# Examiners' Report

## Principal Examiner Feedback

## Summer 2017

Pearson Edexcel IGCSE

In Chemistry/Additional Science (5CH2F) Paper 01

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Summer 2017
Publications Code 5CH2F_01_1706_ER

## Paper Introduction

There is only one further session for this examination – January 2018, which will be an opportunity for anyone needing to resit the paper in order to achieve a better grade.

As in the past, this paper was no different in its format. Six questions, 60 marks in total with two 6-mark open response questions in Questions 5 and 6. This tier assesses the grade range G-C and the candidates are challenged in a variety of ways covering the contents of the specification.

Successful candidates

- show understanding of a variety of separation and purification techniques
- show knowledge of atomic structure
- show knowledge and understanding of chemical bonding, both ionic and covalent
- can construct word equations
- can write simple balanced equations
- can carry out simple calculations involving relative atomic masses
- can carry out simple percentage composition and percentage yield calculations.

In comparison, other candidates were less successful in these skills, and this was compounded by them not reading the entire question and this meant some creating an answer that was for a different question. All too often, other candidates made no attempt at answering the questions.

It was also evident that many candidates were not as familiar with practical techniques as would be expected at this level.

## 5CH2F_01_Q01ai

### Question Introduction

This was a straightforward opening question that required the candidate state what is seen during a particular reaction. For those not familiar with the reaction, the products were given along with the reactants in the stem of the question.

Most candidates gave the answer as ‘bubbling’ or ‘fizzing’ as an observation made when a gas is given off during a reaction. However, there were some who gave answers such as colour change, precipitate formed, ‘you would see it reacting’, gas given off, all of which gained no credit. Some candidates failed to read the question and named the products instead.

## 5CH2F_01_Q01aii

### Question Introduction

All the information was provided for the candidate to write the word equation for the reaction. This was marked in the usual way – 1 mark for the left hand side (which included the arrow) and 1 mark for the right hand side (which also include the arrow).

Many candidates used the information provided to write a complete word equation, but there were some who omitted hydrogen and so scored 1 mark for the left hand side. Several candidates included 'dilute' before hydrochloric acid or 'gas' after hydrogen, but their presence was not needed for the marks. A few candidates had the idea that carbon dioxide was a product and this year there were fewer instances of 'hydraulic acid'. Several candidates did omit the crucial word 'acid' and so missed out on the mark for the left hand side; some included a second arrow between zinc chloride and hydrogen, so these candidates lost the mark for the right hand side of the equation.

## 5CH2F_01_Q01aiii

### Question Introduction

This should have a very straightforward opportunity for candidates to describe a test to show that a reaction is exothermic. At a basic level, 'feel the container and it becomes warmer' would have scored both marks available, but it was hoped that most would go for the using a thermometer to see that there was a rise in temperature. Both approaches have the test and the result.

In practice, although many candidates chose the use a thermometer, many failed to score the second mark by not stating that there would be a temperature rise. For the result of the test, many stated 'to find the temperature change', heat increases, heat rises and so did not score that mark. A sizeable number of candidates confused exothermic and endothermic with what happens in terms of temperature change. Several candidates saw the first three words 'Describe a test ...' thought about hydrogen being a product and then described the squeaky pop test for hydrogen.

## 5CH2F_01_Q01aiv

### Question Introduction

Most of the candidates gave an answer connected with the idea of increasing the surface area of the zinc used leading to a faster reaction. Those that had the idea of making the zinc into a powder were given credit, however, using more zinc pieces or heating the zinc was not given credit. A sizeable proportion of the candidates had not noted 'to the pieces of zinc' and offered suggestions such as use a catalyst, use a more concentrated acid; these also did not score.

## 5CH2F_01_Q01b

### Question Introduction

Generally this question was answered well by the majority of the candidates, but some candidates still try to answer this type of question in terms of speeding up (or slowing down) reaction time. Some candidates did think that a catalyst would slow the reaction rate.

## 5CH2F_01_Q02b

### Question Introduction

In this linking lines question, candidates were asked to link the ion test with the ion that was detected. It was disappointing to see that very few candidates knew the correct answers for this question, with the overwhelming majority linking the first test with chloride ion and the second test with nitrate ion.

