EXAMINER TIPS for Chemistry 5070

How to use these tips

These tips highlight some common mistakes made by students. They are collected under various subheadings to help you when you revise a particular topic.

General Advice

- It is important that you write your answers in black ink. This is because the papers are now marked 'on-line' by the examiners. The scripts have to be scanned and blue ink does not show up very well. For a similar reason, please use a dark black pencil for your drawings.
- It is very important that you understand the words or phrases used by examiners to get you to answer questions in a particular way. These terms are described in the syllabus in the section *Glossary of Terms*. You may sometimes lose marks because you do not understand what to write in response to the words 'explain', 'describe', 'suggest' etc. If you are unsure, ask your teacher to tell you what each of these terms means. For example the term 'explain' means that you have to refer to some idea or theory and you have to write in detail to say why something happens. For example, if you are asked 'Explain why rate of a chemical reaction increases when the temperature increases', you have to use the idea of particle collisions in your answer.
- Make sure that you read the question fully, picking out the key words. For example in a question such as 'Give a use of graphite that depends on the ability of its layers of atoms to move over each other', it is common to find incorrect answers referring to *properties* rather than uses. Therefore the answer slippery is incorrect but the answer 'as a lubricant' is correct. It is useful to underline the key words in a question as you read it.
- Take careful note of how many marks there are for a question. If there are 3 marks, you will need to think of 3 different points that you can write down to answer the question. Take for example, the question 'Explain how increasing the concentration of acid affects the rate of reaction between magnesium and hydrochloric acid'. The examiners are looking for:
    - the rate of reaction increases (1st mark) because the more concentrated the acid, the closer together are the acid particles (2nd mark) the closer the particles, the more frequent are the collisions (3rd mark)
- Make sure that you keep referring back to the beginning of the question or main subsection to get some vital points of information. This is especially important with calculations. In Paper4, you may sometimes need information which is a page back.

- Don't be afraid to write down or choose the answer 'no reaction' if you feel that nothing should happen. The lack of reaction still gives valuable information. This is most commonly seen in questions such as 'Write down the products of the reactions, if any, between (i) chlorine and potassium bromide (ii) iodine and potassium chloride.' The phrase 'if any' suggests a possibility that one of these pairs may not react. But it does not mean that this is definitely the case!

Spelling

The correct spelling of chemical names is not always essential as long as they cannot be mistaken for other chemicals. However, in simple questions where you are asked to select the names of chemicals from a list, you are expected to get the spelling correct. Writing ammonium for ammonia or chlorine for chloride will not be given credit because this is a chemical mistake.

General Tips

- Look for exactly what the question is asking. Many mistakes are made by not reading the question correctly. If the question says give two observations apart from temperature change', then obviously you shouldn't write 'temperature change'. But many Candidates do!
- Read over your answers and ask yourself 'have I contradicted myself?' This generally refers to things written in the same sentence. A common error is to write something like – 'On adding ammonia a soluble blue precipitate is formed'. There is confusion here because if precipitate is not soluble. The correct answer to a question about adding excess ammonia to copper ions would be: 'On adding ammonia a light blue precipitate is formed. The precipitate dissolves in excess ammonia solution.' Notice that splitting it up into 2 sentences has altered the meaning.
- Significant figures are not the same as decimal places. For example 123.08 is to 2 decimal places but to 5 significant figures. Zeros before any definite numbers do not count as significant figures. So 0.000045 is to 2 significant figures.
- When doing calculations, your final answers to each section should be to the correct number of significant figures. Generally, it should be to the same number of significant figures as the data. You may get penalised if you write your answer with too many significant figures e.g. 1.257487 instead of 1.26.
- Make sure that you round up your answers correctly. For example, if an answer to 4 significant figures is to be rounded to 3 significant figures, the answer 22.56 should be rounded up to 22.6 not down to 22.5.
- Always show your working – even if your answer is wrong, you may get some marks for your method. It is not sensible to work everything out on your calculator then just put down the answer. If you make one slip you risk getting no marks for that question.
- Make sure that you know your syllabus statements and definitions exactly. For example, the use of naphtha as a feedstock for the chemical industry. This is because the Principal Examiner has to use the syllabus as a basis for the exam questions.
- Look out for the phrase 'what you would observe'. This means that you must write down what you see/ hear or feel. For example, 'the test tube gets hot'. It is a very common error to write something like 'a gas is given off' or 'copper is deposited'. These are not observations.
- Don't get caught out by the phrase 'describe what you would see'. Some students put down observations about pops (sound) or heat given off.
- When drawings diagrams
  (i) make sure they are large enough to fill the space given on the paper
  (ii) make sure that you draw apparatus for gas measurement without any places for the gas to escape. Don't draw gas syringes with the plunger much smaller than the syringe barrel. This is a common error.
  (iii) always label your diagrams as fully as possible.
- Stick to the number of examples requested by the examiners. For example, if a question asks for two examples of a transition element, do not write three down. If one of the three is incorrect, you will lose a mark. If a question asks for a single use for a substance, stick to one – if you write long lists, the examiner will think that you are 'playing safe' and you won't get the mark. Take for example in the question 'State two properties of transition elements that are not shown by other metals' (2 marks). The answer – 'they are good catalysts, they form ions with different charges, they do not conduct electricity' – will only gain one mark. This is because, although the first two answers are correct, the last one is incorrect.

