Examiners' Report

Principal Examiner Feedback

January 2018

Pearson Edexcel International Advanced Subsidiary Level

Chemistry (WCH03)

Unit 3: Chemistry Labarotary Skills I

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Some learners were very well prepared and seemed familiar with the experiments examined in the paper. In other cases learners were not familiar with chemical tests or with apparatus. In general, learners knew less about the organic experiments than the inorganic ones. The standard of mathematical work was generally good, though not always easy to follow, but understanding the purpose of drawing the cooling curve, and using it to calculate a corrected temperature rise was poor. Marks were regularly lost because the learner did not read questions carefully enough, or because they gave more than one answer and one alternative was incorrect.

Question 1

Most learners knew in (a) how to carry out a flame test, though a few chose the wrong metal for the wire, or neglected to mention the flame. They talked about "putting the sample in a Bunsen" which was not allowed. Most knew the flame colour for calcium ions. A variety of colours including just "red" was allowed, but "crimson" and "scarlet" are shades of red used to describe other ions and did not get the mark.

Many learners could not suggest a correct test for steam in (b). A common incorrect response was to say that red litmus paper would go blue. A few learners mixed up the colour change which occurs with cobalt chloride with the answer for the test using copper sulfate, and vice versa.

The answers to (c) often contained atoms of elements which were not present in calcium nitrate such as carbon dioxide and chlorine. These answers must be guesses. An answer such as nitrogen monoxide, NO, is incorrect, but at least the learner is suggesting something which is plausible. The test for oxygen is one of the first tests that most learners learn about, and even this was often described incorrectly. Oxygen relights a glowing splint, and to say it relights a lighted splint does not make sense. Also it will not relight a splint which is completely extinguished, so the word "glowing" is needed.

The equation for the decomposition of calcium nitrate is not particularly easy, and no marks were given if the wrong products were shown. Incorrect balancing of oxygen was the most common error, but this could still score 1 mark if the formulae of the products were correct.

The two parts of (e) were usually answered correctly.

Question 2

Learners were asked to show how all the information given in (a) is used to identify a compound X. However in many answers there was no reference to the reaction of X with bromine giving a colourless product. This provides evidence that X is an alkene. The rest of this question was usually done well, though again some learners did not read the requirement for a displayed formula, and just gave the answer C_2H_4. In some calculations the rounding was done too early, leading to an answer of 30 for the relative molecular mass, and the suggestion that X was ethane, which of course does not fit the results of the bromine test. Learners have regularly been advised not to round numbers in calculations until the last stage, to avoid errors like this.

The expected answer in (b)(i) was to test with ammonia, but many used an indicator despite being directed not to. Learners always find difficulty remembering the name or formula of ammonia, and confuse it with ammonium which does not exist as a compound. They also confuse steamy or misty fumes, which describe hydrogen chloride, with the white smoke of ammonium chloride. This is why it is better not to describe ammonium chloride as white fumes, though this answer was allowed on this occasion. There are various possible ways of mixing the hydrogen chloride fumes with ammonia, but bubbling hydrogen chloride into ammonia solution is not a suitable method. The reaction of hydrogen chloride with silver nitrate solution to give a white precipitate was allowed, though it is not the most convenient way to do a test for hydrogen chloride in the laboratory.

The deductions in (b)(ii) were not answered well, and many learners simply said that it showed that the mole ratio of Y and hydrogen chloride was 1:2. A few answers referred to hydroxide groups, which is incorrect terminology for hydroxyl groups in an organic molecule.

In (b)(iii) many leraners did not give the relative molecular mass as asked and simply gave the formula of Y, which they may have deduced from knowledge of the reaction of ethene with potassium permanganate(VII)). This question contains various pieces of evidence which lead to a conclusion, and it was surprising that many learners did not seem to see the links.

The diagram required in (b)(iv) should show heating under reflux, so a suitable flask fitted with a vertical condenser was required. Many diagrams do not show the water jacket separate from the inner tube. Another common fault was to put a stopper in the top of the condenser, or to label the direction of water flow incorrectly. A few learners drew distillation apparatus, but could score points for a correctly drawn condenser in this set-up.

