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Chemistry CHEM1

(Specification 2420)

Unit 1: Foundation Chemistry

Report on the Examination

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General Comments

Handwriting was often very poor, very faint or very small introducing the possibility of ambiguity. It also appeared that there were many students who did not use a black pen as instructed in the rubric on the front of the paper. This made these scripts very difficult to read and it was difficult for examiners to be certain that they had interpreted students' answers correctly.

Students were able to access all of the marks on the paper.

There was again a lack of understanding over the difference between decimal places and significant figures in the mathematical answers given.

Question 1

In part (a), a significant number of students struggled with a definition of mass number and many defined A_r instead. The majority of students could answer part (b) well. The answers to part (c)(i) were well known although many students gave too much detail. In some cases, this extra detail was contradictory and, therefore, lost the marks. In part (c)(ii), weaker students thought that mass and charge could be recorded separately. Answers to part (d) were generally good although many failed to read the instruction to quote the answer to 1 decimal place. Answers to part (d)(iii) were generally good although there were many irrelevant references to protons. Weaker students simply quoted that electrons determine chemical properties but did not refer to the isotopes of **R**.

Question 2

The concept of second ionisation energy discriminated well. Good students could apply their understanding of ionisation energy and gave good answers to this question. Weaker students found much of the question difficult.

In part (a)(i), many students thought incorrectly that the cross was below phosphorus. The electron configuration in part (a)(ii) was well answered and the main error in part (a)(iii) was omitting state symbols. Answers to part (a)(iv) often failed to mention the electron being removed and there were several confused responses with inappropriate use of shell/energy level rather than sub-shell/orbital. A large number of students thought that argon had the highest second ionisation energy and therefore could not score the rest of the marks in part (b). The students who did quote sodium often found the explanation difficult. In part (c), various elements were quoted but it was evident that some students did not know which was Period 3. In part (d), many students simply stated the meaning of endothermic but did not explain why the ionisation was endothermic. Some students had the idea that a bond was broken but failed to extend this to an attraction between the nucleus and the electrons.

Question 3

The definition of electronegativity in part (a)(i) was poorly answered. Common errors included referring to the power of an element rather than an atom to withdraw electrons and many students did not refer to the type of bond. In part (a)(ii), many students failed to score the second mark suggesting that shielding or atomic radius increased. Quite a number of students could not identify the bonding in part (b) correctly. Many of those who could often then contradicted themselves by referring to molecules or atoms rather than ions.

Many students did not refer to the small difference in electronegativity between the two atoms in part (c). Instead, they opted for the more accessible answer of bonding between two non-metals. Part (d)(i) was not answered as well as expected. Many students did not

seem aware of the difference between bonding type and crystal structure. The equation in part (d)(ii) was generally well answered although some students thought that the formula of hydrogen fluoride was H_2F_2. The calculation in part (d)(iii) was generally well answered although some students divided by 8 and 9 and a significant number of students thought that the molecular formula was 2OF.

Question 4

Part (a) was well answered. Part (b) was poorly answered. Many students did not understand the negative temperature scale and many did not realise that, when liquefying a substance, the van der Waals' forces reform rather than break. The equation in part (c) was generally well answered as was the environmental problem in part (d). Some students only stated that carbon dioxide was formed without linking this to the effect and a few students contradicted themselves by additional reference to the destruction of the ozone layer. Balancing the equation in part (e) was found to be difficult but the equation in part (f)(i) was given by most students. In part (f)(ii), many students scored the first mark but could not give a reason why the chemical stated would remove the sulfur dioxide. Some students gave excellent answers to part (f)(iii) but many did not realise that hydrogen bonding was only present in one substance leading a to higher boiling point. The naming in part (g)(i) was generally well done with a few losing marks due to poor spelling or the idea that the structure was cyclic. Most correct answers included the numbers although they were not strictly needed. Answers to part (g)(ii) were often poor with many students failing to identify that the molecule **X** was smaller or had smaller surface area and that van der Waals' intermolecular forces exist between the molecules. Some students thought that the breaking of covalent bonds was involved. There were various numbers given for the isomers in part (g)(iii), showing that this is a topic students struggle with. The formula in part (h)(i) was well answered by most students. Part (h)(ii) was generally well answered although if students quoted a value for pressure it was often lower than 1000 kPa.

Question 5

Students are generally confident using the ideal gas equation although some felt the need to convert volume into different units as well. Many students scored three of the possible four marks in part (a) by failing to realise that the question asked about nitrogen oxide only. Some students who realised this still did not quote their answer to the required precision. In part (b), students were more likely to score marks in (b)(i) but a few did not convert to grams in order to calculate the amount in moles. Students found part (b)(ii) difficult with the most common error being the failure to understand the mole ratios in the equation. The calculation in part (c) was not well done by many students since they did not use the balanced equation given and hence did not use the correct mole ratio in their calculation. In part (d), many students referred to nitrogen dioxide as a greenhouse gas and some students failed to score a mark since they gave a list of correct and incorrect answers and were penalised for this. Most students were able to give a correct answer to part (e), although many incorrect answers stated that excess air was needed simply to give a good supply of oxygen. Most students were able to give the correct answer to part (f) although a small, but significant, number quoted exothermic or oxidation.

Question 6

Most students were able to draw the shape of the arsenic trichloride molecule and correctly describe its shape in part (a). The most common error was to include two lone pairs in $AsCl_3$. Students struggled more with the shape of the Cl_3^+ ion with many thinking it was linear or cyclic. A few students lost marks due to only showing dot and cross diagrams without further clarification. In part (b), a large number of students supported their answer with a diagram of the new structure but failed to understand that there would be equal repulsion between the

four bonds. Many students did not realise that the lone pair became a dative bond or thought that if the lone pair was removed there would be no repulsion in the molecule. Other students described repulsion between atoms rather than repulsion between bonding electrons.

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