- In chemistry, the examiners want you to draw graphs of reaction rates by joining up the points with a curve of best fit. If you draw lines with a ruler from point to point, you will not get the mark.
- Make sure that you draw the curve on a graph so that it touches or is a close to each correct point as possible. If one point is clearly incorrect, ignore it when drawing the curve.
- On a graph, make sure that you draw the line in pencil so that you can rub it out if you make a mistake.

Paper 1 (Multiple Choice) Tips

- If you are unsure of the answer to a multiple choice question, don't spend too long on it. Put a star by it and return to it later.
- Within a single multiple choice question, use a pencil to cross out the statements which are clearly incorrect, then choose between those left.
- In a multiple choice question don't be swayed by one of the choices just because it has got a longer (or shorter) statement than the others.
- Don't make any assumptions about the order of responses – just because there have been two answers 'D' in sequence, it does not mean that the next answer cannot be 'D'.
- Take care to read the whole question word by word. For example, in the question 'what is the ratio of the volumes of 2g of H_2 and 16g of methane, CH_4, at r.t.p?' Many Candidates will focus on the numbers and ignore the word 'volume'. Just a quick look at the figures gives the incorrect answer 1:8 (using the molar gas volumes gives 1:1 as the correct choice)
- When given a choice of picking out a noble gas from a group of electronic structures, don't jump to the conclusion that noble gases always have 8 electrons in their outer shell. Remember that helium has 2!
- When given a choice about electrical conductivity of ionic structures remember that the conduction is due to IONS moving (not electrons). The ions can only move when the ionic compound is molten or when dissolved in water.
- When given choices of why alloys are hard, it's not the mass of the atoms which is important but their size. Remember that metals have layers which slip over each other. A different sized atom will distort the layers and stop them slipping over each other. This makes the alloy harder than the pure metals.
- When given choices about the rate of diffusion of gases, remember that the rate of diffusion depends on the mass of the molecules. Heavier molecules (lower relative molecular mass) move and diffuse slower than lighter molecules. If you are unsure which molecule is heavier, use your Periodic Table to calculate the relative molecular masses.
- If you are given a choice of tap water and several other substances as examples from which to select a pure compound, it's not going to be tap water. It is a common error to think that tap water is pure. It contains compounds dissolved from the rocks or carried in the rain as well as the chemicals put in to purify it. It's a mixture. (Don't be fooled by the adverts of the mineral water companies which say 'pure mineral water'!)
- If you are given choices of electronic structures of atoms to select to make a compound of type XY_2, first check the type of compound that the examiner wants e.g. ionic or covalent. If it is ionic, then you can choose an atom with one or two electrons in its outer shell and combine it with a non metal atom. If it is covalent look for the structures of two non-metal atoms i.e. those with 4 to 7 electrons in their outer shell. Remember that the number of electrons in the outer shell is equal to the group number.
- Remember that the valencies (combining powers) of the elements in Groups V to VII are found by taking the group number away from 8. For example, the valency of oxygen in an oxide is 8-6 = 2. (Oxygen is in Group VI)

