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IGCSE Chemistry (4335)

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Examiners' Report

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Paper 1F, Section A

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 rusting and rust prevention. Although most knew that air and water were needed for rusting, very few knew the use of zinc in galvanising. The weakest candidates were unable to select correct uses of different methods of rust prevention, with galvanising food cans and painting bicycle chains appearing several times.

Question 2

This question was about separating mixtures. Although most candidates selected chromatography to separate different coloured inks, and filtration for sand and water, many did not appreciate the difference between distillation and fractional distillation. The physical test for the purity of water was almost unknown.

Question 3

This question was about atomic structure. Knowledge of the mass, charge and location of the fundamental particles was quite good, and the completion of the table of mass numbers and atomic numbers was well attempted. Recognising isotopes and elements in the same period, and electronic configurations, were less well done.

Question 4

This question was about crude oil and ethene. Few candidates were able to correctly select the substances obtained from crude oil, many not appreciating the significance of the term "directly" (which was in bold). Several did not give "fractional distillation" as the method of separating crude oil. Knowledge of ethene and its reactions was not widespread.

Question 5

This question was about the extraction of aluminium and iron. Very few candidates showed much knowledge of aluminium extraction, and the extraction of iron fared little better.

Question 6

This question was about sulphuric acid and copper(II) sulphate. Although most candidates recognised H_2SO_4 as the correct formula of sulphuric acid, far fewer knew its effect on indicators, and a substantial number thought that hydrogen was produced in the reaction with copper(II) carbonate. The questions designed to test understanding of the steps used in the preparation of copper(II) sulphate were poorly answered.

Common Questions

General Comments

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

Paper 1F Question 7 / Paper 2H Question 1

This question was about the manufacture of sulphuric acid. Very few candidates could identify two sources of sulphur; most gave the earth's crust as a source. Answers such as metal ores and volcanoes were not accepted, as these are predominantly sources of sulphur dioxide; several candidates gave sulphur dioxide as a source. Common wrong answers to part (b) included "sulphur", "hydrogen" and "oxygen" (the last was not accepted because it is not a raw material. Part (c) was better answered. Candidates are advised to specify a particular temperature (ideally, the one given in the specification) rather than a temperature range; although a range of temperatures was accepted, candidates whose range is so wide that one value falls outside the accepted range did not score.

Paper 1F Question 8 / Paper 2H Question 2

This question was about the preparation and manufacture of chlorine. Although many candidates knew the colour of, and test for, chlorine, the other question parts were not well done. A wide range of reagents appeared in part (a); even though the question stated that a manganese compound was used, answers such as "calcium carbonate". In part (b), the reason for the given method of collection was often "it is a gas" or there was a reference to irrelevant information such as electronic configuration. In part (e), candidates were asked for one use of chlorine (indicated in bold); they should be advised in such cases to give only one use, since if a second, incorrect, use is given as well as a correct one, no mark is awarded. Although most candidates knew about the use of chlorine in water treatment, several did not score a mark through lack of precision. For example, "in swimming pools" is not sufficient without a reference to disinfection, sterilisation or killing bacteria; also, "purifying" and "cleaning" are not acceptable answers to this question.

Paper 1F Question 9 / Paper 2H Question 3

This question was about alkanes, and was generally well attempted. Even so, there were many places where candidates lost marks:
(a)(ii) – omitting the vital "only"
(b)(i) – carelessness in writing the general formula, such as C_nH_{2n} + 2
(b)(iii) – chemical properties are similar, but physical properties are not – they show a gradation or gradual change
(c) – giving "general formula" instead of "molecular formula"
In questions such as this, a mere "formula" does not score, since candidates are expected to understand the differences between general, empirical, molecular and structural formulae.

Paper 1F Question 10 / Paper 2H Question 4

This question was about relationships between atoms and ions in the Periodic Table. Parts (a) to (e) required candidates to make a selection from a list of atoms and ions; very few all-correct answers were seen, and even for some good candidates there was evidence of confusion between electron loss and gain. In part (f), many candidates correctly selected MgO as having a higher melting point than NaCl, although almost none could explain their choice in terms of the greater charges on the ions, even though the charges on all four relevant ions appeared at the beginning of the question.

Paper 1F Question 11 / Paper 2H Question 5

This question was about hydrogen chloride, and was poorly answered by all but the best candidates. In part (a), although most candidates knew that a negative sign for ΔH meant that the reaction was exothermic, far fewer could give the meaning of the symbol; although "enthalpy" or "heat" appeared in many answers, it was not always linked with "change". In part (b), covalent bonding and electron sharing was quite well known, but the idea of two, or a pair of, electrons was not. In part (c), several candidates correctly showed a shared pair of electrons between the two atoms, but then added an extra electron to each. Part (d) was usually attempted but rarely correct, with many answers not making clear which bonds were breaking; in many cases the terms "hydrogen bonding" or "bonds between hydrogen atoms" appeared. Part (f) was poorly attempted; many of those who gave the correct reagent were unable to write a correct equation. Even better candidates were careless with formulae, such as "$AgNo_3$" instead of "$AgNO_3$".