## 5CH2F_01_Q02c

### Question Introduction

Having been given the formulae for two singly charged ions, the question was asking for the candidate to write the formula of the compound potassium nitrate. It was disappointing to see the errors that were being made. Most centred around the use of poor capitalisation or the inclusion of an errant charge such as $KNo_3$ and $K^+NO_3$. Several candidates wrote K3NO and few wrote $K(NO)_3$.

Examiner Comment

A common problem where the nitrate ion looks like $No_{3^-}$. As a result, this did not score.

Examiner Tip

Keep upper case letter all the same size in a chemical formula.

## 5CH2F_01_Q02di

### Question Introduction

Completion of the word equation required the candidate to use the information provided for the left hand side and then to work out the identity of the second product. For many candidates this was straightforward although with the two line layout for some was a problem thinking it was two equations. The majority scored at least one mark for sodium carbonate on the left, but many common errors were seen on the right hand side. These included 'green precipitate', carbon dioxide and water.

## 5CH2F_01_Q02dii

### Question Introduction

Most candidates attempted this question, but it was surprising to see how few could successfully carry out the procedure to produce a pure, dry sample of an insoluble salt.

Some examiners report seeing the mnemonic 'MFWD' (mix/filter/wash/dry) in the margin on many answers and that had helped those candidates score full marks for this question.

Most of the examiners reported that many of the candidates omitted the stage of filtering to obtain the insoluble salt. Only very few candidates had the incorrect sequence of wash – filter – dry for which two marks were awarded. Those that did identify the need to filter the mixture, a significant number showed confusion between a separating funnel and a filter funnel. Some candidates wrote about funnelling and funnel paper which, unless it was clear that it was to separate the insoluble solid, gained no credit.

Several candidates missed out the washing stage, but went on to dry the solid. Most of those who included the drying stage generally scored the mark for 'leave it to dry'. Unfortunately some lost the third mark for using a hot oven as this would decompose the copper carbonate.

Many incorrect methods were seen by examiners including electrolysis, fractional distillation and chromatography.

## 5CH2F_01_Q03a

### Question Introduction

Fewer than half the candidates could demonstrate an understanding of a chemical formula. The majority could identify the elements present but many did not mention the ratio of atoms within the formula. Several candidates lost marks by including 'molecules' or had the ratio the wrong way (two oxygens and one hydrogen).

Although not asked, several candidates attempted the question by describing the structure or properties of water. A significant number of responses referred to 'hydrogen chloride' rather than water, showing that the candidate had not read the question properly.

## 5CH2F_01_Q03b

### Question Introduction

For a question that has been asked several times in the past, only a very small number gave and answer that involved the sharing of a pair of (or two) electrons. The question was badly answered by the majority with a small proportion of candidates indicating that sharing of electrons was involved. For some, this extended to the idea of filling the outer shell.

The major errors here involved the 'sharing of atoms', or descriptions involving something that 'held atoms together in a compound', or 'between non-metals'.

## 5CH2F_01_Q03c

### Question Introduction

Of those that managed to score marks on this question, only a few scored one mark for a correct shared pair of electrons between the hydrogen and the chlorine. Examiners reported that many students lacked precision in their drawings. With it being the F tier, the overwhelming majority drew circles to represent the electron shells. Most attempted inner shells for chlorine (and sometimes for hydrogen) despite the instruction to show the outer shell electrons only. For many candidates, the overlap contained only one electron – usually that of hydrogen.

Perhaps the most frequently seen error was to combine the HCl in one set of circle(s), with 8 electrons shown in the outermost ring. Only a few had a second electron on the hydrogen and only a few created an ionic bonding situation.

Examiner Comment

A common error reported by many examiners. Many candidates combined the HCl as shown so scoring 0 marks.

Examiner Tip

Practice drawing dot and cross diagrams for a variety of simple molecules.

## 5CH2F_01_Q03di

### Question Introduction

Many candidates did not recognise the piece of equipment shown in the diagram. Of those that did not score here, many gave the answer with just 'funnel' and gave the answer as 'filter funnel'. A few did write 'separator', but that was not sufficient for the mark.

