CHEMISTRY

Paper 0620/01
Multiple Choice

Question Number	*Key*	*Question Number*	*Key*
1	**B**	21	**D**
2	**B**	22	**D**
3	**B**	23	**A**
4	**A**	24	**C**
5	**D**	25	**C**
6	**C**	26	**A**
7	**C**	27	**A**
8	**D**	28	**B**
9	**A**	29	**B**
10	**B**	30	**C**
11	**B**	31	**D**
12	**C**	32	**D**
13	**B**	33	**A**
14	**D**	34	**C**
15	**A**	35	**D**
16	**D**	36	**A**
17	**A**	37	**C**
18	**C**	38	**B**
19	**C**	39	**B**
20	**B**	40	**A**

General Comments

In this examination candidates produced a well spread set of marks with a mean mark of 24.35 and a standard deviation of 7.0.

Comments on individual questions follow

Questions 1, 2, 6, 7, 9, 12, 25, 26, 34 and 40 proved to be particularly straightforward with over 75% of responses being correct.

Question 20 proved to be the most difficult question on the paper with many candidates choosing responses **A** and **C**. The question discriminated well but weaker candidates chose **A**, knowing the pH change correctly but not reading the question correctly to see that the sulphate test would fail. The smaller number choosing **C** realised the test would fail but confused the direction of pH change.

In the following questions weaker candidates particularly chose some of the distractors in significant numbers.

Question 15

Here **B** was a very popular distractor due to weaker candidates halving the temperature change because the volume of water had halved.

Question 21

C was a popular distractor in this question, probably due to candidates realising that an acid was the correct answer and picking the first one without considering the sulphate test.

Question 22

Here **C** was, again, a very popular distractor. This was probably because they chose the first answer that fulfilled the requirements of ‘experiment 1’ but failed to read further and take into account ‘experiment 2’. However, some candidates thought that ammonia is a bleaching agent.

Question 36

Candidates clearly understood that filtration would not work but were unaware of the fact that fertiliser residues are not removed in the water works and so chose the distractor **B**.

Question 33

In this question, **C** attracted a significant number of candidates, both weaker and stronger ones. This can only be due to a lack of understanding of how nitrogen oxides get into the atmosphere. They are not products of the combustion as such, but are still produced as a result of the combustion of fossil fuels in internal combustion engines.

CHEMISTRY

Paper 0620/02

Core Theory

General comments

The question paper was tackled well by many candidates and good answers were seen to most of the questions. However, various aspects of electrolysis and kinetic particle theory in **Question 7** were not well answered. The range of marks obtained by the candidates was very wide and most were entered at the appropriate level.

In general, the rubric was well interpreted and there were only a few instances where candidates disadvantaged themselves by giving multiple answers. The major exceptions were in **Question 4(d)**, where a considerable number of candidates ticked only a single box rather than the two required and in **4(b)(i)** where several candidates selected a letter from the diagram rather than writing the name of a raw material. Many candidates attempted all parts of each question but there were more questions left unanswered than in previous sessions even though the standard and format of the questions was the same as in previous sessions. The standard of English was generally good.

Although most candidates had a good knowledge of the properties of metals, few were able to write simple balanced equations or remember word equations for specific reactions. A surprising number of candidates had difficulty with writing word equations correctly: the arrow was often omitted and there were many more examples where candidates tried to use minus signs in symbol equations e.g. $CaCO_3 - CO_2 \rightarrow CaO$. Encouragingly, fewer candidates than usual wrote symbol equations where word equations were asked for or vice versa.

Unexpectedly, a large proportion of candidates did not know simple basic facts such as the percentage of oxygen in the air or why fertilisers are added to the soil. As in previous sessions many candidates had a poor knowledge of chemical tests for specific ions or molecules. For example, many could not describe a simple test for water and few gave correct answers for the test for calcium ions in **Question 7(c)**. The names of pieces of apparatus such as measuring cylinder and flask were also often not known.

It was encouraging to note that many candidates were able to identify the environmental effects of specific compounds in **Question 2(a)**, an area which in previous Papers has not been well answered. In more extended questions, candidates often disadvantaged themselves by sloppy and non-specific writing. Many candidates did not respond well to the questions on organic Chemistry, especially **Question 6(c)**. The uses of specific hydrocarbons were often not well known, the boxes on the right hand of the table in **Question 6(c)** often being left blank. Few candidates could give a correct use of lime but in contrast to this, it was pleasing to note that most candidates could give a suitable use for aluminium.

Comments on specific questions

Question 1

This question was generally answered well with most candidates scoring well over half marks. The major errors arose from a lack of knowledge of how metallic structure changes across a period and a knowledge of the alkali metals. The most encouraging feature of the candidates' answers was the improved ability to draw the correct electronic structure for an atom, in this case, sodium.

(a) This was generally well answered, many candidates obtaining three or four marks. The most common errors were to suggest that carbon is metallic and that **E** (sulphur) is metallic. The former probably arose because candidates did not read the word carbon and focused on the 'conducts electricity' part. The latter is less explicable but may arise from the fact that conduction of heat rather than electrical conduction was given as a property.

(b) This was the least well answered part of **Question 1**. Few candidates referred to the change from metallic to non-metallic character across the Periodic Table. Those who did gain a mark usually referred to decrease in metal reactivity down the group. Many candidates appeared to muddle groups and periods, so that statements such as 'increase in metal reactivity as the period number increases' were common. Although this is a correct statement it does not answer the question and so cannot be given credit. Increase in proton number was another incorrect response that was often seen.

(c) (i) Most candidates were able to draw the electronic structure of sodium. The most common errors were either to give the outer shell two electrons or to put one or two groups of four electrons in the inner shells.

(ii) Although many candidates balanced the equation correctly by adding an electron to the right hand side of the equation, at least a third clearly did not understand the notion of electron loss or gain and gave the incorrect answer Na^+ on the right.

(d) This was fairly well answered by many candidates. The most common errors were to put potassium in place of lithium and a variety of answers instead of 'Group I elements are relatively soft'. The most common correct answer of the four required was that the Group I elements form basic oxides.

Question 2

This question was fairly well answered by most candidates but there were some surprising errors even by candidates who scored well elsewhere. Parts **(a)** and **(b)(v)** were generally well answered but the rest appeared rather 'hit and miss', with few knowing the percentage of oxygen in the air or recognising a neutralisation reaction.

(a) Most candidates scored at least two of the three marks available for this part. The most common error was to suggest that nitrogen oxides arise from the incomplete combustion of fossil fuels. Most candidates scored the mark for recognising one of the possible sources of carbon monoxide.