Paper 2 (Theory) Tips

- Reading the question thoroughly and noting the number of marks available is important. In response to a question such as 'Use your knowledge of the structure of metals to explain how they conduct electricity', many Candidates just write down that 'metals have a sea of electrons', thinking that this answers everything. What the examiners are looking for is (1) the idea of positive ions in a sea of electrons and (2) the fact that the electrons move.
- Remember that it is the moving valence electrons which are responsible for the conduction of electricity in metals. If you just state that 'the electrons move' it could refer to any electrons in the atoms. It is also a common error to suggest that ions are responsible for this conduction.
- If you are asked to compare things in the question, your answer must also make the comparison obvious. In response to the question 'How do different proportions of carbon affect the properties of steel?' the answer 'mild steel has a low % of carbon' will not receive any marks because nothing has been said about steel with a higher % of carbon. An answer such as 'the higher the % of carbon the more brittle the steel' gets the marks because this is a comparison.
- Properties of transition elements often cause problems. Remember that transition elements themselves are NOT coloured, it is their *compounds* that are coloured.
- If you see the words 'What observations are made?' remember that this means what you see, hear or feel and NOT for example, 'gas given off'.
- Make sure that you know the use of the various substances stated in the syllabus. Go through your syllabus and make a note of these. For example, the uses of the naphtha fraction from petroleum distillation are not well known. Make a list of all the substances in the syllabus whose uses you need to know and test yourself by making 'flash cards' for these.
- If you are asked to describe the meaning of a term which has two words in it, you must make sure that the description has included the meaning of both words. So to get full marks for the question 'What is the meaning of the term *saturated hydrocarbon*? you have to define (1) saturated as well as (2) hydrocarbon.
- Always check back in the question to see the wording in the stem of the question. You will not get any marks for repeating words in the stem of the question or putting what is in the stem into different words. For example, if the stem includes the words 'explain why the reaction rate increases as the concentration of acid increases', you will not get any marks for putting this in another way e.g. 'the reaction speeds up because the concentration of acid increases'.
- Be on the lookout for questions involving processes e.g. 'What advantages are there in using hydrogen as a fuel?' The section underlined is a process. The answer 'hydrogen is not polluting' is therefore not correct because there is no indication that it is being used as a fuel. A better answer would be 'it forms no pollutants when burnt'.
- Watch out for the words 'if any'. e.g. 'State the products in the following reactions if any'. Sometimes the examiner wants to test your understanding of why a reaction does NOT occur.
- If you are asked to draw electronic structures of atoms or ions, it is best to draw full electronic structures showing all shells, not just the outer shell. If the Examiner wants you to draw just the outer shell, that will be stated in the question.
- When drawing the structure of ions, the charge must be put at the top right hand corner. You will not gain any marks if you put the charge in the nucleus as do some Candidates.

- Explaining the properties of ionic structures is always a problem area. Never mention atoms, molecules, covalent bonds or sharing electrons even if you mention ions as well. In answer to the question 'Why does sodium chloride conduct electricity when molten?, the answer 'because the ions and the electrons can move' gets no marks. This is because the incorrect 'electrons' negates the mark for 'ions'.
- A common error involving the conductivity of molten ionic compounds is to state that the electrons are responsible for conduction. Remember that it is the IONS which move when ionic compounds conduct electricity.
- It is a common mistake to believe that energy is needed to form bonds. In answering questions about bond making and bond breaking, think about a model of a compound – to *break* the bonds, you have to physically pull them apart. In other words you're putting in energy. To form bonds, it must be the opposite i.e. energy is given out on bond formation.
- Look out for the term 'explain'. This indicates that you have to write in detail about why something happens. If for example you are asked to explain why the reaction between copper(I) chloride and chlorine is a redox reaction, you must write about redox in terms of either electrons or oxidation number *changes*.
- Make use of all the information given in a question, including graphs. For example if a graph of % yield of ammonia against temperature for various pressures is given, it is there for a purpose. If you use the information given you are less likely to lose marks than if you try to remember figures from a book.
- Never write ammonium hydroxide as the product when ammonia dissolves in water – ammonium hydroxide it does not exist! (even though you may see it still on bottles in the lab and even in some books). The correct term is aqueous ammonia. In addition make sure that you know the difference between ammonia, NH_3 and ammonium, NH_4^+. The latter is an ion present in ammonium salts.
- The number of carbon atoms in formulae of carboxylic acids often causes problems. Make sure that you include the carbon of the –COOH group when you name the acid. $CH_3CH_2CH_2CH_2COOH$ has 5 carbon atoms so it is the 5^{th} member of this homologous series, pentanoic acid.
- Take care with the formulae of the metal salts of the carboxylic acids if the metal is from Group 2. Remember that group 2 metals form 2+ ions and so they need 2 carboxylate ions to balance. e.g. the formula for magnesium ethanoate is $(CH_3COO^-)_2\,Mg^{2+}$.
- When doing mole calculations if given an equation such as:

