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Examiners' Report Summer 2007

GCE

GCE O Level Chemistry (7081)

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Question 1

There were numerous incorrect answers for the formula of methanol in (d) and the oxidation state of iron was sometimes missing in (e) but the other parts were well known.

Question 2

This was well done although some confused atomic number with mass number.

Question 3

Few candidates knew the colours associated with the chemicals in this question. In (b), the colour 'red' was not allowed and neither was 'red-brown' in (c) where candidates seemed to think they were dealing with iron(III) hydroxide. The colour change of sodium from 'silver' (or similar) to 'grey' or 'dull grey' was rarely seen. In (e), 'red-brown' was a popular response but it is unlikely that an aqueous solution of bromine will be this colour; candidates were confusing it with the reaction of an iodide.

Question 4

Most parts were well answered but there were a variety of answers to (d) and C_4H_{10} was a common incorrect response in (f).

Question 5

Most candidates found it easy to select the correct answer from the list of elements.

Question 6

There were many pleasing answers to this question, the main error being in (f) where the mass was divided by 16 (rather than 32) to find the number of moles of oxygen.

Question 7

Few candidates knew that dilute acid would react with a sulphite to produce sulphur dioxide but the test was well known, although there was a tendency to give incomplete answers such as 'dichromate'. In (b), even fewer candidates stated that concentrated sulphuric acid is required to liberate hydrogen chloride. It should be noted that the use of litmus paper as a test is not specific enough for hydrogen chloride as there are other acidic gases.

Question 8

Most candidates were able to select the appropriate type of reaction from the list and this question was well answered.

Question 9

Part (a) was often correct but candidates should note that in the test using silver nitrate, the colour of the silver bromide precipitate is best described as 'cream' or 'pale yellow' to distinguish it from silver iodide which is a more distinct yellow. The test to distinguish between an alkane and an alkene was well known. In (c), many candidates did not appreciate that it is necessary to add dilute acid as well as barium chloride (or nitrate) in order to distinguish between a sulphite and a sulphate. Other tests using acidified potassium manganate(VII) and potassium dichromate(VI) were accepted as was adding dilute acid followed by a suitable test for sulphur dixide.

Question 10

It was surprising to see that a large number of candidates did not know a suitable combination of acid and metal for producing hydrogen. If calcium chloride is used as a drying agent, it must be 'anhydrous'. In (c), there were numerous attempts to test for hydrogen with a glowing splint (creating a 'pop').

Question 11

There was a significant number of incorrect subtractions. For many candidates, the calculation was spoilt by approximating to one significant figure which then gave the incorrect ratio and formula. The equation was quite well done but there were some who wrote nitrogen as monatomic.

Question 12

Many candidates did not recognise the carboxylic acid group in the structure and thought it was an alcohol. Some thought that a C=O group makes it an unsaturated compound and a significant number were convinced it was a hydrocarbon. Part (d) provided one easy mark but to gain the second it was necessary to state that the carboxyl group dissociates to give H^+ ions.

Question 13

The ionic equations caused problems; incorrect balancing and the electrons on the wrong side were the common faults. In (c), it was necessary to make clear that the charge is carried by mobile ions and that in the solid state the ions are not mobile and hence no current flows. 'Free ions' are not the same as 'mobile ions'. References to 'electrons' should be avoided as candidates rarely emphasise that the electrons move only in the wires. The 2:1 ratio in the calculation was often missed, leading to an answer of '20.7g'.

Question 14

Parts (a) and (b) were well done. In (c), the 2:1 ratio was often missed and the M_r of copper(II) nitrate was often calculated to be twice its correct value. Part (d) was well answered.

Question 15

The equation in (b)(iii) was rarely correct as the charge balance proved to be difficult for many. The most successful answers used the simple equation $H^+ + OH^- \rightarrow H_2O$. Many incorrect answers were seen for (d) as candidates did not realise that the pH had to increase by 2 units and not 7.5 units. In (e), it was necessary to state that limestone is a base (not 'an alkali') or that it would neutralise any acid. The equation proved to be beyond most candidates.

