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Chemistry CHEM1

(Specification 2420)

Unit 1: Foundation Chemistry

Report on the Examination

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General comments

Students were able to access all of the marks on the paper. The paper gave students the opportunity to demonstrate their understanding of chemical ideas rather than having questions that asked for definitions. The overall standard of answers was good and students were able to cope well with unfamiliar elements and unstructured calculations.
Whilst the standard of English grammar and spelling remains a concern, there is also a major problem with the legibility of many students' answers. If the examiner cannot read the answer given then it cannot be awarded marks.

Some students did not use a black pen as instructed in the rubric on the front of the paper and consequently their answers were very faint and difficult to read.

There is still a concern that students do not appreciate the difference between decimal places and significant figures in the numerical answers to mathematical problems. Many students also truncated answers rather than correcting to the required precision.

Marks were also lost by students confusing chemical terms such as atom, ion and molecule and confusing principal energy levels with sub levels. Bonding is still a topic that discriminates well.

Question 1

Part (a) was done very well. In part (b)(i), many students stated that a positive ion was formed but failed to say how. The equation in part (b)(ii) was well done with only a few omitting the state symbols. In part (c), a number of students failed to score the mark since they referred to a rubidium molecule, showing a lack of understanding of the metals given. In part (d)(ii) there were many students who filled the 4d rather than the 5s orbitals and some gave an abbreviated electron structure even though the question asked for the full electron structure. Many students found part (e) difficult although it was pleasing to see some gain full marks. Part (f) was not well understood with many students confusing charge and current. The answers to part (g) were generally good although a few students did not give complete explanations and lost the last mark.

Question 2

Part (a) was done well but part (b) proved more difficult for some students. Many simply named the isomer given in part (b)(i) and few knew of the existence of cyclic alkanes in part (b)(ii). Part (c) produced many careless responses; students should know that all equations should be balanced. The type of cracking was not always specified in part (c)(ii) and many students referred to the usefulness of the products rather than to their value. It should be noted that cracking does not produce plastics; it produces alkenes that can be polymerised. Answers to part (c)(iii) showed that some students think that intermolecular forces are the only bonds broken in cracking. There were a vast number of incorrect reagents stated in part (d)(i) and many gave names rather than formulae as asked for in the question. The equation in part (d)(iii) was often not balanced and many students showed carbon monoxide as the solid product. There were many students who did not know the identity of the toxic gas in (d)(iv) and therefore did not know a chemical that could remove it.

The answers to (d)(v) were very varied. Only the students that knew the answer to part (d)(iv) could get this right. Answers to part (e) showed that many students thought that boiling involved the breaking of covalent bonds.

Question 3

The structure in part (a) was well answered. Part (b) was also answered well although a few students gave generic answers about co-ordinate bonds rather than specific answers to this question. Various bond angles were seen for part (c). In part (d), the idea of an electronegativity difference was often seen but then students often gave responses that were not specific to the molecule in the question. Many students lost marks by referring to the electronegativity of the phosphine molecule.

Question 4

Many students did not state the correct crystal structure of graphene in part (a)(i) and did not realise that the properties of graphite could be applied to graphene in parts (a)(ii) and (iii). Many students thought that the structure was metallic even though the reference to carbon atoms was given in the question. Many students knew about delocalised electrons in part (a)(ii) but then did not recognise that the ability to conduct electricity is because the delocalised electrons can move (or flow) along the crystal plane. Many students in part (a)(iii) thought that the high melting point was due to the breaking of van der Waals' forces. In part (b), there were a lot of students who did not realise that titanium was a metal and hence lost a few marks. The students who realised that titanium was a metal often stated in part (b)(ii) that the strong attraction was between oppositely charged particles. Part(c)(i) was not well answered with many students simply stating that titanium was malleable; this was just a restatement of the question and therefore did not score a mark. Students also found part (c)(ii) difficult to answer with many stating that bonds were not broken or restating the question ie that they have the same shape. The ionic nature of magnesium oxide in part (d) was well answered by most students.

Question 5

The unstructured calculation in part (a) was attempted by all but a few students. Most students managed to score two marks. The most common errors were the incorrect conversion of pressure and volume into the appropriate units and a failure to divide the total moles of gas by five. The equation in part (b) was often incorrect with many examples of B_2 and atomic chlorine given. The students who knew that there were three bonding pairs of electrons often did not realise that the repulsions of the bonding pairs were equal. The calculation in part (c)(i) was reasonably well answered. Many students scored the first two marks but then incorrectly multiplied by 500/1000. Very few produced the expected equation in part (c)(ii) although the alternative equations were often seen. Many examples of the incorrect formulae '$NaBO_3$' and 'NaB' in unbalanced equations were also seen. Part (d) was well answered by the majority of students. A wide variety of methods were seen that could score full marks in part (e). The first three marks were usually obtained but the final mark proved elusive. Many students suggested that the molecular formula was $2BCl_2$ rather than the correct answer, B_2Cl_4.

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