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Chemistry CHEM1

(Specification 2420)

Unit 1: Foundation Chemistry

Report on the Examination

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General Comments

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

It was encouraging to see some candidates able to cope with all the mathematical aspects of the paper although often the precision asked for in the question was not given in their answers. A number of candidates confused three significant figures and three decimal places.

Structure and bonding was still an area where candidates struggled. Many confused types of bonding and crystal structures and several marks were lost by candidates contradicting themselves. The organic chemistry also appeared less well prepared than other aspects of this unit. It still needs to be stressed that candidates should write using a black pen and write legibly. Some candidates' writing is so small or faint that it is difficult to read. Marks were lost when examiners could not read the writing. A clear example is in the writing of state symbols where a poorly written 'g' can look like an 's'.

Question 1

Part (a) proved a difficult question with many candidates failing to refer to molecules. Of those that did many thought that the space between the molecules was filled with air or oxygen. Many considered hydrogen bonds but not the effect on the spacing between the molecules. Intermolecular forces in part (b) were generally well known although a few thought incorrectly that there are dipole-dipole forces between methane molecules. In part (b)(iii), many candidates stated that hydrogen bonds were strong but then failed to make the comparison between the intermolecular forces in the two molecules. The shape in part (c)(i) was generally well attempted but less able candidates included two or no lone pairs of electrons. Many candidates thought that the ion was planar, but of those who correctly stated the shape as tetrahedral many followed with a bond angle of 109° in part (c)(ii) showing that they had not taken account of the lone pair of electrons in the molecule. The identification of the molecule in part (c)(iii) proved difficult and many candidates suggested ions rather than a molecule. Part (d) was not well answered.

Question 2

The electron configuration in part (a) was answered well by a good number of candidates. Part (b)(i) was very well answered. The equation in part (b)(ii) was generally well answered but less able candidates omitted the state symbols. In part (b)(iii), some candidates realised why the minimum energy was used although there were many who simply mentioned saving energy or money. The majority of candidates were able to give two correct reasons why indium should be ionised in part (b)(iv).

The definition in part (c)(i) still continues to confuse many candidates. Common errors included omitting the word 'average' on the top line and giving an incomplete expression on the bottom line. The calculation in part (c)(ii) proved difficult for candidates although a surprising number did get the correct percentage of each isotope. In part (d), most candidates stated that there was no difference in chemical properties and explained their answer well. A surprising number of candidates answered that there was no difference in chemical properties because neutrons had no effect on chemical properties. The empirical formula calculation in part (e) was generally answered well although some candidates got the 0.6:1.8:1.8 ratio and then gave the answer as In_3OH.

Question 3

The calculations in part (a) discriminated very well. Parts (a)(i) and (a)(ii) were generally well done although some candidates confused three decimal places and three significant figures

or gave their answers to only one or two significant figures. Parts (a)(iii) and (a)(iv) proved more difficult. Many candidates did not read the rubric of the question and did not give their answer to one decimal place. Answers to part (a)(v) were varied. Even those candidates who reached the correct M_r could not always calculate the A_r of the metal. Common errors included failing to divide by 2 so the answer given was Se with an A_r of 78.2. The calculation in part (b) was extremely well done. Very few candidates could not rearrange the equation. The errors seen were incorrect conversion of the pressure unit or needlessly converting the volume unit. In part (c), most candidates answered this well with less able candidates suggesting that toxic or flammable gases were produced. The calculation in part (d)(i) was generally well done although many candidates used the A_r of magnesium as 24 rather than 24.3 and rounded their answer to 0.070. Part (d)(ii) discriminated well although it defeated many candidates.

Question 4

A surprisingly large number of candidates were able to balance the equation in part (a). Incorrect answers included 49 O_2 or 49 oxygen atoms. Part (b) was reasonably well answered although some candidates just stated the melting point was 18°C and did not follow this through. Even though the formula of the product was given, a surprising number of candidates wrote equations to produce NO_2 in part (c)(i). Other incorrect equations used N and O atoms rather than N_2 and O_2. The conditions were reasonably well known. The catalyst was generally well known in part (c)(ii) but the equation caused more problems. The CO and NO equation was the most popular choice. Errors included incorrectly balancing the equation or an equation showing the production of atomic nitrogen. The equation in part (c)(iii) was done well by the more able candidates. Less able candidates missed out oxygen or used atomic oxygen in their equation.

There were many correct answers in part (d)(i) although the number of correct answers that quoted pressure in atmospheres rather than kilopascals was surprising. The equation in part (d)(ii) caused problems for the less able candidates who could not write the correct formula for butene in the equation. Answers to part (d)(iii) were generally correct although incorrect answers included coal, oil and wax.

Question 5

Only the better candidates were able to score all three marks in part (a) of this question. Common errors included confusing silicon with sulfur or stating that silicon had metallic bonding. Part (b) was not well answered by many candidates and showed that there is still much confusion between bonds and intermolecular forces. The type of crystal structure was not always mentioned. Several candidates knew that sulfur exists as S_8 and phosphorous as P_4 but then went on to state incorrectly that the melting point was high because the covalent bonds were broken. A few candidates thought that sulfur had a higher melting point because the atom was bigger. The first two marks in part (c) were scored by many candidates although the 'six particles in two dimensions' seemed to confuse them. Some obviously did not know what was meant by two dimensions and many drew far more than six particles. The last mark in part (c) proved more difficult for candidates. There were many good answers seen in part (d) but the most common reason for losing marks was the failure to refer to the delocalised electrons. Some answers read like a comparison of ionisation energies. Less able candidates considered the relative sizes of atoms but thought that more protons meant that the atom was bigger.

Question 6

The answers to part (a) were generally quite good although there were some candidates who quoted 'similar properties' without reference to chemical or physical properties. Less able candidates thought that members of the series had the same molecular or empirical formulae. The most common incorrect answer in part (b) was cracking. Part (c) was not well

answered. A surprisingly high number of candidates did not know the correct definition and many candidates could not give the name of the structure. Some candidates did not seem to understand how to deduce the empirical formula and often quoted the molecular formula instead. Very few candidates scored full marks in part (d). Many candidates realised that there would be fewer van der Waals forces in the branched chain isomer but found difficulty with the idea of less surface contact. A disappointing number of answers referred to breaking the covalent bonds in the molecules.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results statistics page of the AQA Website.