## 5CH2F_01_Q03e

### Question Introduction

This question proved to be out of the reach of the candidates taking this paper. It seems that only a few understood what was required and so scored the two marks. Several more scored the mark for weak forces between molecules, but then went onto say 'so that means it has a low melting point' (or similar) without further explanation. A few candidates did score the second point alone for stating that it didn't take much energy to separate the molecules, but again without further explanation. Overall, their concept of molecular structures was weak.

The greater majority of the candidates either left a blank space or wrote about water having a low melting point because it is a liquid. For some who had a vague idea, their answers were spoilt by writing about bonds between molecules or bonds between atoms being weak.

## 5CH2F_01_Q04aii

### Question Introduction

The majority do not appear to understand the use of state symbols in an equation. Many could give a correct state symbol – either 's' or 'aq', but only a few could give both. Errors here included writing 'solid' or 'sol' within the space provided, as well as 'aq2' and 'aq3' in a few cases.

## 5CH2F_01_Q04aiii

### Question Introduction

What should have been a straightforward formula mass calculation resulted in most candidates giving an answer of 53 obtained by just adding up the relative atomic masses of the elements. Other errors seen in fewer numbers were:

- (23 + 14 + 16) x 3
- 23 x 14 x 16
- $23 + 14 + 16^3$
- 23 + 16 + (3x16) - using an incorrect value for nitrogen
- 11 + 7 + (3x8) - using atomic numbers from the periodic table

Candidates should be encouraged to write down their calculation method AND use a calculator.

**5CH2F_01_Q04aiv**

**Question Introduction**

Given that the relative formula mass of lead iodide was given in the question, that didn't stop several candidates from working it out. However for some using an incorrect formula ended up with an answer of 207 + 127.

For those who chose the correct denominator as 461 – the relative formula mass of lead iodide. Probably more candidates chose to use 127 or 2x127 as the numerator than those who used 207 as the numerator.

Many candidates scored one mark for taking a fraction and converting it into a percentage (i.e. fraction x 100), irrespective of the contents of the fraction. Some candidates carried out the calculation and gave just a final answer of 44.9% or 45%. Candidates should be deterred from this sort of approach.

Other common errors seen by examiners included

- Fraction the wrong way round leading to an answer of 223%.
- Rounding the fraction of 207/461 = 0.4, leading to an answer of 40%. Rounding of a value should be left until the last stage.
- Rounding the final answer in the wrong direction to 44%, so scoring only one mark for the correct fraction where shown.
- Giving just a value of 44% with no working, so losing both marks.

Candidates should be encouraged to spend an extra few seconds explaining what they are doing at each step of the calculation.

**5CH2F_01_Q04bi**

**Question Introduction**

This calculation produced more correct answers than the previous one. It was disappointing to see those candidates using the correct fraction to give a final answer of 0.7% and so scored only one mark.

Other errors seen by examiners included

- 3.5 x 5.0 = 17.5%
- 5.0 – 3.5 = 1.5%
- 5.0 – 3.5 = 1.5  (1.5 / 5.0) x 100 = 30%

Again several candidates gave the answer alone as 70% without any working.

## 5CH2F_01_Q04bii

### Question Introduction

What was expected to be a straightforward question at this stage of the paper as it just involved giving back what was given in the specification as reasons for percentage yield being less than 100%, proved not to be the case for the majority of the candidates. Only very few candidates scored marks here. Of those that made a positive attempt at the question, examiners reported the following as common errors:

- 'it can't be 100%' (without further explanation)
- 'yield is never accurate'
- 'yield is only an estimate'
- 'some was spilled'
- 'gas was lost'
- 'not measured properly'

## 5CH2F_01_Q05a

### Question Introduction

This question was fairly well answered by the candidates in a variety of ways, but examiners report seeing the most scoring answers as being fewer elements in Mendeleev's periodic table or that spaces were left for elements discovered much later.

Examiners reported the following as the most common errors:

- using atom, molecule or compound in place of elements
- metals and non-metals not known about at the time of Mendeleev
- elements not arranged in groups in Mendeleev's periodic table.

