WCH06 1601 Report by the Principal Examiner

General

This paper was a reasonable balance of standard and higher demand questions, the latter often requiring candidates to apply their knowledge and understanding in unfamiliar situations. It was similar in style and standard to previous Unit 6 papers on this specification and a range of skills and knowledge was assessed. The levels of difficulty allowed good discrimination between the different grades, while allowing well-prepared candidates at all levels to demonstrate their abilities. This paper is primarily designed to assess practical knowledge as far as this is possible with a written paper, but candidates were much more comfortable dealing with theoretical concepts than laboratory situations. Thus candidates found particular difficulty in dealing with questions involving straightforward ideas in slightly unfamiliar contexts. Candidates seemed much more aware than in earlier series of the requirements for gaining full marks for drawing a graph but the quality of diagrams produced was variable and sometimes very poor.

Question 1

This question provided a good range of marks. Placing one of unknown ions in the transition metals and suggesting its identity were the marks most likely to be scored. The qualitative tests were accessible but quite simple errors in many responses. Testing for ammonia with damp litmus paper was well known, but candidates who attempted to use the formation of ammonium chloride frequently referred to the addition of hydrochloric acid and to the formation of white fumes. Both groups were liable to get the formula of the ammonium ion wrong. Most candidates knew the test for sulfate ions but lost marks by choosing to add sulfuric acid with the barium salt or by using an incorrect formula for barium chloride or barium nitrate. Only the better candidates suggested a plausible formula, some omitting one of the ions that they had identified and others giving a charged species as the formula of the compound.

Question 2

The mark for 2(a)(i) was most likely to be scored for realising that 5 g was too small an amount to present a fire risk. Candidates were much more likely to refer to the melting point, failing to appreciate that it is the vapour that ignites. In 2(a)(ii) the practical issues with using a Bunsen burner were rarely understood and vague comments about controlling the temperature and even heating were the most usual responses. The observation indicating a reaction was well known. 2(a)(iv) proved discriminating with only the better candidates able to gain the marks available. A surprising number of candidates just gave a structure of the product rather than the equation which was clearly required. The identity of the gas formed in 2(b) was well known as was the test with limewater. However, there were many errors in the diagrams the most common being incorrectly placed delivery tubes, open reaction test tubes and sealed test-tubes holding the limewater. 2(c)(i) proved unexpectedly demanding. The reaction of the acid with sodium hydrogencarbonate was well known but some candidates thought that sodium reacted only with alcohols. Even where the chemistry seemed to be understood, answers could lack clarity, particularly in identifying the hydroxy group under discussion or by offering contradictory responses. Some candidates realised that sodium reacted with both functional groups but failed to note that this prevented a definitive identification. 2(c)(ii) brought many good answers; the common errors were references to the aryl carboxylic acid group or to ketones. Some responses failed altogether to link the group and the wavenumber range. Very few candidates seemed to be aware of the possibility of

using the fingerprint region of an IR spectrum in the identification of a compound. A good understanding was needed to recognise the cyclisation reaction as an esterification and many thought that a reduction had occurred although this was not always a bar to gaining the mark for 2(d)(ii). Lithium tetrahydridoaluminate(III) was often identified as a catalyst. In 2(d)(iii) once the proton environments had been correctly identified, the two subsequent marks were likely to be scored, although some candidates tried to give the relative peak heights within each proton environment group. A wide range of non-standard terminology was used to identify the splitting patterns; while this was not penalised, it should certainly be avoided.

Question 3

The use of sodium or potassium nitrite for making nitrous acid was not well known and less than half the candidates were able to suggest an ice-bath for maintaining a suitable temperature for the reaction. Despite many allowable options, the advantages of continuous monitoring over sampling methods were not appreciated and all too often candidates fell back on just 'greater accuracy'. As with 2(b)(iii), while there were some excellent diagrams many were poorly executed or omitted key features. 3(c)(i) was well understood with the better candidates linking their answer to the experimental method. The unfamiliar calculation for 3(c)(ii) proved too demanding for most and, even when the basic mathematics was understood, final answers often omitted the factor of a thousand. The graph in 3(c)(iii) was usually completed accurately and to a higher standard to earlier series. The most common error was the omission of the units on the y axis. A surprising number gave the second half life as approximately double the first and this often led to the loss of the order of reaction mark also. In 3(d), the use of gloves to reduce the risk of a caustic compound was well appreciated but only half the candidates understood the importance of dissolving the crude product in the minimum volume of solvent for recrystallisation. Very few candidates could explain the practical benefit of using a funnel without a stem. While the use of vacuum filtration to remove the soluble impurities was widely known, the advantages of this technique over gravity filtration were less well understood.

Advice

Read the questions carefully and check that your answers match the requirements of the questions.

Familiarise yourself with the sequences involved in standard laboratory procedures.

Learn the standard terminology used in nmr spectroscopy.

When drawing graphs remember that the axes must be labelled with the variable and its units.