answer	Acceptable answers	Mark
	An explanation to include three from • {sodium chloride / ionic compound} – bulb lights / {sucrose / covalent compound} – bulb does not light up (1) • sodium chloride (solution)	ignore references to electrolytic processes circuit will work (in place of bulb lights) / ORA	(3)

	{conducts / ions present} (1) • sucrose (solution) {does not conduct / no ions present (1)		

Q53.

Question Number	Answer	Mark
	B 2.8.8.2 (1)	**(1)**

Q54.

	Answer	**Acceptable answers**	**Mark**
(i)	$BaSO_4$	SO_4Ba ignore charges unless incorrect	**(1)**
(ii)	charged particle	charged atom / {particle/atom(s)} that has gained or lost electrons ignore any stated charges	**(1)**

Q55.

	Answer	**Acceptable answers**	**Mark**
(i)	$BaSO_4$	SO_4Ba ignore charges unless incorrect	**(1)**
(ii)	charged particle	charged atom / {particle/atom(s)} that has gained or lost electrons ignore any stated charges	**(1)**

Q56.

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

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

Q57.

Question number	**Answer**	**Mark**
(i)	(formula showing) simplest ratio of atoms (of each element in a substance)	**(1)**

Question number	**Answer**	**Additional guidance**	**Mark**
(ii)	no. S atoms : no. F atoms = $\frac{4.8}{32}$ (0.15) : $\frac{17.1}{19}$ (0.9) (1) = $\frac{0.15}{0.15}$ (1) : $\frac{0.9}{0.15}$ (6) (1) empirical formula SF_6 (1)	correct formula with no working scores 1	**(3)**

Q58.

Question number	**Answer**	**Mark**
(i)	(formula showing) simplest ratio of atoms (of each element in a substance)	**(1)**

Question number	Answer	Additional guidance	Mark
(ii)	no. S atoms : no. F atoms = $\frac{4.8}{32}$ (0.15) : $\frac{17.1}{19}$ (0.9) (1) = $\frac{0.15}{0.15}$ (1) : $\frac{0.9}{0.15}$ (6) (1) empirical formula SF_6 (1)	correct formula with no working scores 1	(3)

Q59.

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

Q60.

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