IGCSE CHEMISTRY 4335, NOVEMBER 2005
CHIEF EXAMINER'S REPORT

Paper 1F

General Comments
Questions in this section are targeted at grades G, F and E.

Question 1
This question was designed to test candidates' knowledge of atomic structure. Most scored 3 or 4 marks, with none of the five parts proving noticeably more difficult than the others.

Question 2
This question was about the gases in air. Many candidates knew which gases were present and their approximate percentages. Some confused the test for oxygen with that for hydrogen (tested in Question 3).

Question 3
This question was about the reaction between zinc and sulphuric acid. Even though part (a) asked for a word equation there were some attempts at a chemical equation. Most candidates chose filtration as the separation method in part (d).

Question 4
This question was about the extraction of iron and rusting. Part (a) asked for the solid raw materials used in the blast furnace – some responses included gases such as oxygen and carbon dioxide. Most candidates knew the substances needed for rusting, but its prevention by galvanising was less well known.

Question 5
This question was about magnesium and its compounds. In part (a), few could accurately describe the observations made when magnesium burns in air, and in part (b), water was not generally known as the reagent for converting the oxide to the hydroxide. The pH value of magnesium hydroxide solution was often incorrect. Part (d) tested the conversion of the hydroxide into the chloride; few candidates could interpret the information in the reaction scheme to arrive at the correct answers.

Question 6
This question was about hydrocarbons. In part (a), although most candidates knew that the given molecules contained hydrogen and carbon, some did not include the word "only". Candidates were more familiar with homologous series than isomerism. Some attempts at the displayed formula of ethene were based on a different molecule, or used dots and crosses.

Question 7
This question was about the manufacture of ammonia. This was not well known, with few candidates progressing beyond knowing that nitrogen and hydrogen were needed.

Paper 1F Section B/Paper 2H Section A

General Comments
Questions in this section are targeted at grades D and C.

Paper 1F Question 8 / Paper 2H Question 1
This question was about the bonding in, and the solubility and uses of, some common compounds. In part (a), most candidates completed the table with the correct number of ticks in each row, although few scored full marks. The commonest errors were to choose ionic bonding for ammonia and solubility in water for poly(ethene). Most candidates chose a correct use for poly(ethene), although some gave a use that was not specific enough ("plastic bags" scored, but just "plastics" did not). In contrast, few could name two uses of sodium hydroxide, with making sodium and hydrogen featuring among common incorrect responses.

Paper 1F Question 9 / Paper 2H Question 2
This question was about the formation and reactions of chlorine. Few chose a correct manganese compound to react with hydrochloric acid in chlorine's formation, and several errors were seen in the description of the test for chlorine (the litmus not being damp and the colour changing to red without continuing to colourless). In part (c), few could identify iron(III) chloride as the product of the iron-chlorine reaction (iron(II) chloride and formulae were common incorrect answers). Candidates should be reminded that a formula cannot be a correct response to a question asking for a name, and vice versa. Part (d), about the displacement of iodine by chlorine, was generally well answered.

Paper 1F Question 10 / Paper 2H Question 3
This question was about the bonding in hydrogen chloride and water. In part (a), most descriptions of a covalent bond lacked a reference to a pair of electrons. The link between structure and boiling point was better known in part (b). The electronic configurations and the dot and cross diagram in part (c) were generally well done, although several candidates gave 2.8.6 instead of 2.6 for oxygen.

Paper 1F Question 11 / Paper 2H Question 4
This question was about the formation of simple ionic compounds. The idea of electron transfer in part (a) was well known, although many candidates failed to score full marks. The commonest error was not to make clear that two fluorine atoms each gained one electron, while a small minority had the electron transfer the wrong way round. The definition of oxidation in terms of electron loss was less well known in part (b). Parts (c) and (d) were usually well attempted.

Paper 1F Question 12 / Paper 2H Question 5
In part (a), most candidates were able to interpret the information in the table of indicator pH values and colours correctly. Parts (b)(i) and (ii) were poorly answered. The idea of testing for ammonium ions by converting them to ammonia and testing for this gas was unfamiliar to most, even though this method is clearly indicated in the specification. Also unfamiliar was the preparation of ammonium chloride in part (b)(ii), especially the idea of mixing together the reagents in the proportions found by titration, and the avoidance of heating the solution to dryness. Few answers to part (c) were correct, with many candidates choosing to prepare lead(II) chloride using an insoluble lead compound and chlorine.