A couple of the more amusing answers included 'she had arranged the elements in order of mass' and 'Mendeleev hadn't discovered all of the elements in time for his periodic table'.

**5CH2F_01_Q05bi**

**Question Introduction**

Just under half the candidates were able to either use the information provided or use the periodic table correctly to state the atomic number of argon. The main error seen was '40' (being the sum of the protons and neutrons - the mass number), but sometimes another seemingly random number was given which was difficult to explain how the candidate obtained that number.

**5CH2F_01_Q05bii**

**Question Introduction**

This was a straightforward question for the majority of candidates. A significant number of candidates did not score the mark for a variety of errors including:

- writing the name rather than the symbol e.g. helium rather than He
- using two capital letters e.g. HE
- writing the symbol or name of a non group 0 element

In examinations, candidates do need to take a little more care with the size of letters being used as chemical symbols. This was a problem mentioned in question 2(c).

**5CH2F_01_Q05c**

**Question Introduction**

Many candidates score both marks for this question by referring to electrons the outer shell as well as the number of electrons. Several candidates repeated much of the question, which does not gain credit (which was more of an issue in question 5 (d)).

Common errors involved

- leaving out the word ‘electrons’ and just writing 3 on outer shell
- ‘has 3 shells’
- ‘the last number is a 3’
- ‘there are 3 numbers’
- confusing electrons with protons / neutrons / atoms as in ‘3 atoms on the outer shell’

But for many candidates ‘group’ and ‘period’ number have been confused.

## 5CH2F_01_Q05d

### Question Introduction

There were many good descriptions of electrons in shells and how sodium atoms and fluorine atoms became ions, but very few candidates mentioned that protons and neutrons were present in the nucleus. However, it was very surprising to see descriptions of ion formation followed up with a dot and cross of a covalent molecule of sodium fluoride.

Unfortunately most of the written answers seen for the question consisted of rewriting the stem of the question with a description of the numbers of protons and neutrons present in each atom along with the electron configuration, which of course gained no credit.

## 5CH2F_01_Q06aii

### Question Introduction

The correct appearance of bromine was seen only in a relatively few cases. The overwhelming majority gave the colour of bromine water (rather than bromine) with or without the physical state, so descriptions such as 'orange', 'orange-brown', 'red-orange' were often seen. Some referred to bromine being a gas.

## 5CH2F_01_Q06aiii

### Question Introduction

Few candidates realised that dissolving hydrogen chloride in water produced hydrochloric acid, which would turn the universal indicator red. Many candidates tried to hedge their bets by saying that 'it would change the colour of the universal indicator'. Where they did decide on a colour, blue and alkali were the more prevalent choices. Another misconception reported by the examiners was that several candidates thought that chlorine was produced which bleached the indicator.

**5CH2F_01_Q06c**

## Question Introduction

It was disappointing to see that so many candidates were not familiar with the reactions of the alkali metals with water. Equally it seemed that few candidates had watched the any of the readily available videos on the reaction of rubidium and caesium on water.

There were some good descriptions of the reactions with suitable suggestion of how rubidium and/or caesium would react with water to reach level 3, but these were few and far between.

Surprisingly many candidates had the order of reactivity the wrong way thinking that lithium was the most reactive. Some justified this by saying that the lithium atoms were small and so it was easier to lose its electron. Few candidates made any relevant similarities or differences in the reactions of the metals with water. Judging by the answers seen, many of the candidates stopped reading after the end of the first line and missed the crucial 'with water.' This meant many candidates wrote about similarities in atomic structure (all have one electron in outer shell), physical properties (all conduct electricity) or random things (all end in –ium). Word equations or balanced equations if seen were badly constructed. Many candidates wrote about 'strong reactions' or 'bigger reactions' without any detail.

## Paper Summary

For anyone resitting the paper, candidates are offered the following advice, based on their performance on this paper:

- read the whole question carefully and think about the answer before writing it down
- practice writing formulae of ionic compounds using the formulae of the separate ions
- practice drawing electron structures for both atoms and simple molecules
- practice writing word and simple balanced equations
- try to learn the experiments covered in the course, especially any tests for ions and for gases
- try to be precise in your answers rather than giving alternatives
- use the past papers as practice before the final examination.

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