  $$Mg + 2CH_3CO_2H \rightarrow (CH_3CO_2)_2\,Mg + H_2$$

  You ignore the 2 in the equation when calculating the molar mass of ethanoic acid. So the molar mass of ethanoic acid is 60 not 120. Remember though that when calculating reacting masses, the 2 needs to be taken into account because two moles of ethanoic acid react with only one mole of magnesium. The 2 also needs to be taken into account when doing calculations involving limiting reagents.
- Try to be as accurate as possible in all your answers. In response to a two mark question such as 'Explain why the reaction between ethanoic acid and magnesium much slower than the reaction between hydrochloric acid and magnesium?' it is too vague to write 'Ethanoic acid is a weak acid'. 'A weaker acid' would be a more acceptable answer. Some reference to the differences in hydrogen ion concentration or degree of dissociation is also needed.

- When there are questions with large unspecified mark allocations (for example 6 marks) you need to plan your answers out carefully and need to underline or list on the question paper all the points that need to be written about. It is very common to miss out important points in extended questions like this. When you have written a list of the points you need to deal with, you can cross these out one by one as you complete them. e.g. equations, gas tests, colour changes etc.
- Answers to questions on 'chemistry and the environment' are often answered in a too vague manner. The word 'pollution' is too vague to be given credit as an answer to any question. In answering a question such as 'What is a disadvantage of the use of nylon for fishing nets', pollution would not score, neither would vague statements such as 'Dangerous to sea life'. 'Non-biodegradable' would score the mark because it is much more exact.
- In doing calculations, always check that the relative molecular masses are correct. Incorrect addition or extraction of the relative atomic masses is often a reason for failure in a calculation. Also, make sure that you double check that you have used atomic masses and not atomic numbers. If you are unsure, use the key in the Periodic Table at the bottom left to check which number is which.
- Look out for the word 'each'. For example, in the question 'Explain the purpose of adding each of calcium hydroxide and ammonium sulphate to soil. You will lose marks if you do not make it clear exactly which compound you are writing about. To make sure that there is no ambiguity, start each sentence with the name of the compound. In this case: calcium hydroxide is added to….. ammonium sulphate is added because……
- Avoid missing out connecting processes. For example if you are asked about how ammonium sulphate helps soil fertility, an answer that 'ammonium sulphate provides nitrate ions' is not good enough. This answer suggests that the ammonium sulphate contains nitrate ions. A better answer would include the connecting process. For example: 'Ammonium ions are converted by micro-organisms in the soil to nitrate ions.'
- Know the difference between –ides and –ates. Compounds ending with –ide contain only two types of atoms e.g. magnesium oxide, potassium chloride. Compounds ending with –ate contain three or more types of atom, one of which is usually oxygen e.g. sodium sulphate, potassium nitrate. The ions of ides are simple e.g. sulphide, S^{2-} whereas – ates have compound ions e.g. carbonate CO_3^{2-}
- When writing oxidation numbers, remember that the sign + or – should be included. The oxidation number is not written like the charge on the ion. For example Cu^{2+} is a copper(II) ion. The oxidation number of copper in this ion is +2. (rather than 2+)
- Make sure that you know the solubility rules for various conmpounds. These are important when writing state symbols in equations. If you know that carbonates of group II metals are insoluble in water, then you know to write $CaCO_3(s)$ in an equation rather guessing.
- When deciding which method to use to make a given salt, you need to be able to remember to use the solubility rules. For example, to make an insoluble salt from two soluble salts you use a precipitation reaction. In order to make a soluble salt from two soluble salts, you use titration
- Know the difference between (aq) and (l). The state symbol (aq) refers to a substance dissolved in water. The state symbol (l) refers to a substance as a pure liquid e.g. $Br_2(l)$, $H_2O(l)$.
- Remember that when writing equations for the reactions between aqueous solutions of halide and aqueous halogens, the state symbols are all (aq). This is because the halogens are dissolved in water in the first place.

- When given graphs which read back in time from the present day be careful to remember to read the graphs in a forward direction if you are asked about the order of a sequence of events e.g. how carbon dioxide concentration changed over the last 2000 million years.
- Always read the scales on graphs very carefully especially when very large numbers are involved. For example if the graph has the figures 1000, 2000, 3000 with the words 'millions of years' underneath, it is all too easy to miss the word 'millions' when answering questions.
- Remember that if you want to separate a particular gas from the air, you can't just heat the air up. You have to make it liquid first by lowering the temperature so that all the gases liquefy. Then you raise the temperature gradually and collect the gases as they evaporate off one by one. Although the actual process is more complex, this is all that you have to know for your examination.
- With questions which require extended answers, especially in part B of the paper do not write too much. There is often a danger that you will contradict yourself.
- When asked to draw diagrams, make sure that you have included all the pieces of apparatus necessary. Go over each point in the question carefully to check. It is quite common for example, to leave out the test tubes to collect gases when asked to draw the apparatus for electrolysis and test the gaseous products.