Paper 2H Section B

General Comments

Questions in this section are targeted at grades A*, A and B.

Question 6

The theme of this question was sodium chloride solution. The formulae asked for in part (a) were usually correct, although $H_2O(aq)$ instead of $H_2O(l)$ was sometimes seen. The test for chloride ions was generally well known, although a minority described the test for chlorine gas. The term diffusion was not often given in part (b)(iii), with ionisation a common incorrect response. Few candidates scored full marks for the distillation diagram in part (c). A minority connected the pieces incorrectly (the vertical condenser connected directly to the flask side-arm), while some omitted the bung in the flask. Most failed to label the diagram sufficiently. Candidates should be reminded that when a labelled diagram is asked for, it is not normally necessary to label the pieces of apparatus, since a careful drawing should indicate what the piece is. In contrast, it is essential to label substances, since their identities cannot be inferred from a diagram. In this particular case, with three types of water (sea, drinking and cooling water), it is important to label all three clearly. Candidates should also distinguish between distillation and fractional distillation (the former to separate a liquid and a dissolved solid, and the latter to separate a mixture of liquids).

Question 7

This question was about the chemistry of copper. In part (a), although most candidates referred to delocalised electrons, few mentioned that the structure of copper includes a lattice of positive ions. The decomposition of copper(II) carbonate in part (b) was well answered, although there were some word equations instead of the requested chemical equation. The conversion of the oxide to the nitrate was less well known; the reagent was often given as NO_2 and the type of reaction as oxidation. There were few correct attempts at the formula of the ammine complex. Answers to part (c) included CuO_2, CuO_3 and $CuCO_3$ instead of Cu_2O.

Question 8

The theme of this question was the chemistry of ethene. Most candidates quoted correct uses of ethene and hydrogen in part (a). Few candidates understood how to complete the energy level diagram in part (b). Part (c) was well attempted, with many all-correct answers seen, although some omitted coefficients in the calculation. There were several correct answers seen to part (e), although some candidates did not distinguish between a reversible reaction and a reaction at equilibrium. The symbol $\rightleftharpoons$ indicates that the reaction can be made to go in either direction, not that a position of equilibrium has been reached.

Question 9

This question was about some organic reactions. Parts (a) to (c) were usually correct. Part (d), about fermentation, was less well known. The raw material was often given as sucrose, or even glucose, and the reasons for using the process were often vaguely economic (such as “cheaper”, but without explaining why). Correct answers to part (e), about esterification, were rare.

Question 10
The theme of this question was the reactions of three metals. The reaction of calcium with water, tested in part (a), was confused with that of more reactive metals, and several descriptions included the metal “darting” across the water; few mentioned the cloudiness caused by the formation of calcium hydroxide, although there were some successes with the equation. In part (b), the reaction of zinc with steam was invariably thought to produce the hydroxide, rather than the oxide. In part (d), the term displacement was well known, but few could give a correct ionic equation to go with it. The substances need for iron to rust were well known, but its protection by galvanising were not.

Question 11
Over half of the marks in this question were for calculations, and many correct answers were seen to these. Some candidates read kilograms as grams in part (b), but this error still enabled candidates to score the following five marks consequentially. Part (e), about the use of limestone in the blast furnace, was poorly answered, with many candidates not realising the silicon dioxide was the impurity removed.

Paper 3

Question 1
This question was tested the students' ability to recognize items of laboratory apparatus and read measurement scales. Most students, as expected, could name the majority of items correctly. However, a minority of candidates seemed unfamiliar with these common items of laboratory apparatus – students are expected to have used, or have seen in use, a full range of laboratory apparatus and, where appropriate, be familiar with the scales on them.

When reading scales, the greatest degree of accuracy expected will normally be to half a scale division (so a measuring cylinder marked with divisions every $2cm^3$ cubed can be read to $1cm^3$ and a burette marked with $0.1cm^3$ divisions can be read to $0.05cm^3$). Some candidates tried to read the levels shown in the diagrams to unprecedented levels of accuracy while others seemed not to realize that, unless reading the level of a liquid such as mercury, the bottom of the meniscus should be used.