7081/02

All questions were accessible to candidates. The majority scored high marks on the Section B questions, although Section A questions proved to be quite difficult for many. The quality of the equation work was disappointing with many failing to balance a simple equation despite having all the formulae correct.

In Section B, Q6 was the least popular question, whilst Q7 and Q8 were the most popular. Marks generally were high on all questions except Q6. Candidates should realise that the number of lines given for each part of the questions is sufficient for a complete answer and long descriptions are totally unnecessary.

Section A

Question 1

Most candidates understood that the drying agent used in the diagram and the method of collection were incorrect, but candidates should note that upward delivery is the same as the downward displacement of air and not the upward displacement. The responses to the equation in (b) were very disappointing, with many unable to balance the equation. The test for ammonia was well known, but the observations required in (d) were answered correctly by only a relatively small number of candidates. The addition of ammonia is similar to the addition of any alkali to a copper(II) salt in forming a blue precipitate, but in the case of ammonia, the precipitate dissolves in an excess of the reagent. Many were unsure of the formula of the complex ion formed.

Question 2

The responses to the ionic equation in (a) were very disappointing. Candidates did not know that a reaction occurs between magnesium and hydrogen ions in an acid-metal reaction, regardless of which acid is used. As in Q1(b), candidates could not balance the equation despite having the correct species in the equation whilst some candidates thought that the metal carried a charge and the magnesium ion was Mg^{+} rather than Mg^{2+}. In (b) candidates did not understand that the final volume of gas liberated is the same in both experiments when the same number of moles of reagents are used, and that time for half the magnesium to react is taken from the graph when half the volume of gas has been evolved. Part (c) was disappointing and marks were only scored if the molar volume of gas was used in the calculation to find the moles of hydrogen formed and hence the moles of magnesium used in the experiment. The use of different strengths of the acids was responsible for the different rates in (d) whilst in (e) both marks were often scored for recognising the increased rate, steeper graph, and same final volume of gas.

Question 3

Part (a) was often completely correct. Although candidates were able to write the structure of polyethene, many gave the name of the polymer rather than describing the type of polymerisation as 'addition'. The equation in (c) was well known, but candidates are expected to know the temperature and the pressure under which this industrial process is carried out, and that phosphoric acid and not concentrated sulphuric acid is used as the catalyst. Despite being told to answer (d) in terms of intermolecular forces, many answered in terms of the bonding within the molecule.

All the answer required was a statement that the intermolecular forces in ethanol are stronger than in propane.

Question 4

Many gave totally unnecessary long descriptions of fermentation starting from starch. Candidates are only expected to know that ethanol is obtained by adding yeast to an aqueous solution of glucose at a temperature between 30ºC and 40ºC, followed by the fractional distillation of the ethanol. As in Q3b, the name of a polymer was given rather than describing the type of polymerisation as 'condensation'. Candidates did not understand that in condensation polymerisation, water is lost from the monomer and that the structure of the polymer requires alternative O atoms and a "box" with a bond at either end of the structure.

Question 5

This question required an understanding of practical work. In (a) candidates were expected to read all the temperatures to 1 decimal place. Most scored 2 marks for plotting the graph correctly. Failure to realise that the line of best fit did not include the plot of the temperature in experiment VI frequently lost the third mark in (b). The volume and temperature measurement in (c) should have been read from the graph. Those who realised that the acid and alkali reacted in a 1:1 mole ratio often scored both marks and examiners credited the final answer on the candidate's response to the volume of acid given in (c).

Section B

Question 6

Reaction A often scored full marks, but candidates should realise that if a colour change is given for the observation mark it must be correct, (green to black, any other colour to black is penalised). The reagent in B is dilute sulphuric acid. In this reaction an excess of copper(II) oxide is required and the blue solution is obtained after filtration. In reaction C, candidates had to recognise that copper(II) carbonate is insoluble and has to be formed by adding a soluble carbonate, for example sodium carbonate solution, to the copper(II) sulphate solution and then filtering off the green precipitate.