(b) (i) Although many candidates realised that oxygen was involved in the reaction, many wrote too vaguely to gain credit - for example: 'sulphur gains oxygen' or 'there are three oxygen atoms afterwards'. A common error was to suggest that oxidation was the gain of electrons.

(ii) Surprisingly few candidates could remember the approximate percentage of oxygen in the air. Many answers gave 75-78% and answers suggesting that 90-100% of the air consisted of oxygen were not uncommon. Percentages from 5-17% were also common incorrect suggestions as were values around 30%. It is clear that some candidates confused oxygen with nitrogen and others could not convert the proportion of one-fifth to a percentage.

(iii) This was the least well answered part of this question. Few mentioned neutralisation or even acid-base reactions. Most suggested either exothermic or endothermic. Candidates are not expected to know the enthalpy changes of specific reactions other than combustion reactions and should be advised that the response to 'type of chemical reaction' requires a specific type of rearrangement of atoms seen in an equation and not an energy change. A minority of candidates suggested other incorrect answers such as oxidation, reduction and substitution.

(iv) Although about half the candidates scored one mark, usually suggesting that fertilisers promoted plant growth or increased the yield of the crop plant few gained a second mark. Many candidates gave very vague answers which merely referred to fertilising the fields. It was clear that many were thinking of biological fertilisation or a vague idea relating fertilisation to germination rather than in terms of putting back nitrogen, phosphorus or potassium into the soil. The answers had to be marked quite generously in order that candidates could stand a chance of even obtaining a single mark. Examples of poor answers included 'to allow plants to grow' and 'to put minerals into the soil'. Very few candidates mentioned putting back specific compounds/elements such as nitrates or nitrogen into the soil.

(v) This part elicited the greatest number of correct responses for this question, ammonium sulphate being suggested by at least two thirds of the candidates. The commonest errors were to suggest nitrogen or other ammonium salts, such as ammonium sulphate.

Question 3

Although many candidates gained at least half marks for this question, each part provided pitfalls for many. A surprising number of candidates could not describe how lime is obtained from calcium carbonate or made fundamental errors in identifying the correct reactants and products for this thermal decomposition. Very few knew a suitable use for lime. The rate aspects of this question were better answered but a considerable number of candidates failed to respond to **(b)(iv)**. Candidates should also be advised to draw their graphs using a pencil which is not too hard or thin – some of the lines could hardly be seen on the paper.

(a) (i) The word heat or high temperature was rarely seen. Many candidates thought that oxygen was involved in the reaction or that it was a combustion reaction rather than a thermal decomposition. This error may arise from a misreading of diagrams of a rotary kiln, where hot air is blown through to heat the limestone. It should be stressed that this hot air is merely for heating (and removing excess carbon dioxide) and plays no part in the reaction. Many candidates were content to write merely that 'carbon dioxide is removed' – this is not sufficient for credit.

(ii) Many candidates failed to gain this mark because they insisted on putting oxygen on the left or right of the equation or reversing the equation. Another common error was to suggest that calcium oxide, carbon dioxide and oxygen were formed or that carbon or carbon monoxide were formed.

(iii) Very few candidates knew a large scale use of lime. About ten percent of the candidates suggested, correctly, that lime is used to neutralise acidic soils. The answer 'for neutralisation' (without further qualification) was considered too vague to warrant a mark. Common errors included: for making limestone or for building; for making quicklime; for roads; for food and in the extraction of iron. The last of these incorrect uses is understandable in terms that the limestone used in the blast furnace decomposes into lime in the furnace – but it is not added to the furnace as most answers suggested. The use of lime in steelmaking as opposed to iron extraction was, however, an acceptable answer. A minority of candidates suggested that lime is used for limewater. This was not accepted unless it was made clear that it is used *to make* limewater. It is debatable, however, that this is a large scale use of lime.

(b) (i) Most candidates scored at least two marks for labelling the apparatus correctly. The main error was to suggest that the flask was a beaker. The measuring cylinder was often mistaken for a gas jar or a test tube. Nearly all candidates scored the mark for the thermometer, although a few wrote 'temperature'.

(ii) The word equation was generally well done, the most common errors being to forget one of the products, to call hydrochloric acid 'hydrochloride' or to misname calcium chloride as 'calcium chloro' or 'calcium chlorin'.

(iii) Many candidates failed to read the graph accurately enough and chose 80 seconds as the time when the reaction was just complete. Others failed to understand the concept that the reaction stopped when no more gas had been released and gave the answer 160 seconds.

(iv) A significant number of candidates failed to respond to this question, perhaps because there were no answer lines. Just under half the candidates gained the mark for showing a faster rate at the start of the reaction but fewer gained the mark for showing that the final volume of gas was the same. The most common incorrect answer was to show the rate being slower at the start and ending up at a lower volume of gas being produced.

(v) This was generally well answered, most candidates giving the answer of slower rate and faster rate respectively. It should be noted that the Examiners were generous in marking this question. An indication of slow or fast was given credit for a low level answer. The best answers should show some comparison – for example: 'fast<u>er</u> rate', 'slow compared with more concentrated acid'.

Question 4

This was not as well answered and few candidates scored more than half the marks available. Parts **(a)** and **(e)** posed problems for most candidates and each of the other parts showed up particular misconceptions. There were many vague answers to **(c)(ii)** and **(e)**.

(a) This was poorly answered, only a minority of candidates realising that haematite was the ore of iron. Few gave the correct names of other ores. Most candidates simply gave the name iron ore or iron oxide as an answer. There were also many answers which were merely guesses. For example – bauxite or limestone were often seen as incorrect answers, even when 'limestone' was also written down as an answer to **(b)(i)**.

(b) (i) A minority of candidates identified limestone as being added to the furnace to remove impurities. Many just wrote letter **B** or did not answer the question. The most common incorrect answer was 'coke'.

(ii) About a quarter of the candidates correctly identified **C** as being the slag layer. The most common error by far was to suggest **D**, the molten iron.

(c) (i) Many candidates scored a single mark, usually for recognising that oxygen is diatomic. The most common errors were to write 2O for oxygen, write oxygen as $O_,$ balance using 3C and 3CO and to add other species where the dotted lines were.

(ii) In contrast to previous sessions, where the affect of carbon monoxide was fairly well known, in this time, few gave a satisfactory answer. There were many vague statements. The best answers simply stated that the gas was toxic or poisonous. Some good answers included the effect of carbon monoxide in preventing the oxygen binding to haemoglobin. Common errors included causes asthma, makes breathing more difficult, affects the lungs, causes brain damage (confusion here with lead) and stops the blood circulating round the body.

