Examiner Tips for O Level 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 very important that you understand the words or phrases used by examiners to prompt 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 explain what each of these terms means; for example, the term "explain" means that you have to refer to some idea or theory and write in detail, so if you are asked "Explain why rate of reaction increases as temperature increases", it means that 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 copper that depends on the ability of ions to move past each other", it is common to find incorrect answers referring to *properties* rather than *uses*. Therefore the answer "malleable" is incorrect but the answer "for water pipes" is correct. It is useful to underline the key words in a question as you read it through.
- Take careful note of how many marks there are for a question. If there are three marks, you will need to think of three different points that you can write down to answer the question, e.g. in the question "Explain the effect of increasing the concentration of acid on rate of reaction", the examiners are looking for:
  - The more concentrated the acid, the closer together the acid particles (1st mark)
  - The colder the particles the more frequent the collisions (2nd mark) so increasing the rate of reaction (3rd mark)
- Make sure that you keep referring back to the beginning of the question or main subsection for vital points of information. This is especially important with calculations. In Paper 4, you may sometimes need information which is several pages 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" keys you into the idea that one of these pairs may not react.

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 must 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

- Work out 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" as one of your two answers, but many students 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 such as "On adding ammonia a blue insoluble precipitate dissolves". If something is insoluble it doesn't dissolve! 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 how splitting the answer into two

sentences has altered the meaning.

- Significant figures are not the same as decimal places. For example, 123.08 is to two decimal places but to five significant figures. Zeros before any definite numbers do not count as significant figures, so 0.000045 is to two 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 answers to an excess number of significant figures, e.g. 1.257487 instead of 1.26.
- 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 because if you make one slip you risk getting no marks for that question.
- Make sure that you know your syllabus statements and definitions exactly, e.g. the use of naphtha as a feedstock for the chemical industry. 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 (e.g. 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 and always label them.
  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.
- 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 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 are shiny" will only gain one mark because, although the first two answers are correct, the last one is incorrect (2 √ + 1 x = 1 mark).
- 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.

Paper 1 Tips: Multiple Choice

- If you are unsure of the answer to a multiple choice question, don't spend too long on it. Put a cross 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 that are left.
- 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 'D' answers in a row, 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 RTP?" many students will focus on the numbers and ignore the word "volume", resulting in the incorrect answer 1:8, rather than using volume of a moles of gas and giving 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 eight electrons in their outer shell. Remember that helium has two!

- When given a choice about electrical conductivity of ionic structures remember that the conduction is due to *ions* moving (not electrons) and they can only move in liquid or when dissolved in water. This confusion often arises because metals conduct when solids but metals are NOT ionic structures.
- When given choices of why alloys are hard, it is not the mass of the atoms which is important but their size. Remember that metals have layers which slip over each other. A bigger atom will stop the layers slipping and so make it hard.
- 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. Use your Periodic Table to calculate the relative molecular masses if you are unsure which molecule is heavier.
- 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 but it contains the compounds from the rocks and those carried in the rain as well as the chemicals put in to purify it. Therefore tap water is a mixture. (And 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 four to seven electrons in their outer shell. Remember that the number of electrons in the outer shell is equal to the group number.

Paper 2 Tips: Theory

- Reading the question thoroughly and noting the number of marks available is important. In response to a question such as "Use you knowledge of the structure of metals to explain how they conduct electricity", many students 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.
- If you are asked to compare things in the question, your answer must 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 high<u>er</u> 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.
- 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 on 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 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 <u>in using hydrogen as a fuel</u>?" 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 correct 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 means full electronic structures showing all shells, not just the outer shell.
- 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. These are banned words! 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 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 more likely to get 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 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 cause problems. Make sure that you include the carbon of the $-CO_2H$ group when you name the acid. $CH_3CH_2CH_2CH_2CO_2H$ has five carbon atoms so is the 5th 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 two carboxylate ions to balance, e.g. the formula for magnesium ethanoate is $(CH_3CO_2^-)_2\,Mg^{2+}$.
- When doing mole calculations if given an equation such as:

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

Ignore the 2 in the equation when calculating the molar mass of ethanoic acid, i.e. 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.

- Try to be as accurate as possible in all your answers. In response to a question such as "Why is the reaction between ethanoic acid and magnesium much slower than the reaction between hydrochloric acid and magnesium?", it is too vague just to say that ethanoic acid is a weaker acid. Some reference to the differences in hydrogen ion concentration is needed.
- When there are questions with large unspecified mark allocations, e.g. seven marks, you need to plan your answers out carefully and underline or list on the question paper all the points that need to be written about. It is very common to miss parts out in extended questions like this. If 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 too vague a 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 a mark, nor 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. In addition, 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*, e.g. 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 you are referring to, e.g. calcium hydroxide is added/ammonium sulphate is added.
- Avoid missing out connecting processes. For example if you are asked about how ammonium sulphate helps soil fertility, the answer ”ammonium sulphate forms nitrate ions” is not good enough because it suggests that the ammonium sulphate contains nitrate ions. A better answer would include the connecting process, in this example “ammonium sulphate reacts to form nitrate ions”.
- Know the difference between *–ides* and *–ates*. Compounds ending with *–ide* contain only two types of atoms, e.g. magnesium oxide and potassium chloride. Compounds ending with *–ate* contain three or more types of atom, one of which is usually oxygen, e.g. sodium sulphate and 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 + or – sign 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 (NOT 2+).
- Make sure that you know the solubility rules. These become important when writing state symbols in equations. If you know that carbonates of group 2 metals are insoluble in water, then you know to write $CaCO_3(s)$ in an equation rather guessing.
- 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 writing the electronic structures of ions don’t show the charge inside the nucleus. The charge should go on the top righthand corner of the ion, outside the square brackets (which are put round the ion to show that the charge is spread out all over the ion).
- 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 has 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, and 3000 with “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 Tips: Practical

- 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.
- 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 two consistent results which you can tick. 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.
- When describing colours don't use combinations e.g. blue-green or yellow-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 yellow precipitates, e.g. silver bromide, silver iodide and lead iodide. You can do this by calling them creamy yellow, light yellow, deep yellow etc, but do not write green (a common mistake) when the colour is clearly yellow.

Paper 4 Tips: Alternative to Practical

- 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 confused. Useful mnemonic devices for remembering them are:
    - Hydrogen – Lighted splint – Pops (Hylight Pops)
    - Oxygen – Glowing splint – Relights (ogre)

- Practical examiners do not generally like the term ”burns with a pop” for the result for the hydrogen test. Just ”pops” or “explodes” is fine. This is because the explosion puts the flame out, so it doesn’t burn.
- 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 loses its colour.
- When given several diagrams of thermometers showing the temperatures as an exothermic reaction proceeds and asked 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. A common mistake is to take the 3rd from the 4th, the 4th from the 5th etc.

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 is also involved in developing and examining OCR Chemistry courses and examinations in Britain. As well as undertaking several years of research he has 27 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.