

Examiners' Report Summer 2008

GCE

GCE O level Chemistry (7081)

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GCE O Level Chemistry

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7081-01 Paper 1

General Comments

The paper provided an opportunity to demonstrate knowledge and understanding of a wide range of topics and it was possible for well-prepared candidates to achieve high marks. Calculations were often successfully performed and the method used was clearly set out. There were still many instances of incorrect oxidation states being assigned to compounds such as manganese(IV) oxide; marks cannot be awarded if the oxidation state is wrong.

Question 1

The only parts that caused problems were (e), where 'iron(II) oxide' was common, and (f).

Question 2

Most candidates scored full marks here.

Question 3

The commonest error was to write 'sulphur' in (b) and to offer a halogen in (c).

Question 4

A number of candidates wrote 'white' in (a) but the other parts were well done.

Question 5

This was a low-scoring question and guesswork was common. Few could pick out (b) and (d) as neither oxidation nor reduction.

Question 6

This was generally well done, part (d) causing most difficulty as the number of coulombs was written rather than the number of faradays.

Question 7

In (a), there was some confusion between anion and cation and the charges were sometimes omitted.

There were many good diagrams to show the electron arrangement in tetrachloromethane but some missed out the electrons in the outer shells of the chlorine atoms.

In (c), lack of clarity cost marks. It was often difficult to decide whether the weak attractive forces were within the graphite layers or between them. In diamond, it was necessary to

make clear that there are many strong covalent bonds that would have to be broken. Promising descriptions were sometimes nullified by a final reference to 'strong intermolecular forces' being present also. Many answers added confusion by containing descriptions of mobile and non-mobile electrons.

Question 8

Candidates had more success with the tests than with the reactants. Sensible reactants that would commonly be used in the laboratory to prepare these gases were required.

- (a) The expected reagents were hydrogen peroxide and manganese(IV) oxide as a catalyst and so it was surprising to see 'potassium chlorate and manganese dioxide' being offered so frequently. This answer was accepted despite the fact that it is unlikely to be found in any relatively modern text book. 'Manganese oxide' is not precise enough as an answer.
- (b) The reagents were often omitted here and the suggestion that 'a glowing splint will cause a pop' was quite common.
- (c) This part was well done but some incorrect formulae were offered for the carbonates.

Question 9

Most candidates experienced no problems when interpreting the graphs but there were few correct answers to part (d). In (ii) many thought it was the rate of cooling of the crystals rather than the solution upon which they had to comment.

Question 10

This was well answered but some omitted the charges.

Question 11

There were numerous good answers to this question although the final part defeated some candidates. The better mathematicians used very neat and precise methods to arrive at the number of molecules of water of crystallisation but more often there was a confused jumble of figures.

Question 12

Parts (a) to (c) were usually correct although some did not give the main reaction for the increase in temperature in the furnace and wrote equations leading to the formation of carbon monoxide. In (d), the chemical name or formula of the impurity was required and not just 'sand'. The explanation of how the impurity is removed was well known by many, the main error being an incorrect formula for calcium silicate. Few knew that the impurity would make the iron brittle.

Question 13

In (a), diagrams using lines for covalent bonds were expected; diagrams using spheres are not really appropriate in this type of question as they often lack clarity with respect to the shape. Some answers to (b) were good and clearly expressed but many were vague and it was not

possible to decide whether the 'weak attractive forces' were between molecules or within them. 'Intermolecular forces' is clearer than 'intermolecular bonds'. In (c), candidates who correctly deduced the number of bonds usually scored full marks

Question 14

The calculation in (a)(i) was usually correct but 'CH₂Cl' was frequently offered in (ii). The structures in (b) were sometimes identical as the bromine atoms were simply moved around on the two carbon atoms but there were many correct responses. The name was usually correct although 'dibromoethene' was seen on a number of scripts.

Question 15

Part (a) was often correct although some thought it is only the copper ions that carry the current in the solution. The ionic equation was also known by most candidates. Part (c) caused more problems. The final mass of the anode was often stated to be 8.760 g i.e unchanged. In (iii), the number of moles of copper was often not calculated and the answer was given as '19300 coulombs'. Some could not calculate the number of seconds and so did not score any marks in part (iv). There was little pattern to the answers for (d) with all options being offered.