(d) There was a wide variety of responses to this question. The most frequently ticked box was the third down (carbon gets oxidised). The most common error was to suggest that the reaction was an example of thermal decomposition, the candidates here presumably focusing on the word heat in the stem of the equation rather than understanding the term decomposition. Another common incorrect combination was boxes three and five – the latter indicating that many candidates do not understand the term neutralisation.

(e) This was one of the least well attempted questions on the paper. Most candidates focused, incorrectly, on the high melting point of aluminium but many also gave arguments about the low melting point of aluminium. Those candidates who did refer to the high reactivity of aluminium failed to capitalise on this by not comparing the reactivity with carbon. Many candidates suggested, incorrectly, that aluminium had too low a reactivity.

(f) (i) The majority of the candidates remembered that aluminium is extracted by electrolysis. Common errors were to suggest that oxygen is used to extract aluminium or that a more reactive metal is used.

(ii) Most candidates gained this mark. The most common correct answer referred to the bodies of aircraft while a minority suggested pots and pans or cars. The candidates who failed to gain a mark often wrote vague statements such as 'for things in the kitchen' or 'for alloys'. Uses must refer to specific uses not general chemical terms.

Question 5

Many candidates scored less than half marks for this question. Parts **(a)(i)**, **(b)**, **(e)(i)** and **(e)(iii)** were generally correct but **(c)** and **(d)** proved difficult for many. Few candidates understood that combustion of any organic compound produces carbon dioxide and water. This has been commented on in previous Examiner Reports. The concept of a functional group was little understood and even a low level question such as **(b)** caused difficulties for a considerable number of candidates.

(a) (i) This was generally well done, most candidates realising that energy was released which raised the temperature of the water. The various ways that this was expressed, although given credit, were often poor.

(ii) As in previous sessions, this type of question about the products of combustion of organic compounds was poorly done. Water was the most common correct answer but few candidates identified both water and carbon dioxide. Incorrect answers included incorrect compounds such as ethanol oxide and butanol oxide, as well as elements such as hydrogen and unrelated organic compounds such as butane and carboxylic acids.

(b) Some candidates failed to gain the marks here because they gave products of combustion rather than fuels – for example: carbon dioxide. Others failed to gain marks because they suggested fuels not containing carbon, for example hydrogen. Other errors included generic substances such as petroleum (which is not used as a fuel by itself) and alcohols. Credit was given to a wide range of fuels with specific names.

(c) Very few candidates appeared to understand the term functional group. OH was rarely seen and many penalised themselves by merely writing –ol rather than the formula as requested. Most candidates incorrectly wrote either the general formula for alcohols or the formula for ethanol.

(d) Only a minority of candidates knew a chemical test for water. When this question was answered, candidates often wrote about a physical test with reference to the boiling point of water. A variety of inappropriate tests were suggested – for example relating to bromine or to the addition of organic chemicals.

(e) (i) Most candidates could describe a method of preventing iron from rusting. The most popular choices were painting and galvanising. Candidates who failed to gain the mark for this question generally wrote about excluding air or excluding water without mentioning any method of doing this.

(ii) The term hydrated was fairly well known although it was seldom well expressed in the answers. Common errors were that it was the loss of water from a substance, addition of hydrogen to a substance (or of hydrogen plus water) or removal of hydrogen.

(iii) Most candidates gained at least one mark for this part. Many candidates referred to general metallic properties rather than the properties such as formation of coloured compounds or high melting points that are typical of transition elements. Some candidates lost marks because they implied that the transition elements were coloured rather than the transition element compounds.

Question 6

As in previous sessions, many candidates appeared to struggle with the concepts of organic Chemistry. The idea of a homologous series was not well known; neither were naming and writing the formulae for organic structures. Many candidates left the 'uses' column in the table in **(c)** blank or suggested rather strange uses, especially for methane.

(a) This was the least well answered part of this question. Many candidates referred to definitions of hydrocarbons rather than to the concept of a homologous series. Those who tried to answer the question in terms of chemical and physical properties often gave incorrect statements – for example: 'the physical properties are similar' or 'their properties are the same'. The latter did not gain a mark because the candidates had failed to distinguish between chemical and physical properties. Few referred to the same functional group.

(b) Although most candidates scored one mark for this part, few scored both marks. The formula was generally correct but the incorrect name, methane or butane, was very often given. A significant minority of candidates wrote the formula for butane or methane after having given the name ethane.

(c) Very few candidates obtained five or six marks for this part with most achieving only two or three marks. Methane was often named correctly and the structure for dibromomethane was generally correct. The most common errors were to either put one bromine atom or the incorrect number of hydrogen atoms. Only a minority of candidates could draw the structure of ethene. Common errors included lack of a double bond and six hydrogen atoms rather than four. The correct structure of ethanoic acid was rarely seen – the most common error being to attach single oxygen atoms to each carbon. These candidates clearly did not even realise that oxygen forms two bonds when it combines with other atoms. The uses for ethene and methane were not well known. Methane was often incorrectly held to be the starting point for the manufacture of ethanol and a variety of other implausible compounds whilst ethene was often incorrectly stated to be a fuel. The use of methane as a natural gas for cooking was the mark most commonly scored for the uses.

(d) A considerable number of candidates failed to calculate the relative molecular mass of dibromomethane. Candidates should be advised that there will generally be some sort of simple calculation in the core paper, either a calculation of relative molecular mass or a calculation involving simple proportions. Those candidates who did attempt the calculation were generally successful. The most common errors were to use atomic numbers or to count up the number of atoms.

Question 7

This was the least well answered question on the paper with most candidates scoring well under half marks. The major errors arose from a lack of knowledge of the test for calcium ions and misunderstandings about the nature of solids, liquids and gases and electrical conduction in ionic substances.

(a) (i) Most candidates failed to mention ions and wrote vaguely about particles or molecules moving about. When ions were mentioned, there was often much confusion about what was happening. Electrons were often incorrectly held to be the particles responsible for conduction in a molten electrolyte. Candidates who recognised that the ions were able to move in the molten calcium chloride often failed to mention the solid calcium chloride and therefore lost the second mark.

(ii) Many candidates wrote vague answers about melting and boiling points, often lumping them together. Answers such as ‘chlorine has a lower boiling point than calcium’ were common. Few candidates wrote about the proximity or motion of the particles. In fact many candidates did not mention particles at all. Statements such as ‘the chlorine is far apart and the calcium is close together’ were common. Incorrect statements about bonding abounded - for example: ‘the bonds between calcium atoms are strong but the bonds between chlorine atoms (not molecules) are weak’.

(b) (i) Although many candidates got at least one of the two marks available, usually the mark for calcium, many others appeared to guess the answers here. Hydrogen and oxygen were common incorrect statements as was stainless steel. The most common error, however, was to suggest that calcium chloride was formed at the anode. A considerable number of candidates suggested that the anode product was chloride rather than chlorine.