Very few candidates could identify the most and least accurate items of apparatus, suggesting a lack of familiarity with laboratory work.

Question 2
In part (a), the students were required to calculate the volume of oxygen contained in the bottle used. Those candidates who had read the introduction to the question - and so knew the total volume had to be $1000cm^3$ - had little difficulty in calculating the required volumes; others seemingly entered random numbers into the table.

The graph proved straightforward to plot. Most candidates produced a sensible scale for the y-axis and plotted the given values accurately. The best fit line was difficult to draw; the mark was given for any reasonable attempt at a best fit line. Candidates did not obtain the mark for the line if they had simply joined points 'dot to dot' or if they had multiple graph lines visible at any point.

Part (c) required candidates to realize that where a graph as a turning point (a maximum or a minimum), then additional data in the region of the turning point will help decide the shape of the graph line more accurately. Part (d) focused on the idea of reliability; reliable data is data that is similar when the experiment is repeated (the data is precise or reliable if repeats give similar values). We can tell if data is reliable only if it is repeated and results compared.

Part (e) was testing an understanding of reacting molar ratios in equations. Many candidates realized that when the bottle contained only hydrogen, there would be no oxygen and so no reaction. The idea of the 2:1 ratio in the equation was only commented on by the best candidates and very few realized that with a stoichiometric mixture of hydrogen and oxygen in the bottle, the maximum amount of hydrogen is able to react and so propel the bottle the furthest. Part (iii) extended this idea to a different reaction: very few candidates realized that the ratio was the other way round to the hydrogen reaction.

Question 3
The majority of candidates stated that timing should start when the last of the reagents (hydrochloric acid) had been added. In part (b), most candidates were able to select the anomalous point correctly, but it must be remembered that points near the line are not anomalous. Very few candidates scored highly when explaining what may have caused the anomalous result. The given reason for any anomalous result must account for the observed direction of deviation, in this case the reaction time is too short, and so the reason given must specifically cause a shorter reaction time (vague statements such as 'measured it wrongly' will not gain credit). Since this part of the question started with 'Explain…', candidates were expected to suggest a possible cause for the shorter recorded time and then explain why this would cause the recorded time to be low. Most candidates could read the value from the graph in part (b) (iii), but a few failed to work out the rate or rounded the value for the rate incorrectly.

In part (d), candidates were required to 'give two reasons' (and so, in contrast to part (b) (ii), no explanations were required). Very few candidates realized that at higher temperatures the rate of cooling would be faster and so the temperature may not be controlled properly; only the best candidates stated that with high rates of reaction the time becomes difficult to measure accurately (due to a greater percentage error).

In part (e), candidates were required to state a relationship and explain it. The statement of the relationship was worth two marks, and so a simple statement of 'as temperature increases rate gets faster' could not gain full credit. The second mark was for further detail of the relationship (such as 'non-linear' or 'exponential'). Very few candidates scored highly on the kinetic theory based explanation.

The experimental plan in part (f) required students to devise a fair test in which the independent variable was the volume of the hydrochloric acid. Very few candidates understood that as the volume of acid was changed, the volume of water must also change to maintain the same total volume – unless this volume is maintained 'depth of solution' changes and so introduces another variable.

Question 4
Some candidates failed to read the information through and so did not know the mass gained was the mass of gas dissolved – these candidates simply read the value of 160.6 from the table and failed to do the required subtraction. The majority of candidates spotted the simple relationship required in part (b) and it was pleasing to note that they could spot a suitable safety precaution and link it to the toxic nature of SO_2.

Very few spotted the possible problem of evaporation of the solvent in part (d), and in part (e) few realized that the more SO_2 that dissolved, the lower the pH would become.

CHEMISTRY 4335, GRADE BOUNDARIES

Option 1 : with Written Alternative to Coursework (Paper 3)

	A*	A	B	C	D	E	F	G
Foundation Tier				44	37	30	23	16
Higher Tier	79	64	49	35	29	26		

Option 2 : with Coursework / Transferred Coursework

	A*	A	B	C	D	E	F	G
Foundation Tier	No candidates this session							
Higher Tier	82	68	54	40	33	29		

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