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7081-02 Paper 2

General Comments

All questions were accessible to candidates with every marking point on the paper being scored. There was a wide range of marks, although a lack of understanding of chemical principles was evident in question 2. Examiners found that the standard of calculation work was good; however it was disappointing to see a lack of application of practical work and many candidates could not balance simple equations.

Section A

Question 1

Almost all candidates scored full marks on part (a), but many candidates did not appreciate that the time for half of the metal to react is the time when half of the final volume of hydrogen has been formed. Although candidates were aware that 15 cm³ of gas remained after 20 s, they found it difficult to express this quantity as a fraction of 60 cm³.

Part (c) was well answered by candidates who appreciated that molar volume had to be used to calculate the moles of hydrogen produced, but some answers were subsequently spoilt by using an incorrect mole ratio from the equation.

In part (d) almost all candidates recognised that using magnesium powder increased the surface area and hence the rate of the reaction, but only the best candidates realised that an increase in the number of successful collisions was due to an increase in the collision frequency.

Question 2

This question was on the whole very poorly answered and scored low marks.

In part (a) candidates had difficulty in recognising the -COOH group and the -OCO- group as the two functional groups required. Examiners accepted the -OCOCH₃ group as an alternative answer for the ester.

In part (b), the only acceptable answer was one that showed the actual number of each type of atom in the molecule, ie C₆H₉NO₅. However most candidates could correctly calculate the percentage of carbon in the molecule.

In (c) candidates did not appreciate that an acid was being added to a carbonate resulting in effervescence due to the liberation of carbon dioxide. The correct ionic equation, CO₃²⁻ + 2H⁺ → CO₂ + H₂O, was rarely seen.

Candidates were expected to relate the diffusion of the particles to molecular motion and collisions in (d)

Question 3

Many candidates were unable to write the correct structure for propene in part (a). The relationship between length of carbon chain and boiling point was well answered in (b). In part (c), most candidates could write the formula for ethanol and knew that it was formed in an addition or hydration reaction.

The equation in (d) was very badly answered, candidates being unaware that the hydrogen is removed from the alcohol as water.

The answers required for (e) were sodium ethoxide and chloroethane. Candidates must be aware that any extra chemicals listed negate the mark.

Question 4

Most candidates scored both marks in part (a) but the response to the ratio of the chlorine isotopes in (b) was very disappointing, many answers being guesswork.

There was a very mixed response to part (c). Only the best candidates knew that hydrogen chloride and chlorine were the reagents used to prepare iron(II) chloride and iron(III) chloride respectively. Many candidates started with the oxides of iron in parts (i) and (ii), or iron(II) chloride in part (ii) instead of starting with the metal. The symbol for iron is Fe, and the formulae Fe^{2+} , Fe(II), Fe^{3+} , and Fe(III) are not acceptable in equations. It was very disappointing to see monatomic chlorine and even Cl_3 being used in equations and also the use of FeCl and Fe_2Cl_3 for the formulae of the chlorides.

In part (d) there was a disappointing response to this practical-based question. Candidates should realise that when aqueous sodium hydroxide is added to aqueous iron(II) or iron(III) salts green and brown precipitates are formed and not coloured solutions.

Question 5

In part (a), the diagrams of graphite were generally well drawn. In (b) there were many answers that simply stated that the 4th electron on each carbon was free to carry current; candidates did not understand that it is the delocalised electrons between the layers that move to carry the current.

In (c)(i), candidates had to use the graphs to explain why the reaction was exothermic; the answer required the knowledge that the energy of the products is lower than that of the reactants. There was a very disappointing response to part (ii), as candidates did not appreciate that the enthalpy change is the difference in the energies between the reactants and products.

In (d), the toxicity of carbon monoxide, or the affect the gas has on the haemoglobin, and the fact that the reaction gives out less heat were the answers required. It is not sufficient to simply state, without qualification, that carbon monoxide is harmful.

Section B

Questions 6, 7 and 8 had equal popularity whilst only a very small number of candidates answered question 9. The introduction to section B in the answer booklet states, 'Where appropriate, equations and diagrams should be given to clarify your answers'. Many candidates lost marks by failing to write balanced equations which were required in Q6a, Q7a,b,c,d, Q8b.