(ii) This was surprisingly poorly done, with less than half the candidates realising that carbon/ graphite was the required answer. A wide variety of substances were suggested, many of them gases or liquids! This suggests that many candidates do not understand the basic terms in electrolysis. Metal electrodes were often suggested, aluminium being a particularly popular incorrect example.

(iii) Many candidates left this question unanswered. Those who attempted it, often realised that inert gases were unreactive but only a few wrote about preventing air reacting with the hot calcium. Some candidates failed to obtain the mark because they suggested that the inert gas reacts with the calcium.

(iv) A surprisingly large number of candidates suggested that hydrogen, oxygen or chlorine were inert. The most common correct answer was argon.

(c) Many candidates did not know the test for calcium ions. Common errors were: to suggest the use of pH paper; to write about blue precipitates; to write about other tests such as the test for nitrates and to suggest that ammonia is released.

Many candidates suggested that the precipitate re-dissolves in excess sodium hydroxide. Those candidates who scored three marks were likely to be the ones who knew that there is no precipitate (or hardly any) with aqueous ammonia.

Location Entry Codes

UNIVERSITY *of* CAMBRIDGE
International Examinations

As part of CIE's continual commitment to maintaining best practice in assessment, CIE has begun to use different variants of some question papers for our most popular assessments with extremely large and widespread candidature, The question papers are closely related and the relationships between them have been thoroughly established using our assessment expertise. All versions of the paper give assessment of equal standard.

The content assessed by the examination papers and the type of questions are unchanged.

This change means that for this component there are now two variant Question Papers, Mark Schemes and Principal Examiner's Reports where previously there was only one. For any individual country, it is intended that only one variant is used. This document contains both variants which will give all Centres access to even more past examination material than is usually the case.

The diagram shows the relationship between the Question Papers, Mark Schemes and Principal Examiner's Reports.

Question Paper	Mark Scheme	Principal Examiner's Report
Introduction	Introduction	Introduction
First variant Question Paper	First variant Mark Scheme	First variant Principal Examiner's Report
Second variant Question Paper	Second variant Mark Scheme	Second variant Principal Examiner's Report

Who can I contact for further information on these changes?
Please direct any questions about this to CIE's Customer Services team at: international@cie.org.uk

CHEMISTRY

Paper 0620/31
Extended Theory

General Comments

All of the following points have been mentioned in previous reports but they still persist as being both major sources of concern and possible reasons why the mark/grade achieved is lower than that expected.

The following paragraph is repeated from the June 2008 report.

The practice of drafting the response in pencil and then going over it in ink is not ideal, since it not only uses up valuable examination time, but also, it greatly reduces legibility for the Examiners. Erasures should be complete; if this is not possible the material ought to be deleted and rewritten.

Particularly with respect to handwriting, candidates might be reminded of the saying – "what cannot be read, cannot be marked". Ambiguous responses, whether deliberate or otherwise, cannot be of any advantage to the candidate. The Examiner will make every reasonable effort to ascertain the candidate's intention but will not select the correct alternative without evidence. Similarly, offering more than the required number of answers, presumably in the hope that the Examiner will select the correct ones, is a futile tactic.

Candidates should be strongly advised to read the question carefully and then consider what is needed to answer the question. Many responses included extraneous material, which might have been correct Chemistry, but did not relate to the question.

Some candidates entered for this paper rather than Paper 2 achieved extremely low marks. For this cohort, Paper 3 represents an inappropriate challenge in terms of the knowledge and understanding of IGCSE Chemistry. It is probable that the difficulties were compounded by inadequate preparation for the examination.

Individual Questions

Question 1

This was one of the best answered questions on the paper and full marks were not uncommon. Typical errors included

- litmus paper turned blue; red to blue was needed
- litmus paper changed from blue to red
- the test for hydrogen had to include ignition, a burning splint or hydrogen burns
- a glowing splint was not accepted, and neither was the phrase "the pop test" without any additional information

The last two gases were easily recognised as oxygen and carbon dioxide respectively.

Question 2

(a) Despite being told that the compound is ionic, some candidates gave a covalent structure and others put the ions close together as if hedging their bets by offering a hybrid which could be either ionic or covalent.

Candidates should be advised to ensure that the stoichiometry is correct, as this is the key to drawing correct diagrams showing the structure of ionic compounds.

(b) (i) Some candidates described ionic bonding instead of metallic, often with delocalised negative ions, while others thought that the metallic bond was covalent. Frequently, references were made to both alloys and to compounds between metals instead of to a single metal. The general standard of the responses was disappointing both in terms of the knowledge and the construction of the description of metallic bonding.

(ii) The standard of the explanations as to why metals are good conductors of electricity and why they are malleable were significantly better. To explain malleability, the usual theory was quoted (the layers/ions can slip over each other), however, a few candidates introduced non-directional bonding or the concept of grains in metals. Both were awarded the marks.

(c) (i) Candidates who had prepared this topic thoroughly scored full marks. The less well prepared discussed ions, molecules of oxygen and intermolecular forces. They often resorted to a general discussion of macromolecules or listing their properties. A minority referred to silica being made up of carbon atoms.

(ii) The properties of these macromolecules were well-known although considerable confusion existed between the terms strong and hard which are not synonymous. These macromolecules are hard. With a few notable exceptions, for example conductivity, not possessing a property does not warrant the award of a mark e.g. they are not malleable.

Question 3

(a) (i) Most knew that air/oxygen and water must be present for rusting to occur.

(ii) Typical errors were as follows.
For plate or electroplate, a suitable metal must be named.
Coat with oil or wax were not accepted.
There were some strange and impractical suggestions such as keeping in a vacuum or not allowing it to be in contact with water.

(b) (i) Most candidates were able to suggest a suitable reagent to reduce iron(III) oxide to iron.

(ii) Many equations contained the error Fe_2 instead of 2Fe.

(c) (i) The mass of one mole of $Fe_2O_3.2H_2O$ is 196 g.
The most common error (which occurred nearly as often as the correct answer) was 180 g.
$(56 \times 2) + (16 \times 3) + 4 + 16 = 180$

(ii) The percentage of iron in rust is $112/196 \times 100 = 57.1\%$
Using the above error $112/180 \times 100 = 62.2\%$. This would have gained 2 marks ecf.

(d) (i) The removal of carbon as either carbon dioxide or carbon monoxide was well-known.

(ii) Rarely were two marks awarded for the removal of silicon, and although most answers referred to slag, few included the formation of silica first.

Question 4

(a) (i) Very few were able to deduce the formula of benzoic acid from that of its sodium salt.

