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Chemistry CHEM2

(Specification 2420)

Unit 2: Chemistry in Action

Report on the Examination

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General Comments

This paper was very accessible and high scoring with full marks seen on every question. The ability to think through the answers to the questions with novel approaches proved to be quite demanding.

Question 1

This question applied known chemistry in an unfamiliar context. Part (a)(ii) was found the most demanding, even though all that was required was 'distillation'. The formula of magnesium oxide in part (c) proved to be a challenge.

Question 2

Questions that test ideas about equilibria are being answered with greater precision than in the past. In part (b), the idea that a catalyst increases the rate of the forward reaction and the rate of the reverse reaction equally was not well known and many answers either defined catalysis or explained how catalysts work. Part (c) was high scoring and most answers stated clearly the necessary information about the reaction (eg the forward reaction is exothermic) followed by the idea that the equilibrium shifts to oppose the specified change. In part (d), the idea that higher temperatures lead to higher rates of reaction was understood, but the linkage between operate at high pressures and either increase in equipment costs or increase in pumping costs was not well known.

Question 3

There was a requirement in parts of this question to refer specifically to molecules since the distribution was for molecular energies. Part (e) proved to be the most challenging because students were required to state that <u>many</u> more molecules gained energy greater than the activation energy when there was a small increase in temperature.

Question 4

The thinking required in part (b)(i) proved too much for many and only a few were able to state that, in practice, CO is not the only product and that some complete combustion to form CO_2 would occur. The answer of +1 kJ mol^{-1} was seen frequently in part (c), but some were disconcerted by this value and sought to find an alternative. State symbols were often missed in part (d)(i) and a clear statement in part (d)(ii) that the same reaction occurs for the two specified standard enthalpies was not well understood.

Question 5

Many very good answers were seen throughout this question. In part (b), the oxidising agent was not well answered by some. In parts (c), (d) and (e), the answers requiring observations suggest that not all students have had the chance either to see or to perform these simple experiments. Part (f) was well answered with the correct use of chemical names and terminology.

Question 6

Part (a) was a different approach to the ideas behind this concept and only 24% of students were able to explain their thinking sufficiently well to gain two marks. Part (b) was well known.

Question 7

Part (a) involved a simple format but the chemical demand did not diminish and only 70% of the students wrote the correct response in part (a)(i). As in Question 5(f), the correct use of chemical names and terminology was required in part (b). Part (c) was generally well answered.

Question 8

The two mechanisms in parts (b) and (c) continue to challenge some and full marks were scored by fewer than 60% of the students in both cases.

Question 9

The idea in part (a) was that Reaction 1 claimed to be carbon-neutral, based solely on the sum of the chemical reactions that occur for photosynthesis, fermentation and combustion of ethanol, was poorly understood. Answers rarely referred to the fact that fuels have to be used to plant, harvest and transport crops and then to process them to extract the sugar and to distil the aqueous solution of ethanol. Even when these ideas were given, the idea that this fuel use leads to the release of CO_2 into the atmosphere was given only rarely.

Part (b) discriminated well, although relatively few students referred to the idea that the yield is low or that bromoethane has to be made first.

In part (c), many missed the fact that a concentrated strong acid is required as the catalyst and only a few had recognised the specification requirement to know the typical conditions for the industrial production of ethanol from ethene.

Question 10

The message that students should read the full question is an important one given that as many as 10% of students gave E as the response for part (a)(ii). Answers in part (b) often included a correct reagent but with the observations the wrong way round. ~~A~~again, this suggests that students may have limited experience in either seeing or performing these simple experiments.

Parts (c) and (d) were generally well answered although rather too many wrote correct free-radical substitution mechanisms in part (d) and then contradicted themselves by trying to write alternative mechanisms. If two mechanisms are given and one is correct and the other incorrect then the rule is to penalise the student.

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