The next question, (b)(v), asked for two peaks to be drawn. The product, Z contains only one type of functional group, so learners had to deduce this was an aldehyde group and draw peaks at the correct wave numbers. Some learners drew a peak for every stretch given in the data table. Others tried to draw the whole spectrum, and showed so many ups and downs in the background noise that it was impossible to decide which peaks were to be considered as their answer. A small number showed the peaks going upwards from the horizontal axis. Learners would benefit from looking at some infrared spectra so that they understand what peaks are significant when identifying a compound. They should draw only two peaks when that is the requirement of the question.

Question 3

Most learners correctly calculated the moles of copper sulfate in (a). Many divided the mass of magnesium, 0.250g, by its relative atomic mass, 24.3, and said that the number of moles of magnesium was 0.01. Generally answers given to one significant figure are not accurate enough, but the point of the question is to show that magnesium is in excess, so it was allowed here. However, as a general rule, the number of significant figures in the data is a guide to how many should be quoted in the answer, and one significant figure would be too low. Numbers frequently written all over the answer space, without any words to show what was being calculated.

Acceptable observations in (b) were either about the colour change in the solution or the appearance of the copper which is formed.

Many learners did not score the first mark in (c) because their choice of scale did not make use of at least half of the grid. For the second mark they had to extrapolate the cooling line back, so that the temperature change at 3 minutes could be determined. Many leaners did not use a ruler when extrapolating their line, making it difficult to find the temperature rise. However the most common temperature rise given was 12.8°C, found by simply using the figures in the grid and ignoring cooling. It was also common to see a maximum temperature quoted instead of the temperature rise. The energy transfer calculation in (d) was usually correct, but many learners stopped at this point and did not use their answer for the moles of copper in (a) to calculate the enthalpy change. A significant proportion of those who completed the calculation either missed the negative sign or gave the answer to more than three significant figures.

There were many correct answers to (e). Learners had to realise that the burette is read twice when measuring out a volume of solution.

Giving an answer to (f) proved to be challenging, and only a few learners were successful. Most answers were about heat losses or molar quantities, rather than the fact that the same species were reacting and only the spectator ions differed.

Question 4

Many learners realised that 2-methylpropan-2-ol was flammable, but a surprisingly large proportion described concentrated hydrochloric acid as irritant, rather than corrosive. In (b) many answers were also correct, though some candidates answered in terms of using a tap funnel rather than a flask. If pressure is not released there is a risk of the flask breaking or the bung flying out, but some learners answered (c) as if there was an equilibrium reaction which would be affected by a pressure change.

Suggested answers in (d) were that sodium chloride is a drying agent, or that it reacts with alcohol or with hydrochloric acid or provides chloride ions for the reaction. None of these was allowed. It is added to increase the density of the aqueous layer, which makes separation of the layers easier.

The quality of the diagrams of separating funnels in (e) was very varied. Filter funnels and Buchner funnels cannot be sealed properly so are unsuitable, and so are burettes. When a suitable funnel with a tap was drawn, there were many errors in labelling the layers. The less dense compound, 2-chloro-2-methylpropane, was often incorrectly shown at the bottom.

Many candidates knew that anhydrous sodium sulfate would make the mixture in (f) look clear, or less cloudy. However answers to (g) were less well done, and the choice of a range was often either well below or well above the boiling temperature.

An unexpected error in (h) was that learners based the number of moles of reactant on the $20cm^3$ of 0.01 mol dm^{-3} sodium carbonate used as a neutralising agent in Step 3. However many good answers were seen. Learners rounded their intermediate values in different ways so a variety of final answers was allowed. A few made the error of using the 85% yield the wrong way round, but could still score 3 of the 4 available marks.

Conclusion

Learners who knew their chemistry, and read the questions carefully, were able to display their knowledge and do well.

In other cases the standard of presentation of the work was poor. Some candidates apparently arrive at the exam without such an item as a ruler to use for a graph, and it is important to make sure that work can be read easily, and that calculations can be followed.

Advice to candidates

Read the question carefully and follow the instructions which are given.

If you are asked for two reasons, two peaks, two hazards etc don't give three!

Look at examples of mass spectra and infrared spectra, and try to interpret them.

Look at a condenser so that you can draw it accurately. It has an inner tube and an outer water jacket.

Put some words beside the numbers in your calculations eg "mol Mg = ……" so that the examiner knows what you are doing.

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