(ii) Despite the question clearly requesting a word equation, the majority attempted a symbol equation with varying degrees of success. Where a word equation was given, the spelling of “benzoic” and “benzoate” had to be correct; there were far too many “benzenoates”. A common mistake was to give the salt and hydrogen, not the salt and water.

(iii) The acceptable answers were sodium oxide, carbonate and hydrogen carbonate. Correct answers were rare, and most of the suggestions were not sodium compounds – potassium hydroxide, ammonia, calcium carbonate, etc. Most of the suggested sodium compounds were not bases – chloride, sulphate, nitrate, etc. Sodium was not accepted as it is not a compound, and from safety considerations is not an appropriate choice.

(b) (i) Most of the candidates were able to calculate the percentage of hydrogen in benzene - that is 7.7%.

(ii) Very few were able to calculate the ratio of moles of C atoms to moles of H atoms in benzene.

	carbon	hydrogen	
percentage	92.3	7.7	
number of moles	92.3/12	7.7/1	divide each by its A_r
	= 7.7	7.7	
simplest ratio	1	1	

The most frequent error was to give the following method.
carbon 78 × 0.923 = 72, hydrogen 78 × 0.077 = 6
(at this point the candidate was close to a correct solution)
so the ratio C:H is 72:6, which is 12:1. This part is wrong and so is **part (iii)**.

(iii) empirical formula is CH
molecular formula is C_6H_6

The usual pattern was that those who had **part (ii)** correct also gave the correct formulae in this part. An incorrect ratio in **(ii)** does not generate meaningful formulae in this part.

(c) (i) The molecular formula of vitamin C is $C_6H_8O_6$. The usual errors were incorrect addition of the number of atoms or, even more prevalent, was the inclusion of functional groups e.g. $C_6H_4O_2(OH)_4$.

(ii) Alkene and alcohol or carbon-carbon double bond and hydroxyl were the correct responses. Typical mistakes were to write just “double bond” and “hydroxide” instead of hydroxyl.

Question 5

(a) (i) and (ii) These equations did not prove as easy as one might expect.
A selection of incorrect equations is given below.
$H^+ + 2e = H_2$
$2H^+ + e = H_2$
$2Cl^- - e^{2-} = Cl_2$

There were many other variations which included positive electrons and equations which included all four ions mentioned in the question.

(iii) Many candidates did not realise that Na^+ and OH^- are simply left in the solution. They do not react together, this suggestion invalidated a high proportion of otherwise correct responses.
For example H^+ and Cl^- are discharged at the electrodes, leaving Na^+ and OH^-(correct) which react to form sodium hydroxide (incorrect).

(b) (i) Most candidates correctly stated that chlorine kills bacteria/sterilises the water, etc.

(ii) There were a wide variety of chemicals thought to be made from hydrogen, ranging from sodium hydroxide to hydrogen peroxide. The list included some compounds which do not contain hydrogen. The most popular but surprising suggestion was to make water.

(iii) The required answer was that fat is heated with sodium hydroxide. The fact that the mixture has to be heated was rarely mentioned.

Question 6

(a) (i) Some candidates confused R and NR but a pleasing proportion were awarded full marks. The ability to complete this table correctly did not always correlate to the candidate's performance in the rest of the paper, possibly because it relies on recognition of a pattern and there is no element of recall.

(ii) The ionic equations were usually incorrect, with many odd products being given as combinations of Ag and Sn. Some candidates used the wrong symbols for these metals despite having the correct symbols in the table.

(iii) The instruction to mark a change on the equation requires that both species be mentioned, in this case a line joining Mn to Mn^{2+}. The comments that this change shows electron loss or there is an increase in oxidation number of manganese or this change causes the reduction of Sn^{2+} were valid reasons why the change is oxidation.

(iv) Aluminium is covered with a layer of aluminium oxide which protects it from other reagents, such as oxidants, and reduces its reactivity. This, or an equivalent idea, is the correct explanation and featured on a minority of the scripts.
Incorrect suggestions included:

- it is amphoteric
- it is a transition metal
- it has more than one oxidation state
- aluminium can accept three electrons or lose three electrons

(b) (i) Most of the candidates had the correct general idea but did not give a specific answer that addressed these two metals, so the marks were not awarded. The marking points were:
potassium has one valency electron or loses one electron
calcium has two valency electrons or loses two electrons
A most unfortunate but common mistake was to state that K^+ has one outer electron and Ca^{2+} has two.

(ii) and (iii) The general standard of writing these equations was disappointing. Candidates have to be able to recall the equations, particularly the ones involving nitrates, and it appears that the preparation of this topic for most of the candidates was minimal.

Question 7

(a) (i) Candidates did not seem to be familiar with this type of calculation and did not realise that the mole ratio for gases is the same as the reacting volume ratio. With this knowledge, the calculation is easy and involves some simple arithmetic.

	butane	oxygen
mole ratio	1	6.5
volume ratio	10	65

Therefore 65 cm^3 of oxygen used. 100 – 65 = 35 cm^3 left.
By the same reasoning, 10 cm^3 of butane will form 40 cm^3 of carbon dioxide.

(ii) The formation of carbon monoxide and its toxic nature were well-known.

(b) (i) Both chlorobutane and 1-chlorobutane were accepted. Examples of unacceptable responses were:
chlor-butane
4-chlorobutane
chlorobutanoic
butane chloride

(ii) Light or UV was given on most of the scripts.

(iii) There was a tendency to misinterpret this question as "write a different equation for this substitution reaction between butane and chlorine". The required equation had to show a different product e.g. 2-chlorobutane or a dichlorobutane. Most of those who attempted this question gave a replacement reaction not substitution.
$CH_3–CH_2–CH_2–CH_3 + Cl_2 = CH_3–CH_2–CH_2–CHCl_2 + H_2$
Another widespread difficulty was to include the chlorine in the "2" position as if it is part of the chain.
$CH_3–CH_2–CH–Cl–CH_3$ instead of either showing the chlorine atom as being bonded to just one carbon or using the convention
$CH_3–CH_2–CH(Cl)–CH_3$.
Additional chlorination of 1-chlorobutane does not answer the question.

(c) (i) The structure of poly(propene) was wrong in the majority of cases, typically the double bond was retained in the polymer or the structure was that of poly(ethene).

