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Examiners' Report
Summer 2009

GCE

GCE Chemistry (8CH07)
International Supplement to US021182

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General

This was the first of a new type of paper designed to be a written alternative to the continuous assessment of practical skills. The paper tested the ability of the candidates to read and correctly interpret questions and their skills in extended transactional writing, framing short but precise answers and in setting out calculations clearly and logically. While there were many excellent responses which showed a keen awareness of the practical dimension of this paper, the answers of quite a number of candidates suggested limited first-hand knowledge of some of the basic experimental techniques required by the AS course and this was particularly apparent in the question on Organic synthesis. Candidates need to know how and when to round values to an appropriate number of significant figures.

Question 1

Parts (a) and (b) produced many excellent answers showing a familiarity with the tests, their outcomes and the writing conventions associated with test, observation and inference tables. Some candidates were uncertain of the distinction between observation and inference for example giving as the observation for (a)(ii) 'gas (or carbon dioxide) evolved' even though this was also the inference. The most common error in (a) was confusion between the flame test for magnesium and the appearance of the flame when the metal is burned. Part (a)(iv) proved a good discriminator and even when the formation of a white precipitate was known weaker candidates often identified the precipitate as sodium chloride, and sometimes magnesium carbonate.

Part (b)(i) and (b)(ii) were generally done well although some candidates gave the calcium cation as being responsible for the second red flame which was an acceptable but not preferred answer. The most frequent error in (b)(iii) arose from incorrectly identifying sulfur dioxide as the product that could be inferred from the observation and then suggesting an appropriate observation to match this. The colour change of potassium dichromate(VI) was well known although some candidates reversed the colours. There were some excellent answers to (b)(v) but it proved very challenging for many candidates. Some ignored the requirement to refer to both redox processes and focused on the sulfuric acid; weaker candidates were often confused and contradictory in their answers. A significant number of candidates misread the question and discussed the redox reaction involving potassium dichromate(VI) and sulfur dioxide.

Question 2

The enthalpy change for the reaction between zinc and copper(II) sulphate is well established as an Advanced level experiment and has formed the basis of numerous questions on papers in the previous specification yet question 2 proved challenging in the range of demands that it placed upon the candidates. While there were many excellent treatments of the graphical data, a significant number of candidates were clearly unfamiliar with this type of experiment. Common errors were extrapolating the line joining the points at 3 and 4 minutes and extrapolating this to meet the extrapolation of the cooling curve and uncertainty about the appropriate time at which to measure the temperature. Weaker candidates were often uncertain which starting temperature to use. The calculations in (a)(i) and (a)(ii) were extremely well done but few candidates were able to score on (a)(iv); common suggestions referred to the 'negligible mass' of the zinc, the zinc being in excess and the fact that the

zinc reacts. Most candidates completed the calculation in (a)(v) correctly but there were still a number who, despite the prompt in (a)(iv), added the mass of the metal and others used density rather than mass. The most frequent errors in (a)(vi) were associated with correcting the final answer to two significant figures, the typical incorrect answer being given to two decimal places although some gave a final answer to two figures, for example 193 became 19. Fewer candidates had problems assigning the correct sign.

There were many excellent answers to part (b) which showed a clear understanding of the key factors involved in carrying out this experiment accurately and one that was rooted in a clear appreciation of laboratory procedures. Too many candidates relied on vague generalisations such as 'to ensure accurate temperatures' in (b)(i) and (b)(ii) or simply re-stated how the data was processed. Most candidates explained the choice of the polystyrene cup in terms of the insulating properties of the material but some confused heat capacity and specific heat capacity while others regarded heat absorption as synonymous with insulation. Most candidates appreciated that improving the insulation of the system was a simple and effective way of reducing errors but a small number relied on using more elaborate equipment, magnetic stirrers being a common suggestion; some appeared not to have read the question and suggested various more accurate measuring equipment.

Part (c) attracted a number of impressively clear and precise answers but there were a surprising number of errors. Some were unable to identify zinc as the most reactive metal but, even where the sequence was correct, the explanations either just re-stated the enthalpy changes or became very confused. Some candidates worked from the premise that high enthalpy change indicated high reactivity and deduced a reverse order (i.e. copper as most reactive).

Question 3

The observations for this question were generally of a high standard, the most common error being the failure to include the start colour of the testing solutions as well as the final appearance. Some candidates gave the colour change for dichromate(VI) (with a reducing agent) for the manganate(VII) question. The explanations were less impressive with candidates often relying on statements such as 'carbon-carbon double bond and OH group present'. Explanations of the addition reactions in terms of bonds breaking often became quite muddled. A small number of candidates ignored the statement that mechanisms were not required. The displayed formula was generally well done.

Question 4

The quality of the answers to this question was often very high but a significant number of candidates displayed a lack of familiarity with the routine procedures of Organic synthesis. There were many excellent diagrams of a separating funnel but some candidates lost this mark through careless drawing. For example, sealing the funnel or showing unrealistically wide necks to their funnel. A few candidates were clearly unfamiliar with the apparatus. Most candidates were able to correctly use the density differences given in the table. Part (b)(i) tested candidates' powers of expression as well as their understanding; while many appreciated the need to prevent the immiscible liquids separating into layers not all could articulate this clearly. Weaker candidates took refuge in vague generalisations or suggested that the shaking increased the energy of the system. The purpose of the sodium hydrogencarbonate was well understood and those that realised a gas was evolved

were also aware of the need to ensure that the pressure was not allowed to build up. Weaker candidates confused this part of the procedure with the removal of the aqueous layer. A common error in (b)(iv) was to describe calcium chloride as a dehydrating agent. While there were some excellent explanations of 'decant' in 4(b)(v) many candidates simply took this to mean pour, pour carefully or pour into a distillation flask.

In part (c) the direction of the water flow was widely understood but the bulb of the thermometer was placed in almost every possible position from in the liquid to outside the flask altogether.

The calculation in part (d) produced many excellent answers; common errors included failing to convert the volume of 2-methylbutan-2-ol into a mass and forgetting to take 70% of the theoretical mass of product. As usual candidates who set out their solution logically were less likely to make arithmetical errors. Candidates should be encouraged not to round intermediate answers but retain these in their calculator and only round the final answer.

Hints for revision

- Remember that descriptions of chemical tests should include colours at the start and end of the reaction.
- Read questions carefully.
- Familiarise yourself with the basic procedures used in chemical syntheses and understand the reasons for their use.
- Make sure that you understand how to round numbers to a specified number of significant figures.

Appendix A: Statistics

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Grade	Max. Mark	A	B	C	D	E
Raw boundary mark	50	30	26	22	18	14
Uniform boundary mark	60	48	42	36	30	24

Maximum Mark (Raw): the mark corresponding to the sum total of the marks shown on the mark scheme.

Boundary Mark: the minimum mark required by a candidate to qualify for a given grade.

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