Examiners' Report/ Principal Examiner Feedback

January 2010

GCE O

GCE O Level Chemistry (7081) Paper 02

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General Comments

Candidates found it difficult to score very high marks on Section A but there were many good answers to the Section B questions. There was a full range of marks on the paper. The descriptive chemistry on Section B was generally well known and candidates showed their ability to handle calculations. Practical observations, experimental detail and writing balanced equations remain a cause for concern.

SECTION A

Question 1

In part (a), although most candidates knew that a metal carbonate was the second reagent, far too many failed to give a complete answer to the drying agent; concentrated sulphuric acid or anhydrous calcium chloride were required for the mark. A dry sample of a gas cannot be collected over water.
It was rare to see full marks scored on part (b). Good candidates knew both observations but only a few could write the equation for the formation of calcium hydrogencarbonate. Many candidates gave 'CaOH' as the formula for calcium hydroxide.
The gas formed in part (c) was generally well known but many candidates could not write two balanced equations for the reactions.

Question 2

In part (a), only the better candidates could write equations for the formation of the magnesium and sulphide ions. Many started with the ion or failed to recognise the sulphide ion as S^{2-}. The reason for magnesium being oxidised had to be related to a correct equation in part (i).
Nearly all candidates recognised that the non-metallic sulphur would form an acidic oxide and could write the equations required; however, H_2SO_4 was often given as the product of the reaction between sulphur dioxide and water.
For the diagram of the magnesium lattice, candidates were expected to draw a regular arrangement of at least two rows of 'circles' labelled as Mg^{2+} ions with delocalised electrons between the 'circles'. Candidates should realise that current is carried by the movement of the electrons in a metal.

Question 3

This was a very low scoring question that showed a lack of knowledge of practical chemistry.
Marks were awarded in this question for describing the experimental method of separation. It was quite disturbing to read that nitrogen in part (a) and oxygen in part (b) were lighter or heavier than air and could be collected by upward or downward delivery; and also to find that some candidates treated the mixture of nitrogen and oxygen as nitrogen oxide and the mixture of sulphur dioxide and oxygen as sulphur trioxide.

In part (a), candidates were expected to pass the mixture of the two gases over heated copper in a combustion tube and to collect the nitrogen over water or in a syringe. The equation for the oxidation of the copper was often not balanced.
In part (b), the gases need to be passed through a solution of the alkali to remove the sulphur dioxide and then the oxygen should be collected over water or in a syringe. Again the equation was often not balanced.
In part (c), a large number of candidates thought that iodine was soluble in water and tried to separate the mixture by filtration. Candidates who recognised that iodine sublimes on heating were expected to heat the mixture in a test tube or other suitable apparatus and to collect the iodine on a cooled surface.

Question 4

The calculation in (a) often produced full marks, although a common error was made in translating the ratio of 1 to 1.5 by rounding up 1.5 to the nearest whole number resulting in the incorrect formula PO_2.
Part (b) was very well answered by nearly all candidates; all the lone pairs of electrons had to be shown on the three chlorine atoms and the phosphorus atom.
In part (c), most candidates recognised that an ionic bond is formed between a non-metal and metal but it was rare to see a full explanation for the difference in the melting points. Candidates must realise that more heat energy is required to break or weaken the strong attraction between the oppositely charge ions in the ionic compound than to break or weaken the weak intermolecular forces that hold the molecules of a covalent compound together. Covalent bonds are strong and are not broken when a covalent compound melts.

Question 5

This was a very low scoring question. Candidates were expected to use the data provided in the table to answer all parts of this question. Most candidates could score some of the marks in parts (a) to (d), but found it difficult to score marks on (e) and (f). In part (e), candidates had to recognise that the solubility of 8.5g in 50g of water equates to 17.0g in 100g of water and that the saturated solution was formed at 50°C. In part (f), candidates were expected to use the data to recognise that at 10 °C all the sodium chloride but only 21 g of potassium nitrate would dissolve, whereas at 100 °C both salts would be fully dissolved. The data shows that only sodium chloride would crystallise out when the volume of the solution was reduced.

SECTION B

Questions 8 and 7 were the most popular questions but there was a wide range of marks on all Section B questions. Far too many marks were lost by candidates failing to write balanced equations to support their answers to the Section B questions.

