

# Examiners' Report Summer 2009

GCE

## GCE O level Chemistry (7081)

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# GCE O Level Chemistry

## Examiners' Report June 2009

### 7081-01 Paper 1

#### General

The paper provided candidates with the opportunity to demonstrate their knowledge and understanding of a range of topics and many achieved high marks. It is essential that questions are read carefully so that answers are relevant to what is being asked; it is sometimes not sufficient to write down a standard text book statement in the hope that it will satisfy the question's demands.

#### Question 1

Misreading the question led to formulae for aluminium species rather than ammonium ones.

#### Question 2

In (c), a common incorrect answer was 'nitrogen dioxide'.

#### Question 3

Good candidates scored full marks here.

#### Question 4

This was generally well done. It is sufficient to write '2,8,6' for the electronic configuration of sulphur; the use of the s p d type of configuration is not required.

#### Question 5

In (c) it was necessary to indicate a deepening of the blue colour when excess ammonia is added. In (d) the description 'red-brown' is usually associated with the liberation of iodine from an iodide solution and so was not given a mark. The question asked for 'colour' so 'milky' was not allowed in (f) unless accompanied by 'white'.

#### Question 6

Candidates are often good at balancing equations so part (a) caused few problems. There were many instances of incorrect formulae in (b), particularly in part (i). Part (c) asked for an equation showing only the ions involved in the reaction but many included spectator ions; there were few totally correct answers.

#### Question 7

This question caused problems for many candidates. Few realised that a nail wrapped in copper would rust fastest. The explanation was well done but it should be noted that magnesium does not 'rust'. Many of the diagrams and labels contained errors. 'Anhydrous' must precede 'calcium chloride' and there should be a bung in the top of the test tube. Concentrated sulphuric acid is not a suitable drying agent in this situation - particularly if the

nail is standing in it or if it has been used to soak a piece of cotton wool! In (b)(ii), there was often no indication that the water had been boiled.

#### Question 8

This was often completely correct, the main error being identifying the catalyst.

#### Question 9

Part (a) was well answered by most but a significant number suggested hydrogen sulphide as the gas. In (b) all that was required was 'flame test' and then the appropriate colour. Some wrote lengthy descriptions of the preparation of the wire etc. but omitted to say it is put in a Bunsen flame.

#### Question 10

This was difficult for most candidates. In (a) the question asked for the type of particles so 'ions' (or  $H^+$  and  $Cl^-$ ) and 'molecules' were the correct answers. In b(i), the particle responsible for acid behaviour is  $H^+(aq)$  etc. A completely correct ionic equation was rarely seen. In (ii) a statement that there are no ions present (from HCl) or that HCl exists as molecules was required.

#### Question 11

In (a) most realised that a gas being evolved would explain the decrease in mass. In (b) candidates then often said that the cotton wool was to stop the gas escaping. There were many guesses to this part. The graph was often good but some still use a ruler to join every point. The common misconception in (d)(i) was that the reaction speeded up at first and/or did not start to slow down until after a few minutes. In (ii) the collision theory was fairly well known but some answers concentrated on the speed of the reaction at the start and never progressed to why it slows down. Some candidates just threw 'use a catalyst' and 'increase the pressure' at this part without thinking about what will really increase the rate. It was necessary to be specific about what needed to be done i.e. increase the concentration of the acid and use smaller pieces of marble (and not just 'increase the surface area'). The calculation often resulted in the correct answer but 0.56/100 rather than 0.56/44 was quite common when calculating the number of moles.

#### Question 12

Part (a) was well answered but the calculations in (b) caused difficulties because the incorrect numbers of moles were assigned.

#### Question 13

The type of polymerisation was well known but the amide link was not (all bonds were required to be shown). In (b) the repeating unit was often incorrect, either too many units or still with a double bond or no extension bonds. In (b)(iv) some answers omitted to say which is saturated and which is unsaturated. The structure in (v) often had only two chlorine atoms in it.

#### Question 14

In (a), comparisons between metals and non-metals were required. The equations in (b) were frequently correct, the common errors being hydrogen as a second product in (i) and sulphuric acid as a product in (ii). Part (c) asked for the full electron configuration of the ions; some gave only the outer shell. It was fairly common to see an extra shell in the case of the oxide ion. The question required diagrams showing the arrangement of the electrons in the final ions and did not want ones attempting to show the transfer of electrons. Candidates should note that an ionic bond is the attraction between oppositely charged ions.