Paper 2H, Section B

General Comments

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

Question 6

This question was about the halogens. Many candidates had problems with part (a); although some were able to predict that astatine would be a solid, suggesting a reasonable value for the boiling point of bromine proved a challenge, and many values below 0 °C and above 100 °C were seen. In part (b), although most candidates wrote that the charge on a halide ion was negative, few actually stated "–1". The explanation often included a mention of electron gain but rarely anything about achieving a full outer shell of electrons. In part (d), few scored both marks for the equation, common errors being "Cl" instead of "Cl_2" and formulae such as "KBr_2". Although many knew that the bromine formed was coloured, many lost the mark through describing it as bubbles or a gas. The empirical formula calculation in part (e) was often well done; relatively few spoiled their attempts by using atomic numbers instead of relative atomic masses.

Question 7

This question was about the extraction of aluminium. High scores were rare, and most parts of the question caused problems for candidates. In part (a), many answers repeated information from the question, such as "it is difficult to obtain molten aluminium because its melting point is high". Cryolite was often stated to reduce the temperature, or the boiling point, frequently with no reference to the substance. In part (b), balancing the supplied equation for the discharge of the oxide ion proved beyond most candidates, and the equation for the discharge of the aluminium ion revealed many errors, including the reverse equation and the wrong charge on the ion. In part (c), many of those who correctly avoided "aluminium" as the species being oxidised referred to their choice as oxygen rather than the oxide ion. In part (d), the burning of the carbon electrodes in oxygen was better known, although a surprising number failed to mention carbon or graphite. Part (e) was rarely correct, with few candidates being able to describe the structure of aluminium in terms of a lattice of positive ions surrounded by delocalised electrons; there were several references to negative ions, covalent bonds and molecules.

Question 8

This question was about acids and ion tests; half the marks were for calculations. In part (a), many candidates were unable to distinguish between strong and weak acids, and many misconceptions were revealed, examples including that strong acids have higher pH values and are more corrosive. The series of calculations in part (b) was very well attempted, with a pleasing number of candidates scoring full marks; most of those who did not were able to obtain the majority of marks through consequential marking. Common errors included giving the answer in dm^3 in (iii) and omitting the unit in (vi). In part (c), the flame test was much better known than the test for sulphite ions.

Question 9

This question was about crude oil and some organic reactions. In part (a), many candidates wrote that the crude oil fraction containing methane as natural gas. In part (b), very few candidates realised that methane was a contributor to global warming as a greenhouse gas in its own right; many suggested that its combustion to carbon dioxide caused the problem. In part (c), many knew that a high temperature was need for cracking, but the question about why long-chain hydrocarbons were available was the most difficult mark on the paper to achieve. The calculations in part (d) were very well done; relatively few candidates obtained a positive value in (iii) through doing the subtraction the wrong way round. In part (e), the toxic nature of carbon monoxide and its effect on blood was well known, although the equation for its formation was less well done.

Question 10

This question was about the manufacture of ammonia and nitric acid. In part (a), the source of hydrogen and the catalyst used were generally well known, but the equation for hydrogen's formation was not; many attempts used laboratory methods such as the reaction of potassium with water, or cracking reactions using methane instead of a hydrocarbon with many more carbon atoms. In part (b), the other materials needed were rarely correct; substances such as nitrogen, nitrate and various oxides of nitrogen Part (c) was generally well answered – the reversible arrow was well known and many candidates were able to successfully apply Le Chatelier's Principle. The term dynamic equilibrium proved more difficult, with many answers referring to amounts being "balanced" or "equal", with no reference to rates of reaction. In part (d), some recognised nitrogen oxides as contributors to acid rain, while many gave vague answers such as "harmful", and a few referred to the ozone layer. Other answers lacked precision, such as "is a pollutant" or "is bad for buildings".

Question 11

This question was about a comparison of diamond and graphite. High scores were rare, with many candidates not even correctly stating the number of bonds formed by each carbon atom (six in graphite appeared frequently). The term "sliding" often appeared in explanations of graphite's lubricating power, but all too often it was not made clear what was sliding (atoms, electrons, molecules, rather than layers of atoms). In part (c), most of those who got as far as quoting the strong covalent bonds failed to refer to the need to break them during sublimation.

Paper 3

Question 1

This question was tested the students' ability to recognize items of laboratory apparatus and their use in the laboratory. Most students, as expected, could name the majority of items correctly. The funnel was sometimes incorrectly identified as a 'filter'. Candidates are expected to have used, or have seen in use, a full range of laboratory apparatus.

Most students could identify the funnel as being used to help remove insoluble substances for a solution but it was less common for students to be aware that the burette was suitable for measuring a given volume.

