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Chemistry CHEM2

(Specification 2420)

Unit 2: Chemistry in Action

Report on the Examination

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General

This paper was similar in standard to previous CHEM2 papers with a mean mark of 60.1% (SD = 20.5); a small number of students scored full marks for the paper.

Question 1

In this question it was necessary to have an appreciation not only of amount of substance but also how changes in conditions altered the rate of a reaction. In part (e), the only acceptable answer for the overall equation was one in which the various intermediates were cancelled.

Question 2

The standard enthalpy change calculation in part (a) was straightforward and high scoring. In parts (b) and (c), good discrimination occurred and a great many well-articulated responses were seen. It is worth noting that no marks were scored in either of parts (b) or (c), if the effect on the yield was assigned incorrectly. The meaning of *carbon-neutral* in part (d) is spelled out in the specification and needs to refer to net emissions of carbon dioxide to the atmosphere. Parts (d)(ii) and (d)(iii) were challenging and only the best students were able to arrive at the equation for the overall reaction between hydrogen and oxygen to make water. Most students scored at least one mark in part (e); the commonest error was a failure to give the final answer a negative sign for this exothermic process.

Question 3

Balancing the equation in part (a) taxed some students but most were able to score at least one mark in part (b). There was a need for students to use correct chemical terminology in part (d), requiring, for example, reference to the "addition of water" in part (d)(ii). It was surprising to see how many made simple errors in the relatively straightforward part (d)(iii), for example, naming the alcohol as propanol rather than propan-2-ol.

Question 4

Most students have some familiarity with the extraction of titanium and many were able to apply their ideas in the novel context presented in part (b). Part (c) produced many good answers but the equation in part (d) was only answered correctly by the best students.

Question 5

Much of Group 2 chemistry requires learning and this question was no exception. The usual errors were seen although there were many very good answers.

Question 6

Part (a) involved familiar chemistry and despite this, some students struggled to score many marks, making the usual mistakes. Identification of CCl_4 as the unknown **X** was accessed by many in part (b) and equations were generally done well. The explanation of the infrared spectrum usually yielded some credit but only the best students linked together the fact that there is an absorption missing in the range 2850 – 3300 cm^{-1} with the idea either that $CHCl_3$ has a C-H bond that would give rise to that absorption or that CCl_4 does not.

In part (c), too many students referred to Cl_2 as the source of chlorine atoms in the upper atmosphere rather than referring to the breakage of the C-Cl bond in $CHClF_2$. Most students attempted to write the correct equations for the catalytic decomposition of ozone and understood the significance of this process. Part (d) was generally answered well.

Question 7

Providing the students with the basic information for the elimination reaction in part (a)(i) enabled most students to score at least one mark and more than half scored full marks. Structures of *E* and *Z* isomers were generally well understood and many students could score at least one mark in their answers to the meaning of the term *stereoisomers*.

The mechanism in part (b) is demanding and discriminated very well.

Question 8

Part (a) required a plausible safety reason and many students referred correctly to the corrosive nature of sodium hydroxide. The idea that Process 2 used waste CO_2 from the bioethanol factory was in the stem but this was not always explained appropriately.

The mechanism in part (b)(i) was answered well and although the usual mistakes were seen, students were not put off by the context. The infrared spectra in part (b)(ii) were straightforward to interpret and caused problems only for a minority of students. Fermentation in part (c) was well-known and high scoring. Not surprisingly in part (d), only the best students were able to score the mark for the equation.

Question 9

Parts (a) and (b)(i) required interpretation of inorganic results from what should be familiar chemistry. Those who had learned this area of the specification fared well, although some lost marks from failing to read (and then answer) the full question. The ability of students to work out half-equations in redox processes such as those in part (b)(ii) has improved and this question discriminated well with the better students scoring full marks and many of the weaker students still scoring something.

The question in part (b)(iii) has been asked previously in a slightly different form. It was demanding then and remained so on this occasion, with relatively few students able to recognise the fact that sodium hydroxide will react with the H^+ ions and the position of equilibrium will move from left to right to oppose the decrease in concentration of those ions.

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