(ii) Many candidates did not attempt this question or **(c)(iii)**. Many of those, who did tried to answer it, did not know that an alkene and steam react to form an alcohol. Consequently there was an assortment of names and an even greater variety of strange formulae.
Names:
ethanol
butanal
butenol
butanoic acid

Formulae
$CH_3–CH_2–CH=CHOH$
$CH_3=CHCHOH$

(iii) Either 1 or 2-chloropropane is the product of this reaction. In common with **(c)(ii)**, some candidates' knowledge of organic Chemistry and of structural formulae was inadequate. This can be illustrated by the following errors.
4C per molecule
retention of the C=C
HCl in the product
Cl_2 group in product
dichloropropanes
hexavalent carbon

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Paper 0620/32

Extended Theory

General Comments

All of the following points have been mentioned in previous reports but they still persist as being both major sources of concern and possible reasons why the mark/grade achieved is lower than that expected.

The following paragraph is repeated from the June 2008 report.

The practice of drafting the response in pencil and then going over it in ink is not ideal, since it not only uses up valuable examination time, but also, it greatly reduces legibility for the Examiners. Erasures should be complete; if this is not possible the material ought to be deleted and rewritten.

Particularly with respect to handwriting, candidates might be reminded of the saying – "what cannot be read, cannot be marked". Ambiguous responses, whether deliberate or otherwise, cannot be of any advantage to the candidate. The Examiner will make every reasonable effort to ascertain the candidate's intention but will not select the correct alternative without evidence. Similarly, offering more than the required number of answers, presumably in the hope that the Examiner will select the correct ones, is a futile tactic.

Candidates should be strongly advised to read the question carefully and then consider what is needed to answer the question. Many responses included extraneous material, which might have been correct Chemistry, but did not relate to the question.

Some candidates entered for this paper rather than Paper 2 achieved extremely low marks. For this cohort, Paper 3 represents an inappropriate challenge in terms of the knowledge and understanding of IGCSE Chemistry. It is probable that the difficulties were compounded by inadequate preparation for the examination.

Individual Questions

Question 1

This was one of the best answered questions on the paper and full marks were not uncommon.
The first two gases were easily recognised
The test for hydrogen had to include ignition, a burning splint or hydrogen burns.
A glowing splint was not accepted, nor was the phrase "the pop test" without any additional information.
The test for oxygen had to include "a glowing splint".
The only systemic error in the description of the test for carbon dioxide was not mentioning limewater, for example, it went cloudy

Question 2

(a) Despite being told that the compound is ionic, some candidates gave a covalent structure and others put the ions close together as if hedging their bets by offering a hybrid which could be either ionic or covalent.

Candidates should be advised to ensure that the stoichiometry is correct, as this is the key to drawing correct diagrams showing the structure of ionic compounds.

(b) (i) Some candidates described ionic bonding instead of metallic, often with delocalised negative ions, while others thought that the metallic bond was covalent. Frequently, references were made to both alloys and to compounds between metals instead of to a single metal. The general standard of the responses was disappointing both in terms of the knowledge and the construction of the description of metallic bonding.

(ii) The standard of the explanations as to why metals are good conductors of electricity and why they are malleable were significantly better. To explain malleability, the usual theory was quoted (the layers/ions can slip over each other), however, a few candidates introduced non-directional bonding or the concept of grains in metals. Both were awarded the marks.

(c) (i) Candidates who had prepared this topic thoroughly scored full marks. The less well prepared discussed ions, molecules of oxygen and intermolecular forces. They often resorted to a general discussion of macromolecules or listing their properties. A minority referred to silica being made up of carbon atoms.

(ii) The properties of these macromolecules were well-known, although considerable confusion existed between the terms strong and hard which are not synonymous. These macromolecules are hard. With a few notable exceptions, for example conductivity, not possessing a property does not warrant the award of a mark e.g. they are not malleable.

Question 3

(a) (i) Most knew that air/oxygen and water must be present for rusting to occur.

(ii) Typical errors were as follows.
For plate or electroplate, a suitable metal must be named.
Coat with oil or wax were not accepted.
There were some strange impractical suggestions such as keeping in a vacuum or not allowing it to be in contact with water.

(b) (i) Most candidates were able to suggest a suitable reagent to reduce iron(III) oxide to iron.

(ii) Many equations contained the error Fe_2 instead of 2Fe.

(c) (i) The mass of one mole of $Fe_2O_3.2H_2O$ is 196 g.
The common error (which occurred nearly as often as the correct answer) was 180 g.
$(56 \times 2) + (16 \times 3) + 4 + 16 = 180$

(ii) The percentage of water in rust is $36/196 \times 100 = 18.4\%$
Using the above error $36/180 \times 100 = 20\%$. This would have gained 2 marks ecf.
However, a second error was usually introduced $= 20/180 \times 100 = 11.1\%$ of water.
This second error precluded ecf marking.

(d) (i) The removal of carbon as either carbon dioxide or carbon monoxide was well-known.

(ii) Rarely were two marks awarded for the removal of silicon although most answers referred to slag, few included the formation of silica first.

Question 4

(a) (i) Very few were able to deduce the formula of benzoic acid from that of its sodium salt.

(ii) Despite the question clearly requesting a word equation, the majority attempted a symbol equation with varying degrees of success. Where a word equation was given, the spelling of “benzoic” and “benzoate” had to be correct, there were far too many “benzenoates”. A common mistake was to give the salt and hydrogen not the salt and water.

(iii) The acceptable answers were sodium oxide, carbonate and hydrogen carbonate. Correct answers were rare, and most of the suggestions were not sodium compounds – potassium hydroxide, ammonia, calcium carbonate, etc. Most of the suggested sodium compounds were not bases – chloride, sulphate, nitrate, etc. Sodium was not accepted as it is not a compound, and from safety considerations is not an appropriate choice.

(b) (i) Most of the candidates were able to calculate the percentage of hydrogen in benzene - that is 7.7%.

(ii) Very few were able to calculate the ratio of moles of C atoms to H atoms in benzene.

	carbon	hydrogen	
percentage	92.3	7.7	
number of moles	92.3/12	7.7/1	divide each by its A_r
	= 7.7	7.7	
simplest ratio	1	1	

The most frequent error was to follow the following method.
carbon $78 \times 0.923 = 72$, hydrogen $78 \times 0.077 = 6$
(at this point the candidate was close to a correct solution)
so the ratio C:H is 72:6, which is 12:1. This part is wrong and so is **part (iii)**.

(iii) empirical formula is CH
molecular formula is C_6H_6

The usual pattern was that those who had **part (ii)** correct also gave the correct formulae in this part. An incorrect ratio in **(ii)** does not generate meaningful formulae in this part.

(c) (i) The molecular formula of vitamin C is $C_6H_8O_6$. The usualerrors were incorrect addition of the number of atoms or, even more prevalent, was the inclusion of functional groups e.g. $C_6H_4O_2(OH)_4$.

(ii) Alkene and alcohol or carbon-carbon double bond and hydroxyl were the correct responses. Typical mistakes were to write just “double bond” and “hydroxide” instead of hydroxyl.