Question 2

This question was designed to be a relatively straightforward on the process of chromatography.

Part (a) required knowledge of the method used and the reason for that method. Very few candidates realized that if the sample was placed at the bottom of the paper it would dissolve in the eluting solvent in the beaker rather than be carried up the paper. Surprisingly few candidates could give observations that would be made during the procedure, suggesting that those candidates had not actually carried out this process. In (c) (i) most candidates scored the mark for the measurement but some candidates did not realize the measurement should be made from the middle of the start point to the middle of the spot. In (ii) candidates were expected to give two letters corresponding to the two coloured dots present in M, many candidates gave only one letter and so could not score. (iii) tested the candidates' ability to apply their knowledge of a procedure and resolve a problem; very few candidates suggested the expected answer of using a different solvent.

Question 3

This question was concerned with measuring the volatility of liquids. Part (a) dealt with the idea of 'fair testing' and was generally well answered. Part (b) dealt with experimental design. Many candidates seemed to be unaware of the flammable nature of many organic liquids and were more concerned with the prospect of the watch glass cracking. While most candidates could read the thermometer and stop watch scales in part (c) a few made the same mistake and gave 60.7 (rather than 67) and 45.7 (rather than 52) – thinking that every unlabeled scale division must be 0.1 rather than look at the values of the labels shown.

Part (d) required analysis of the data provided. This was generally well answered. The distillation apparatus in (e) caused a few more problems. The name of the process was known by approximately half of the candidates but some candidates failed to even attempt part (ii) while some others labeled everything on the diagram that they could. Only a minority of candidates could name the condenser and even fewer could relate this procedure to the boiling point of the liquids. As said earlier, candidates are expected to have used, or have seen in use, a full range of laboratory apparatus

Question 4

This question was based on the determination of the oxygen content of air. In part (a) very few candidates seemed aware that the volume of gases changed with temperature. The most common error in (b) was to read the left hand syringe as 55 rather than 45; these candidates had not noticed that the left syringe faced the opposite direction to the right hand syringe. To answer part (c) candidates had to add together the gas volumes shown in the table above; many candidates did not realize this or gave answers that resulted from simple arithmetic errors. The graph in (c) proved to be straightforward although candidates must be made aware that a straight line graph needs the use of a rule to produce the line – freehand attempts at straight lines will not be credited. In (d) most could correctly identify an anomalous point. Part (e) was based on a standard laboratory experiment, although the use of phosphorus rather than magnesium is more often seen. Very few candidates understood that the magnesium would combine with oxygen in the air and so result in an increase in water level. It was not uncommon for candidates to state the water level would drop due to evaporation caused by the heat. In (d) (iii) candidates were expected to be able to explain why the use of a bell jar would give less accurate results than a syringe; very few candidates scored a mark here. It is expected that candidates will know that the wider the cross section of an item the less accurate it will be in measuring a volume (so a pipette is more accurate than a burette, which is more accurate than a measuring cylinder which is more accurate than a beaker); no candidate spotted this fact – those who gained a mark here did so by noting that the bell jar had no graduations.

Question 5
This question was based on reaction kinetics.

It was clear from some answers that some candidates did not read through the question carefully. In part (a) a common wrong answer was to state that temperature should be kept constant despite the fact that the question told then it was at 'room temperature'. In part (b) most failed to spot which student did not use $50 cm^3$ of solution – had they read the introduction explaining the experiment? In part (c) most candidates were able to calculate the rate correctly but a similar proportion were unable to calculate the % concentration of the hydrogen peroxide; a common error was to say student D had used 60% rather than 50% (a result of not checking the total volume used by that student). In general the graph in (d) was well plotted but a significant number of candidates failed to add a line to the graph; the instruction in the question was 'draw a graph' – this means plot the points and draw a line. In d (ii) very few candidates scored the mark; as had been said before in examiners reports, when describing a relationship candidates are expected to give a full description; here the relationship was directly proportional and that was the expected answer, just saying 'as one gets bigger, so does the other' was not sufficient. Part (e) required some experimental design and fair testing. Some long and rambling answers were seen that failed to get down to the main points – some candidates may find it easier to answer this type of question with series of bullet-pointed statements.

COURSEWORK (PAPER 4), PRINCIPAL MODERATOR'S REPORT

Centres who entered candidates for the coursework option have received a report directly from the Principal Moderator.

For general comments about coursework please refer to the Moderator's Report for June 2006.

CHEMISTRY 4335, GRADE BOUNDARIES

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

	A*	A	B	C	D	E	F	G
Foundation Tier				54	44	35	26	17
Higher Tier	75	62	49	36	25	19		

Option 2: with Coursework

	A*	A	B	C	D	E	F	G
Foundation Tier				N/A	N/A	N/A	N/A	N/A
Higher Tier	75	63	51	39	28	22		

No candidates at foundation tier entered coursework so there are no grade boundaries for this category

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

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