Paper 3 (Practical) Tips

- If you are asked to heat up a substance with sodium hydroxide and aluminium, don't assume that ammonia is the gas that is given off. It could be hydrogen. Get your answer from your observations not from theory.
- When asked for observations don't write down things like 'A gas is given off'. This is not an observation. It is far better to write 'The mixture effervesces (bubbles)'
- The observation of effervescence is often missed out from practical observations. Look for the bubbles!
- In carrying out titrations you must repeat them until you get at least 2 consistent results or results which are the closest to each other. You then tick these results only. Examiners often find that only one result is ticked – make sure that two are ticked.
- In titrations you must only average the consistent results that you have ticked not all the titration results.
- When describing solutions do not use the word 'clear' when you mean colourless. In Chemistry, clear just means you can see through it – it is the opposite of cloudy.
- The word precipitate is often used incorrectly. You can only use it about a solid formed when two solutions are mixed.
- When making observations about a solution don't forget that 'colourless solution' may also gain a mark. Lack of colour is just as important an observation as presence of colour.
- Take care when adding a solution of sodium hydroxide to test for ions. If you add a large volume of sodium hydroxide too quickly, you may get the precipitate re-dissolving without you ever noticing that one was formed e.g. in the case of adding sodium hydroxide to aluminium chloride solution. So add about five to ten drops of sodium hydroxide to about 1 cm^3 of the solution to be tested. Then observe if a precipitate is formed. Only after this has been done do you add excess sodium hydroxide.
- When describing colours don't use combinations e.g. bluish-green, yellowish-red, unless absolutely necessary for distinction and certainly don't use contrasting colours e.g. greenish brown.
- When observing colour changes, make sure that you observe all the colour changes not just the first and last. For example when adding silver nitrate to sodium thiosulphate, the colour changes are white → yellow → red → black.
- You must be able to distinguish between the different shades of white or yellow precipitates e.g. silver bromide, silver iodide, lead iodide. You can do this by calling them creamy yellow, light yellow, deep yellow etc. But do not write green, as so many of you do for the colour of a silver chloride precipitate, when the colour is clearly white.

Paper 4 (Alternative to Practical) Tips

- When plotting graphs, you should be able to accurately plot to within one-half a small square and the lines should go through the 0-0 point which should also be plotted if there is data for it. However do NOT draw a line through the 0-0 point if it is clear that the trend shows that the line is unlikely to go through this point.
- Practice extrapolating graphs. The extrapolated curve must follow the pattern of the line or curve that is already there. If it is levelling off gradually, the extrapolated curve must continue this levelling off.
- In the practical papers marks are not usually given for suggesting that you can separate a solid from a solution by decanting off the solution. Filtration is the method that is expected.
- Make sure that you know the difference between the tests for oxygen and hydrogen – these are frequently muddled.
  Hydrogen – Lighted splint – Pops (Hylight Pops).
  Oxygen – Glowing splint – Relights (ogre)

- If you are asked to state a test for hydrogen do not just write down 'Use the pop test'. This description is too vague – it describes the result and not the test. It is far better to write 'Insert a lighted splint into the test tube'.
- In describing colour changes which you expect to see when a metal such as zinc reacts with a solution of copper sulphate, don't write that the solution goes white. This is a common error. You should state that the blue coloured solution looses it colour.
- You are given several diagrams of thermometers showing the temperatures as an exothermic reaction proceeds and then have to plot a graph from the data. Make sure that you always calculate the temperature change by taking away the initial thermometer reading from each of the other readings. Don't take the 3rd from the 4th, the 4th from the 5th etc as so many of you do.

About the Examiner

Dr. Roger Norris has been an examiner for many years. He is currently a Principal Examiner for Cambridge International 'O' level Chemistry as well as IGCSE Chemistry. He has also been involved in developing and examining OCR Chemistry courses and examinations in Britain. As well as undertaking several years of research he has 28 years of teaching experience in Chemistry (as well as in Biology and Physics). He has contributed to a number of publications ranging from General Science for 11-13 year olds to advanced level Chemistry courses.