Question 5

(a) (i) and (ii) These equations did not prove as easy as one might expect.
A selection of incorrect equations is given below.
$H^+ + 2e = H_2$
$2H^+ + e = H_2$
$2Cl^- - e^{2-} = Cl_2$

There were many other variations which included positive electrons and equations which included all four ions mentioned in the question.

(iii) An inability to realise that Na^+ and OH^- are simply left in the solution. They do not react together, this suggestion invalidated a high proportion of otherwise correct responses.
For example H^+ and Cl^- are discharged at the electrodes, leaving Na^+ and OH^-(correct) which react to form sodium hydroxide (incorrect).

(b) (i) Most of the candidates correctly stated that chlorine kills bacteria/sterilises the water, etc.

(ii) There was a wide variety of chemicals thought to be made from hydrogen ranging from sodium hydroxide to hydrogen peroxide. The list included some compounds which do not contain hydrogen. The most popular but surprising suggestion was to make water.

(iii) Esters, lipids and triester were all accepted. The most frequent error was to suggest polyester which did not gain the mark. Many responses were pure guessing - polypeptides, polymers, organic, etc.

Hydrolysis or saponification (this had to be correctly spelt) was the reaction type. The typical errors were esterification and condensation.

Question 6

(a) (i) Some candidates confused R and NR but a pleasing proportion were awarded full marks. The ability to complete this table correctly did not always correlate to the candidate's performance in the rest of the paper, possibly because it relies on recognition of a pattern and there is no element of recall.

(ii) The equation was usually incorrect. The most common error was to treat silver as being divalent, which greatly simplified the equation.

(iii) It had to be made clear that the oxidant is Sn^{2+} not Sn. The reason had to be from the viewpoint of Sn^{2+}; its oxidation number decreases or it is reduced or it has accepted electrons or it has taken electrons from Mn.

(iv) Aluminium is covered with a layer of aluminium oxide which protects it from other reagents, such as oxidants, and reduces its reactivity. This, or an equivalent idea, is the correct explanation and featured on a minority of the scripts.
Incorrect suggestions included:
- it is amphoteric
- it is a transition metal
- it has more than one oxidation state
- aluminium can accept three electrons or lose three

(b) (i) Most of the candidates had the correct general idea but did not give a specific answer that addressed these two metals, so the marks were not awarded. The marking points were:
potassium has one valency electron or loses one electron
calcium has two valency electrons or loses two electrons
A most unfortunate but frequent mistake was to state that K^+ has one outer electron and Ca^{2+} has two.

(ii) and (iii) The general standard of writing these equations was disappointing. Candidates have to be able to recall the equations, particularly the ones involving nitrates, and it appears that the preparation of this topic for most of the candidates was minimal.

Question 7

(a) (i) Candidates did not seem to be familiar with this type of calculation and did not realise that the mole ratio for gases is the same as the reacting volume ratio. With this knowledge, the calculation is easy and involves some simple arithmetic.

	butane	oxygen
mole ratio	1	6.5
volume ratio	20	130

Therefore 130 cm^3 of oxygen used. 150 – 130 = 20 cm^3 left
By the same reasoning, 20 cm^3 of butane will form 80 cm^3 of carbon dioxide.

(ii) The formation of carbon monoxide and its toxic nature were well-known.

(b) (i) Both chlorobutane and 1-chlorobutane were accepted. Examples of unacceptable responses were:
chlor-butane
4-chlorobutane
chlorobutanoic
butane chloride

(ii) Light or UV was given on most of the scripts.

(iii) There was a tendency to misinterpret this question as "write a different equation for this substitution reaction between butane and chlorine". The required equation had to show a different product e.g. 2-chlorobutane or a dichlorobutane. Most of those who attempted this question gave a replacement reaction not substitution.
$CH_3–CH_2–CH_2–CH_3 + Cl_2 = CH_3–CH_2–CH_2–CHCl_2 + H_2$
Another widespread difficulty was to include the chlorine in the "2" position as if it is part of the chain.
$CH_3–CH_2–CH–Cl–CH_3$ instead of either showing the chlorine atom as being bonded to just one carbon or using the convention
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Additional chlorination of 1-chlorobutane does not answer the question

(c) (i) The structure of poly(propene) was wrong in the majority of cases, typically the double bond was retained in the polymer or the structure was that of poly(ethene).

(ii) Many candidates did not attempt this question or **(c)(iii)**. Many of those, who did tried to answer it, did not know that an alkene and steam react to form an alcohol. Consequently there was an assortment of names and an even greater variety of strange formulae.
Names:
ethanol
propanal
propenol
propanoic acid

Formulae
$CH_3–CH=CHOH$
$CH_3–CH_2–COOH$
$CH_3–CH_2–CH_2=OH$

(iii) Either 1 or 2-chlorobutane is the product of this reaction. In common with **(c)(ii)** some candidates' knowledge of organic Chemistry and of structural formulae was inadequate. This can be illustrated by the following errors.
5C per molecule
retention of the C=C
HCl in the product
Cl_2 group in product
dichlorobutanes
C=H group

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Paper 0620/04
Coursework

General comments

The few Centres that entered this component in November, submitted well-organised samples of work which presented few problems. It was pleasing to see work of high quality from many candidates. The fact that, in most cases, Centres used appropriate tasks and mark schemes meant that many justifiable high marks were attained.

Below are a few reminders which are designed to help Centres in selecting appropriate tasks and creating suitable mark schemes.

Comments linked to each skill follow

Skill C1

It is essential that tasks used for this skill give an opportunity for candidates to follow a complex (branched) set of instructions and that, at some point, they have the opportunity to decide which of two courses of action is appropriate. Only in this way can they have access to the higher marks. The mark scheme used to allocate marks should take account of this 'choice'. Simple one-step tasks only give access to two marks.

Skill C2

It is desirable that both qualitative and quantitative skills are assessed, though not necessarily in the same exercise, and candidates must also design their own means of recording results and observations.

Skill C3

Graphing is included in this skill, not in C2. There should be a conclusion to be made and candidates should not be lead to it by too many questions. It is often disadvantageous to the candidates to assess this skill in an exercise which they planned themselves (C4). If their plan is unsuccessful their conclusion would be more difficult to write.

Skill C4

It is essential that this skill gives candidates the opportunity to control and change a number of different variables appropriately. Otherwise, the higher marks cannot be obtained. It is also essential that candidates actually carry out the plan and comment on its success and on possible improvements.

Finally, Centres are reminded that the instruction sheets and mark schemes for ALL exercises used for assessment must be included with the sample of work submitted.