# GCE O Level Chemistry

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### 7081-02 Paper 2

There were a large number of excellent scripts on this paper which produced a full range of marks. Practical observations and writing balanced equations remain a cause for concern, but calculations were generally well done.

#### Section A

##### Question 1

Most candidates scored 3 to 4 marks on part (a) of this question. Addition of nitric acid to copper(II) carbonate in order to prepare copper(II) nitrate was well known as were carbon dioxide and water as products. Candidates who used sulphuric acid as the source of sulphate ions in the preparation of the insoluble salt barium sulphate did not appreciate that an interchange of radicals occurs and that nitric acid was the product of the reaction; an oxide of nitrogen and water were frequently given as products. Candidates should be aware that addition of hydrochloric acid to iron results in the formation of an aqueous solution of iron(II) chloride which gives hydrated crystals on evaporation; the preparation of the anhydrous chloride requires anhydrous conditions, thus hydrogen chloride gas was the reagent required. In part (b), the removal of impurities was too vague an answer to score; examiners were looking for removal of the nitrate salt. As expected the calculation was generally well done by most candidates.

##### Question 2

Candidates found part (a) difficult and there were a variety of incorrect observations made. Marks for the product were only awarded if related to a correct observation. Examiners were looking for a blue precipitate indicating the formation of copper(II) hydroxide and litmus turning blue showing the evolution of ammonia. The tests in parts (b) and (c) were generally well known but candidates should be aware that an incorrect reagent or the use of sulphuric acid and hydrochloric acid to test for a sulphate and halide respectively score no marks.

##### Question 3

Most candidates could score the equation mark in part (a). In the explanation, it was not fully appreciated that removal of the hydrogen ions left a surplus of hydroxide ions that rendered the solution alkaline. It was disturbing to read answers that implied that hydrogen is an alkaline gas or that sodium chloride is an alkaline solution. The test for hydrogen was well known but many candidates suggested the use of a glowing splint to identify the gas. Despite being given information about the bleaching action of the gas at the anode, oxygen was a very common error when answering part (ii). Many candidates had difficulty balancing the anode equation. Failure to include the state symbols as directed caused the loss of a mark in (b)(i). Although there were many correct answers to part (ii), weaker candidates did not understand

that the equation in (i) showed clearly that 2 moles of electrons (2 faradays) give 1 mole of copper and hence 20 faradays give 10 moles which equals 635 g.

#### Question 4

Part (a) provided a different approach to empirical and molecular formula calculations. Examiners were looking for the method here and marks were awarded for first dividing the percentage composition by the relative atomic mass to give a ratio of 1.5 to 3 to 1 which had to be doubled up to give the empirical formula. Candidates must have practiced this type of calculation but many did not appreciate that the relative molecular mass was the extra information required. In (a)(iii) failure to correctly show the addition of bromine to propene to give 1,2-dibromopropane lost the first two marks. There were disappointing responses to the observation made during this addition reaction, candidates often stating incorrectly that a brown solution or brown gas was formed or that propene was decolourised. Although there were many correct answers to part (c), it was disturbing to find that the alkane and the alkene were reversed on many answers. There was also much guesswork indicated by impossible alkanes or alkenes given in answers.

#### Question 5

Most candidates had little difficulty with parts (a)(i) and (ii). However candidates should understand that covalent compounds exist as simple molecules and the process of melting (or boiling) requires the separation of the molecules by breaking the weak intermolecular forces. Covalent bonds are not broken during the process. In parts (b) and (c), positive metal ions and delocalised electrons are the particles present in metals whilst  $\text{Na}^+$  and  $\text{Cl}^-$  ions are present in sodium chloride. Candidates should understand that the conduction of electricity in metals and in ionic compounds is caused by the movement of electrons and the movement of ions respectively.

### Section B

The better candidates scored highly on their two section B questions. Question 8 was the most popular question closely followed by questions 7 and 6. Question 9 was the least popular question and the lowest scoring.