Question 6

Part (a)(i) required knowledge of practical chemistry in order to give the observations made. In reaction 1, examiners were looking for the formation of a blue solution (not a precipitate as $Cu(NO_3)_2(aq)$ was given in the equation). In reaction 2, a black solid and a brown gas were the required answers; a precipitate is not formed when a solid is heated.

In part (ii), most candidates assumed that the solution of copper(II) nitrate had already been formed and lost the first two marks for not filtering off the excess of copper that should have been added to make sure that all the nitric acid had reacted.
The calculation in part (iii) was generally well done, but a common error was to use a 1 : 2 ratio for the moles of copper to the moles of copper(II) oxide instead of the correct 1 : 1 mole ratio.
There were many excellent responses to part (b).
In part (c), the copper(I) is both oxidised to copper(II) and reduced to copper(0) in the metal. Neutralisation was an alternative answer to redox. This question demanded knowledge of practical work; a blue solution and a brown solid being the required answers. After removing the copper by filtration, candidates were then expected to show that copper is a metal by testing its ability to conduct electricity.
Many candidates had learnt that a dark blue solution is formed on addition of excess ammonia to an aqueous copper(II) salt together with the formula for the complex ammine produced. However, it was rare to see the initial blue precipitate of copper(II) hydroxide and, when given, this was often accompanied by an unbalanced equation.

Question 7

There were many excellent descriptive answers to fractional distillation, cracking and the hydration of ethene. Candidates should be aware that in fractional distillation the crude oil is vaporised in a furnace and the vapours then pass into the fractionating column; also that the hydration of ethene is carried out at 300 °C and not 600 °C. Marks were lost through failure to write equations for the cracking and hydration processes.
Good candidates often scored full marks in part (b), but ethane-1,2-diol was a common error in (ii).
The conditions for esterification are the use of heat and concentrated sulphuric acid. Many candidates could write the displayed formula for ethyl propanoate and could show the correct ester linkage.

Question 8

In part (a), marks were carelessly lost through failure to balance the two equations. In part (i), candidates were expected to know that the second stage of the process is carried out at a high temperature and that zinc is formed as a vapour. The use of carbon as a reducing agent was well known. A specific problem associated with a stated pollutant gas had to be given to score the final mark; it is insufficient to vaguely state that, for example, carbon monoxide is harmful.
As expected there were many high marks for the description of the Contact Process. Marks were lost for not reacting the sulphur dioxide with air, not dissolving the sulphur trioxide in concentrated sulphuric acid when forming oleum and not balancing equations.
In part (b)(i), weaker candidates incorrectly gave sulphur dioxide as the liberated gas. The test for hydrogen requires the use of a lighted splint, not a glowing splint. The observation mark (effervescence) was rarely scored and the equation for the combustion of hydrogen was not balanced.
The conditions for rusting were well known in (ii) and also the idea that zinc acts as a sacrificial metal.

Question 9

Marks were lost on this question through the inability of candidates to write balanced equations and correct formulae, common errors being NH_3Cl, MgCl, C_2H_5OH for ethanoic acid, $NaSO_4$, $NaSO_3$, Br and NaI_2.

In part (a), candidates were expected to know that the lower relative molecular mass of ammonia means that ammonia gas diffuses faster than hydrogen chloride gas, resulting in the appearance of the white ring of ammonium chloride closer to the hydrogen chloride end of the tube.

In part (b), most candidates scored the marks for recognising that hydrogen was evolved faster in the reaction with the stronger hydrochloric acid. It was rare to see reference made to the increase in the frequency of collision of the reacting species when magnesium was added to the hydrochloric acid. There were two marks for equations.

In part (c), candidates were expected to identify the white precipitates as insoluble barium sulphite and barium sulphate with only barium sulphite being soluble on addition of hydrochloric acid. There were three marks for equations.

In part (d), only a small number of candidates could write structures for the two isomers of C_3H_7Cl and there were only a few balanced equations for its formation.

In part (e), most candidates could discuss the relative reactivities of the three halogens but only the better candidates could write a balanced equation for the reaction.

CHEMISTRY 7081, GRADE BOUNDARIES

Grade	A	B	C	D	E
Lowest mark for award of grade	67	52	38	33	23

Note: Grade boundaries may vary from year to year and from subject to subject, depending on the demands of the question paper.

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