Question 6

Many candidates did not 'state the principles involved in each process' and lost the available marks.

In part (a), the extraction of aluminium was well known. Candidates should realise that although bauxite is the main ore of aluminium, the electrolyte is purified bauxite or alumina which is dissolved in molten cryolite. Accounts of the purification of bauxite are not required. The principle involved in electrolysis is the chemical change brought about by the passage of electricity.

In part (b), the fractional distillation of crude oil was not as well known. The principle involved is the separation of liquid mixtures on the basis of boiling point difference. Many candidates were not aware that the crude oil is first heated to vaporise it and the temperature gradient within the fractionating column allows for the condensation of the fractions over their respective boiling point ranges. Inappropriate descriptions of laboratory scale fractionations were given by a number of candidates.

The addition of a catalyst to increase the rate of the reaction which remains unchanged at the end of the reaction is the principle of catalysis in part (c). The catalysis process is for the oxidation of sulphur dioxide to sulphur trioxide, and this was well known. Descriptions of the formation of sulphur dioxide and the subsequent formation of the sulphuric acid were not required.

Question 7

This practical based question produced many disappointing answers.

In part (a) candidates were required to heat the blue crystals and test for the presence of the condensed water with cobalt chloride paper. An equation was required.

In part (b), many candidates realised that the trend in reactivity is best achieved by displacement reactions, but these must be carried out in solution. Observations and an equation were required. The use of oxides is not a suitable method.

Candidates who added dilute hydrochloric acid to each metal, rarely gave an observation and many thought that copper reacted with the dilute acid to produce hydrogen.

Part (c) was generally well answered. An equation was required.

In part (d), it was necessary to compare the addition of the same mass of zinc to the same volume of dilute hydrochloric acid at different temperatures. Some evidence of the faster reaction at the higher temperature, e.g. by comparing the rate of effervescence was required.

Candidates who collected the gas in a syringe must realise that marks cannot be scored simply by stating that the graph is steeper at the higher temperature without making reference to the axes used. An equation was required.

The chromatography experiment required in (e) was generally well attempted, but candidates must be aware that water is not a suitable solvent for the extraction of the green colour from the leaf; nor can it be used to achieve separation of the coloured pigments.

Question 8

In part (a) specific transition metal chemical properties include, variable oxidation state, coloured ions or compounds, complex ions or catalytic activity. Examples using transition metals other than copper were not rewarded.

In part (b), the oxidation of copper to the oxide in reaction 1 was well known. Many candidates were not aware that in reaction 2, an excess of copper(II) oxide is added to hot dilute sulphuric acid and the unreacted oxide is then filtered off. Equations were required in both parts (a) and (b). The copper(II) sulphate solution should finally be heated to the point of crystallisation only so that the crystals can then form on cooling. Evaporation to dryness lost all marks relating to the crystallisation process.

The equations for the decomposition of copper(II) carbonate and copper(II) hydroxide in part (c), were well known, but many candidates had difficulty in writing a balanced equation for the decomposition of copper(II) nitrate.

Question 9

In part (a), many candidates could write the correct structures for the monomers but were unsure of the peptide link in the polymer.

In part (b), only a small number of candidates knew that a polyester was formed between a diol and a dicarboxylic acid, although the structures were well known.

In part (c)(i), many candidates were aware that a small molecule such as water is lost during the formation of the condensation polymer only. The need for the unsaturated monomer for the addition polymer and for compounds with two different functional groups as monomers for the condensation polymer was not well known. The cracking process in (c)(ii) was well answered.

In part (d), the structure of poly(ethene) in (i) required an open bond at each end of the structure. Candidates were aware of the saturated and unsaturated nature of poly(ethene) and poly(ethyne) respectively in (ii) and the use of bromine water in (iv) to distinguish between the two polymers was well known. The empirical formulae in part (iii), CH for poly(ethyne) and CH₂ for poly(ethene), were the only answers, any extra formulae negated the marks. Combustion was the common reaction expected in (v).

CHEMISTRY 7081, GRADE BOUNDARIES

Grade	A	B	C	D	E
Lowest mark for award of grade	72	61	51	46	33

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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