#### Question 6

In part (a) the use of cryolite and the equation for the formation of aluminium were well known. The high cost of electricity and the need to replace the anodes explain why the process is expensive. High temperature or the use of a magnesium fuse was required to start the Thermite reaction. Candidates had difficulty writing a balanced equation with diatomic  $\text{Al}_2$  or  $\text{Cr}_2$  being common incorrect answers. When explaining redox, candidates must clearly state what is oxidised or reduced and why. Aluminium is oxidised because it loses electrons or it gains oxygen and chromium(III) oxide (not chromium) is reduced because it loses oxygen, or the  $\text{Cr}^{3+}$  ion was reduced due to electron gain.

Candidates had difficulty writing a balanced equation for the oxidation of lead(II) sulphide in part (iii) despite being given all the information in the question, but most recognised that the lead(II) oxide could then be reduced to the metal by either hot coke or hot carbon monoxide. When candidates are asked to state a reason for a problem, examiners are not expecting short



essays. Identification of two pollutants with simple statements, e.g. sulphur dioxide leads to acid rain, carbon monoxide is toxic or carbon dioxide leads to global warming, were all that was required.

Only the better candidates could write balanced equations for the formation of  $\text{FeCl}_3$  and  $\text{Fe}_3\text{O}_4$  in part (c). There were many excellent responses to part (d) but there are still too many candidates failing to record that precipitates are formed after addition of an alkali to the metal salt solutions.

### Question 7

Most candidates scored full marks on (a)(i). In part (ii) candidates were expected to identify reaction 2 because it was exothermic. A very wide range of answers, in terms of equilibrium, yield of product or polluting gases, were seen rather than the obvious answer that a slow rate was a disadvantage of using a low temperature. Candidates who were aware of how pressure affects the position of equilibrium of a reversible reaction scored high marks on part (iii).

The conditions for the Haber process were well known in (b). Most candidates scored either full marks on part (c), or the calculation marks following on from an incorrect equation, or incorrect formula for ammonium nitrate.

The description of the titration was generally well done. Candidates should realise that the reagent from the burette is only added dropwise near the end point, which is shown by the formation of an orange colour when methyl orange is used as the indicator. Full marks were scored for the calculation by almost all candidates.

### Question 8

The methods of obtaining ethanol by hydrolysis and by fermentation were very well known, although equation marks were often not scored. It was totally unnecessary in questions of this type to explain the formation of the ethene by fractional distillation and cracking, and the formation of glucose starting from starchy products. Although many candidates realised that the slow production of ethanol was a disadvantage of fermentation, it was not appreciated that the main advantage of fermentation is due to sugar being a renewable source of raw material.

Many candidates scored full marks on the calculation in (b) but others lost marks through failure to work out the correct number and type of bonds broken or formed during the reaction.

There were many disappointing answers to part (c). 'Dichloroethane' was a common incorrect answer in (i) and 'ethyl hydrogen sulphate' in (iii). Most candidates could score the mark in (ii) for the name of the ester but were unable to write down the correct structure. The answers demanded structures showing all the bonds for chloroethane, ethyl ethanoate and ethene.

### Question 9

In part (a) candidates did not appreciate that this question concerned how an increase in surface area in (i) and an increase in temperature in (ii) lead to an increase in effective collisions and hence in the rate of reaction. Marks were lost through failure to write balanced equations for the two reactions as demanded by the question.

Part b(i) was well answered but, in part (ii), very few candidates were aware that a brown solution or a black precipitate is formed when chlorine is passed into a solution of an iodide. Candidates were unable to write the ionic equation for the reaction. In part (iv) the oxidising agent, manganese(IV) oxide, and the method of collection by downward delivery, were well

known, but candidates did not understand that the hydrogen chloride impurity is removed by passing through water. Failure to specify that sulphuric acid is concentrated or that calcium chloride is anhydrous lost the drying agent mark, a point mentioned on previous reports.

In part (c), the comparison between the reaction of steam and cold water on metals giving rise to the oxide and hydroxide of the metal respectively was fairly well known, but candidates had difficulty writing balanced equations for the reactions. Nearly all candidates could identify a more reactive metal than calcium, but again were unable to write a balanced equation. It was rare to score two marks for the observations made when calcium is added to water.

## CHEMISTRY 7081, GRADE BOUNDARIES

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Grade	A	B	C	D	E
Lowest mark for award of grade	74	61	49	44	29

**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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