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Examiners' report

CHEMISTRY B (SALTERS)

H433

For first teaching in 2015

H433/01 Autumn 2021 series

Version 1

Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates.

Reports for the November 2021 series will provide a broad commentary about candidate performance, with the aim for them to be useful future teaching tools. As an exception for this series they will not contain any questions from the exam paper nor examples of candidate responses.

The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

A full copy of the exam paper and the mark scheme can be downloaded from OCR.

Paper 1 series overview

This was a small entry and included a wide range of abilities. The scores on multiple choice questions showed that candidates had revised the material and they generally did well, reflecting the continued improvement since these questions were introduced. Candidates' performance on the rest of the paper showed that in some questions they lacked detail in their responses, compared with previous series in similar questions. There was also some uncertainty in practical techniques.

Candidates who did well on this paper generally did the following:	***Candidates who did less well on this paper generally did the following:***
• Successfully interpreted rate of reaction data, both graphically and in numerical form. • Balanced equations using oxidation states. • Performed calculations using moles in solution. • Calculated concentrations at equilibrium and hence K_c. • Described practical procedures in a clear, detailed and logical way.	• Omitted charges on ions. • Struggled with calculations involving solubility product and equilibrium constants. • Struggled to add curly arrows to an organic mechanism. • Did not identify or explain the intermolecular bonds in organic substances.

Themes in candidate responses

Making full use of the information in the question

	**AfL**	It was noted that careful attention to detail and close reading of the question to make best use of the information provided was not always seen and was the cause of some loss of marks. Some of the issues will be considered below in the types of questions but it is worth noting a few points here.

Charges on ions: A large proportion of candidates did not include the charge on the dot and cross diagram for the NH_4^+ ion in Q31(a)(i). Others did not include a dative bond but had 4 dots and 4 crosses. A few candidates omitted the charges on the complex ions in Q33(b)(ii) when giving K_c.

Oxidation states: Although many candidates got the correct oxidation states in Q31(b)(i), very few used the oxidation states to construct the equation in part (ii). As a result, equations did not balance or give the correct products. Some also did not notice the information given that the reagents were ammonium ions and atmospheric oxygen producing nitrate ions.

Reaction mechanism and curly arrows: Very few candidates got the curly arrows correct, while others used full, double headed arrows despite the instruction to draw half curly arrows. Many also did not give a radical as one of the products despite the fact that it was stated that it was a propagation step, with 'propagation' in bold.

Comments on responses by question type

Multiple choice questions

Multiple choice questions continued to show an improvement. The performance on the questions generally followed that expected by the level of demand of the question.

Questions on which candidates performed well were on polluting gases (Q5), catalysis (Q11) and green chemistry (Q28). They also performed well on electron configuration (Q8), half-life (Q21) and the Arrhenius equation (Q23).

Questions that were generally found more difficult were on practical topics; organic preparations (Q16 and 17) and preparation of HCl gas, which also proved difficult last year, (Q26). Other questions where scores were lower than expected were ΔH (Q4), strong and weak acids (Q19) and the detail of the greenhouse effect (Q7).

Level of response questions

In both the Level of Response questions there was a lack of detail which limited most of the responses to Level 1 or 2.

Q32(d)(ii)

There was some confusion on the types of intermolecular bonds in each of the substances in many cases and the covalent bonds were considered in some cases. The permanent dipoles in fat molecules arising from the polar C=O bonds were most frequently identified, but the description for hexane and 1,1,1-trichloroethane was rather vague. The consideration of the relative strength of intermolecular bonds broken and made and the impact on solubility was rarely seen which limited the score to Level 1 or 2.

Q33(b)(iv)

Responses on this question included slightly more detail than Q32(d)(ii). The section on setting up the colorimeter generally included the relevant details, but the calibration of the colorimeter was more vague. The idea of plotting a calibration curve was known, but details on how to obtain it were sketchy. Some responses had confused the use of a colorimeter to follow the progress of a reaction.

Calculation questions

It was pleasing to see some candidates score full marks on some of the calculation questions. In general responses were set out clearly so that the working could be followed and subsequent marks after an error could be scored. Candidates should note the instruction to give responses to a particular number of significant figures. An area of difficulty was finding the number of moles in different volumes of solution, sometimes this was due to not reading the question and giving mol/dm^3 rather than in 250 cm^3. Finding equilibrium concentrations continued to prove difficult, as did use of solubility products.

	AfL	Many responses to calculation questions were able to score 'error carried forward' marks following a mistake in an earlier part of the question as the response was set out clearly and could be followed easily by the examiner.

Practical questions

Practical techniques continue to produce a mixed response with some good responses and some lacking in detail. For example, the need to warm sodium hydroxide with an ammonium salt to get ammonia gas. The procedure for recrystallisation was sometimes vague and sometimes confused with crystallisation of an inorganic salt.

The explanation of the relative rates of hydrolysis of chloroethane and iodoethane was well understood and expressed. Many candidates did not give equations for first the hydrolysis followed by the formation of the silver iodide precipitate. In most cases they tried to combine the equations into one.

There was a similar issue with the formation of copper hydroxide from the reaction of copper ions with ammonia solution. The role of ammonia as a base was not known and responses focused on the formation of the complex. This may be due to not reading the stem of the question where it states that a pale blue precipitate is formed followed by the dark blue complex.

Data interpretation

Graphical representations of rate data proved difficult in some cases. The axes were sometimes reversed making it hard to get a rate constant from the gradient. Many candidates haven't read the stem of the question, to plot the square of concentration. The concentration time graph for a zero-order reaction was not well understood, in some cases the downward sloping line was described as directly proportional.

Key teaching and learning points – comments on improving performance

The importance of reading the question carefully cannot be overemphasised.

Guidance on using this paper as a mock

Using this paper as a mock with detailed reference to the mark scheme afterwards would help candidates see the level of detail required for the Level of Response questions. It can help candidates to structure their responses in a way that logically covers the ideas. This is especially the case in describing intermolecular bonds between different substances. It will also help in showing how calculations can be set out to make sure as many marks are gained as possible even if an error has been made. A feature of the responses from candidates who sat this paper was that they had not made full use of the information in the question, so hopefully these skills can be developed before next year's paper.

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