In (b) the change from copper(II) oxide to copper required a reducing agent such as hydrogen, carbon monoxide or ammonia which is passed over the heated oxide. The colour of the copper formed is red-brown and not red. Addition of a suitable more reactive metal, for example, magnesium or zinc, (but not sodium) is the reagent in the conversion of copper(II) sulphate to copper. Part (c) was well known, but a mark was lost through failure to recognise the electrolyte as an aqueous solution of a specified copper(II) salt.

Question 7

This question required short descriptions of an experiment to show each statement. Answers that explained theoretically why an increase in surface area of a reactant increased the rate, or why gases diffuse at different rates did not receive credit.
Answers tended to give too much detail, often repeating what had already been written, in each of these 5 mark sections. There was sufficient space for complete answers to these questions.

Part (a) was well known but an equation showing a reversible reaction was required to score the mark. Candidates should note that the formula of the hydrate includes 5 moles of water per mole of salt. In (b) candidates were expected to add equal volumes and concentration of acid to the same mass of lumps and powdered calcium carbonate. A simple sentence to illustrate how the statement could be proved, such as, 'the powdered compound gave the same volume of gas in a shorter time', was all that was required to score 2 marks. The equation was frequently not balanced. In (c) sulphur dioxide had to be formed first by burning sulphur in air, and the acidic nature of the oxide shown by use of a suitable damp indicator paper. Part (d) was well answered, but candidates should note that the thermometer must register the change of temperature of the solution rather than the temperature of the air outside the test tube. Full marks were often scored in (e).

Question 8

Parts (a)(i) and (iii) were well answered, although a small number of candidates used 12g as the mass of carbon in 1 mole of pentane rather than the mass of 5 moles of carbon atoms. The two isomers were generally well known in (ii); numbers were not required in front of the names as they were not ambiguous, but if given they must be correct, i.e. (2)-methylbutane and (2-2)-dimethylpropane. Many simply rotated the methylbutane isomer through 90º to give an incorrect second isomer.

Candidates are advised to write out structures showing all the bonds in order to do calculations using bond enthalpies. Use of the incorrect numbers of bonds broken and bonds formed often lost 4 marks. The overall enthalpy change is then obtained by subtracting the numerical value of the energy for the forming of bonds from the value of the energy to break bonds.

Failure to balance equations lost marks in (c) and it was disappointing to see hydrogen as a product of combustion of pentane rather than water. Candidates should avoid statements such as carbon monoxide is dangerous or harmful without qualification. The answers required included the toxic nature of the gas and the effect it has on causing asphyxia, together with the inefficiency of the incomplete combustion process due to less heat being given out.

Question 9

As expected the industrial manufacture of aluminium was well known, but candidates must understand that the electrolyte used in the extraction process is alumina, (purified bauxite) and not the impure ore, dissolved in molten cryolite. Marks were lost by writing incorrect electrode equations. The thermite reaction in (b) was generally well known. Marks were carelessly lost in (c) through a failure to read the question. The answer required the electron configuration of both the atoms and ions of the two elements, not just the atom. It was not appreciated in (d) that the metal structure contains a regular arrangement of Al^{3+} ions, not Al ions, and delocalised

electrons, and that electricity is carried by the movement of these electrons and is not due to the movement of the metal ions.

Appendix A: Statistics

Overall Subject Grade Boundaries

Grade	Max. Mark	A	B	C	D	E	U
Overall subject grade boundaries	100	74	62	51	46	33	0

Paper 1

Grade	Max. Mark	A	B	C	D	E	U
Paper 1 grade boundaries	100	74	64	54	49	34	0

Paper 2

Grade	Max. Mark	A	B	C	D	E	U
Paper 2 grade boundaries	100	74	61	49	44	32	0

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