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Paper 0620/05

Practical Test

General comments

All candidates attempted both questions. There are still a minority of Centres which did not submit a copy of the Supervisor's results with the candidates' scripts. The Examiners, when marking the scripts, use Supervisors' results to check comparability.

One Centre encountered difficulty in obtaining anhydrous copper sulphate for **Question 1** and successfully prepared a sample from the hydrated salt. One Centre used the wrong solid in Experiment 4 and another used the wrong quantities of the solids. No candidates were penalised as a result.

Question 2 was well answered by the majority of candidates.

Comments on specific questions

Question 1

The observations recorded for Experiment 5 lacked detail from some candidates. Vague references to a gas given off instead of bubbles etc. or a solid formed instead of reference to a light blue precipitate scored no credit.

The table of results was generally fully and successfully completed. Marks were awarded for temperature changes similar to those reported by the Supervisor. A large number of candidates recorded the sign of the temperature changes incorrectly e.g. a – sign used in Experiment 1.

(a) The bar chart was often drawn from the base of the grid and the scale on the *y* axis ignored. Some candidates did not label the bars as requested or labelled them at the edge instead of the middle.

(b) A minority of candidates thought that a decrease in temperature indicated an exothermic reaction.

(c) Well answered. This question was marked by reference to the candidates' results.

(d) A good discriminating question, which only the more able candidates successfully attempted, realising that the temperature would double in **(i)** and halve in **(ii)**. Correct values for these temperature changes using the results table were often seen and clearly given full credit.

The explanation in **(iii)** commonly referred to excess water or the rate of dissolving. Only the more able candidates identified that doubling the volume of water would cause the final temperature to decrease by half the value.

(e) Many vague answers referred to the reaction of an acid and a base or metal, forming hydrogen. The idea of carbon dioxide being produced from the reaction of an acid and a carbonate was realised by few candidates.

Question 2

(a) The majority of candidates scored the mark for giving the correct colours.

(b) Well answered. A small number of candidates recorded neutral or alkaline pH values.

(c) In **(i)** most candidates noted the blue precipitate correctly. In **(ii)** a minority of candidates failed to note the colour of the solution formed. Some contradictory statements were seen e.g. 'the blue precipitate dissolved to give a dark blue precipitate'. In **(iii)** and **(d)(iii)** the correct observation of 'no reaction' or 'no change' was missed by some candidates who discussed colour changes or the formation of precipitates.

In **(iv)** the majority of candidates correctly identified the formation of a white precipitate.

(d) In **(i)** and **(ii)** most candidates mentioned the brown colour but a number omitted the formation of a precipitate. Some incorrect descriptions of red precipitates were seen. In **(iv)** some pale yellow precipitates were described instead of white precipitates.

(e) The acidity of the solutions was usually correctly identified.

(f) Some answers mistakenly referred to iodide or chlorine instead of chloride ions.

(g) Well answered. A few candidates thought solution L contained iron(II) ions instead of iron(III) ions.

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Paper 0620/06

Alternative to Practical

General comments

The vast majority of candidates successfully attempted all of the questions. The full range of marks was seen and the paper discriminated well between candidates of different abilities.

Candidates found **Questions 1, 2** and **7** to be the most demanding. Some Centres had not covered all sections of the syllabus. As in previous years most candidates had a good knowledge of basic practical techniques. The majority of candidates were able to complete tables of results from readings on diagrams e.g. **Question 4**, and plot points successfully on a grid e.g. **Question 6** but drawing bar charts caused problems.

Comments on specific questions

Question 1

(a) Many candidates were unable to name the mortar - many referred to crushing/grinding bowls. The funnel was sometimes labelled as a filter paper or separating funnel. Some candidates labelled the stirrer as a thermometer.

(b) The origin was often incorrectly labelled and the solvent front was commonly indicated. The solvent used was given as ethanol by many candidates despite the information given in the introduction to the question.

(c) Generally well answered though some diagrams showed spots not in line or far too many spots.

Question 2

(a) Graphite was a common correct answer. Despite carbon rods being labelled on the diagram, reactive metals such as zinc were often chosen.

(b) Most candidates gave the correct test for hydrogen but a significant number used a **glowing** splint.

(c) A good discriminating question. Only the most able candidates realised that the gas dissolved in the solution before bubbles were observed. References to reactivity were common.

(d) A good discriminating question. Credit was given for sodium hydroxide/alkali at the negative electrode but sodium and base were common incorrect answers. The bleaching action of chlorine at the positive electrode was not recognised by many candidates and chlorine ions or chloride were common responses.

Question 3

(a) Generally well answered. Some vague answers referred to the lack of liquid or solution in the container instead of specifying water.

(b) A number of candidates used a lighted or glowing splint and even barium instead of bromine to test for ethane.

Question 4

(a) The table of results was usually completed correctly. A common error was to put the + and – signs the wrong way round or miss out the – signs.

(b) Most candidates plotted the bar heights but many started at the bottom of the grid rather than at the zero line. Labels were often omitted or wrongly placed at the edge of a bar instead of the middle.

(c) and **(d)** were generally well answered. A minority gave sodium or potassium in **(c) (i)**.

(e) A good discriminating question. In **(ii)** the answer was often given as 12 instead of 3. Many candidates discussed the rate of dissolving in **(iii)** instead of explaining that doubling the amount of water would halve the temperature rise.

(f) Candidates found this difficult. The presence of acid and the formation of carbon dioxide from a carbonate was realised only by the more able candidates.

Question 5

Parts of this question were generally well answered, particularly **(e)** and **(f)**. In **(c) (ii)**, random guesses were frequent and confusion common, e.g. 'the blue precipitate dissolved to give a dark blue precipitate'. In **(c)(iii)** and **(d)(iii)**, some candidates wrote 'white precipitate' despite there being no possible reaction.

Question 6

(a) The points were normally plotted correctly. However, dot-to-dot lines drawn with a ruler and straight lines were common instead of a smooth curve.

(b) The extrapolation of the line to obtain the answer was needed for both marks. Some candidates extrapolated the line and gave no answer and vice versa.

(c) Many candidates who just referred to the solubility decreasing missed the idea of crystals/solid forming.

Question 7

This was a good discriminating question.

(a) Despite the information given in the stem of the question, the wrong chemicals were often used. Many erroneous titration procedures were described. The use of excess acid, dissolving magnesium oxide in water and converting magnesium oxide to magnesium were all indications that many candidates had not made a salt in a practical lesson.

(b) Answers were Centre dependent. Some excellent descriptions of heating to crystallisation point and methods of drying the crystals were seen. However, many candidates started the question by adding water and then heating to dryness, so that all of the water was removed. No credit was given for this approach.