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General Certificate of Education

Chemistry 1421

CHEM5 Energetics, Redox and Inorganic Chemistry

Report on the Examination

2010 examination - January series

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Dr Michael Cresswell Director General.

General Comments

This paper was attempted by a very small number of candidates but it produced a good spread of marks and appeared to differentiate well.

Question 1

This question produced a range of answers. Parts 1(a), 1(b) 1(c)(i) and 1(c)(ii) were answered well by most candidates. The answer to part 1(c)(iii) was less well known and only 54% of candidates could suggest how to minimise poisoning of the catalyst by removing impurities from the reactants.

Question 2

This question was answered well except for part 2(b) where only the best candidates were able to write a balanced equation with the oxidising and reducing agent in the correct position.

Question 3

This question covered a new area of the Specification although the principles of redox that were involved have been tested for many years. Candidates have always found difficulty with the understanding of these principles when applied to electrochemical cells. This question discriminated very effectively between candidates. In part 3(a) only about 20% of candidates knew that the zero electrode potential of the hydrogen electrode is an arbitrary definition. In part 3(c) candidates had great difficulty with the conventional representation of the alkaline fuel cell. The most common mistakes were to give the oxidised and reduced forms in the wrong order and to use the hydrogen half-equation in acidic rather than alkaline conditions. Similar mistakes were made in part 3(d) although 39% of candidates did score full marks. About half of all candidates scored full marks in parts 3(g) and 3(h) but only 23% of candidates gained the mark in part 3(f). Many candidates opted not to answer this part.

Question 4

This question also proved to be very testing. In part 4(a) the majority of candidates did not realise that the chlorine-chlorine bond enthalpy is twice the enthalpy of atomisation. In part 4(b) only 20% of candidates could suggest correctly why the chlorine-chlorine bond is stronger than that in bromine. Many answers confused bond enthalpy with ionisation energy. Answers to parts 4(d)(i) and 4(d)(ii) were reasonable but answers to the new Specification material in parts 4(e)(ii) and 4(e)(iii) were rarely good enough to gain full marks. Candidates did not recognise that additional covalent interactions in an ionic lattice will result in a requirement for more energy to separate the particles in the lattice.

Question 5

This question was generally answered well except for part 5(b) where candidates were expected to state that, in a solid as the temperature rises, the particles move by vibrating more.

Question 6

It was very pleasing to note that most candidates made a good attempt at this unfamiliar, 'How Science Works' question. The most difficult part of the question was part 6(a) where only the best candidates could write a balanced equation showing the release of a chloride ion and the formation of a platinum complex with a single positive charge.

Question 7

This question covered familiar ground but good answers required a detailed and accurate knowledge and understanding of the cobalt chemistry in the Specification. Part (a) was well known but only about 30% of candidates answered parts 7(b) and 7(e) fully. In parts 7(c), 7(d) and 7(f) about 40 % of candidates were able to recall the correct information, and give correct explanations.

Question 8

The first part of this question tested synoptic understanding of periodicity. The question discriminated well with good candidates gaining full marks. Weaker candidates often confused electronegativity with ionisation energy. Part 8(b) also produced a wide spread of marks. Many candidates did not include in their explanations, reasons for the strong forces between ions in sodium oxide and why the forces between molecules in phosphorus(V) oxide are relatively weak. Common errors amongst weak candidates were to mistake sodium oxide for an oxide of sulfur or to refer to the existence of molecules in sodium oxide. Part 8(c) demanded an appreciation that three moles of sodium hydroxide react with one mole of phosphoric acid and that one mole of phosphorus(V) oxide gives four moles of phosphoric acid. This, together with the dilution factor of one million, resulted in a wide but even spread of marks for the question with only 15% of candidates gaining all six marks.

Question 9

Part 9(a) produced a wide spread of marks but many candidates gave good answers. Amongst the weaker candidates, there appears to be a false impression that the colour of a compound is caused by emitted light rather than the correct reason that some of the incident white light is absorbed and the remainder reflected or transmitted. Answers to part 9(b) were very disappointing and, as in question 7, showed poor recall of transition metal chemistry. The 'How Science Works' question in part 9(c)(i) was not answered well. The most common response was to claim that a spectrometer is 'more accurate'. This answer was not given any credit. It would help candidates to answer such questions if centres were able to demonstrate how a colorimeter can be used in similar experiments. It was pleasing to see many very good answers to part 9(c)(ii) where over 50% of candidates gained four marks or more.