CHEMISTRY

Paper 0620/12
Multiple Choice (Core)

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

General comments

Candidates performed well on this paper.

Questions 1, **2**, **14** and **28** were answered correctly by most candidates.

Questions 11 and **25** and **39** proved to be the most challenging with only the strongest candidates answering correctly.

Comments on specific questions

Question 4

A number of candidates wrongly selected **B**, thinking that brass (an alloy) is a compound.

Question 9

Candidates did not appear confident in this area, with a significant number giving **C** as the answer.

Question 10

Weaker candidates selected **A**, with these candidates recognising the correct products but the wrong electrodes.

Question 13

Weaker candidates mistook increasing particle size for increasing surface area and so selected **A**.

Question 16

A significant number of candidates selected **C**, showing that while they realised that red shows an acid they did not know that orange also shows acidity.

Question 20

A number of candidates did not realise the significance of 'diatomic molecules' which leads to Group 7 rather than Group 8 and so selected **B** as their answer.

Question 23

Less confident candidates gave **B** as the answer because it showed a coloured oxide.

Question 24

Candidates did not appear to be familiar with the properties of uranium, with a number giving **A** as the answer.

Question 31

A number of candidates selected **B**, possibly misreading 'potassium' for 'phosphorus'.

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Paper 0620/22
Multiple Choice (Extended)

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

General comments

Overall, candidates performed well on this paper and showed strong subject knowledge.

Comments on specific questions

Question 3

Weaker candidates measured the distances correctly but inverted the formula for calculation and so gave **D** as the answer.

Question 10

D was a common incorrect answer. Candidates understood that electrons move from negative to positive but some did not realise that this only happens in the external circuit, not through the solution.

Question 15

D was a common incorrect answer.

Question 17

Most candidates realised that increasing temperature increases collision rate but some candidates appear to have misread the energy level diagram taking the initial rise to indicate an endothermic reaction, giving **B** as their answer.

Question 23

A number of weaker candidates selected **C** as the answer and may have confused the change in metallic character with a different property such as melting point.

CHEMISTRY

Paper 0620/32
Theory (Core)

Key messages

- The standard of English shown in answers was good.
- Candidates should be reminded to read questions carefully in order to understand exactly what is being asked and to check that they have included this in their answers.
- Interpretation of data from tables and completion of chemical equations was generally well done.

General comments

Many candidates tackled this paper well, showing a good knowledge of core Chemistry. Nearly all candidates were entered at the appropriate level. Weaker candidates sometimes left questions unanswered but on the whole candidates attempted all questions. Questions involving general chemistry including, electrolysis and atomic structure were tackled well by many candidates.

Some candidates need more practice in reading and interpreting questions. Occasionally questions were misinterpreted by a small number of candidates. For example, in question **4(b)(iv)** many candidates gave the name of an element and not a compound, whilst in **5(d)(ii)** many did not refer to the equation and gave only vague answers about hydrated or anhydrous salts, often using copper(II) sulfate as an example rather than the cobalt(II) chloride shown in the equation.

Candidates need more practice in answering extended questions such as **3(a)** (the reaction of sodium or iron with water or steam) and **4(a)** (relating properties to structure and bonding). Stronger candidates were able to note the bullet points provided and could select relevant information and organise ideas in a logical way. Other candidates need practice in answering questions relating to practical procedures such as those relating to crystallisation and describing a practical method for determining reaction rate.

Many candidates were able to extract information from tables and balance symbol equations but some candidates need more practice in writing word equations. Most candidates were able to undertake simple calculations of relative formula mass but weaker candidates did not always manage to do this successfully.

Comments on specific questions

Question 1

(a) (i) Most candidates identified nitrogen. The most common error was to suggest oxygen.

(ii) Many candidates correctly identified carbon dioxide. The most common incorrect answer was oxygen.

(iii) Only the strongest candidates gave the correct answer of aluminium. A wide variety of incorrect answers were given. Non-metals such as silicon, oxygen and sulfur were often given.

(iv) This question proved challenging with many candidates giving, chlorine, iodine or the noble gases as the answer. Of the metals, lithium was a common incorrect answer.

(v) This question was answered well by most candidates. Weaker candidates gave the incorrect answers of iron or lithium.

(b) (i) There were some good definitions given for this question. However, there were also statements which were contradictory e.g. ‘compounds made of the same types of atoms’. The most common incorrect answers related to the same type of molecule, many atoms joining together or ‘a single atom’.

(ii) Stronger candidates understood the isotopic notation. Other candidates suggested that the number of neutrons in the two isotopes was 43 and 48 respectively. A significant number of candidates suggested that there were 23 and 28 electrons (rather than 20 in each isotope) and a small number of candidates suggested a small number of neutrons e.g. 2 and 3 respectively.

(iii) Although this question was answered correctly by some candidates, it proved challenging for many. Candidates needed to realise that the calcium ion has two electrons fewer than the calcium atom and weaker candidates gave an incorrect answer of 20. A few candidates added the 2 electrons to give an incorrect answer 22.

Question 2

(a) Some candidates identified both electrolysis products correctly. Others either gave two correct products but at the wrong electrodes or gave bromide rather than bromine as the product at the positive electrode. A number of candidates suggested incorrect products not related to potassium bromide e.g. copper or iron.

(b) (i) Most candidates gave a suitable explanation for the use of graphite as an electrode. Some candidates suggested ‘good conductor’ but did not go on to refer to electricity. Other answers suggested that the electrodes are reactive.

(ii) A majority of the candidates gave a correct use for graphite. The most frequently seen incorrect answers were ‘for drills’ or ‘for cutting’. Occasionally answers also suggested that graphite is used instead of coke in a blast furnace. Some candidates identified its use in steelmaking.

(c) Most candidates were able to identify bromine. Common incorrect answers were chloride or bromide. A few candidates suggested iodine even though no iodine was present in the reaction mixture.

(d) A few candidates recognised that a cream-coloured precipitate would be formed. However, many candidates stated that there is a ‘colour change’ without specifying the colour or precipitate. A small number of weaker candidates either just named the precipitate, suggested bubbles would be seen or that the solution would become acidic.

(e) This question proved challenging and many answers given were vague. Examples of these answers included ‘kills cells’, ‘harmful’ or ‘causes infections’.

Question 3

(a) Stronger candidates gave well-written answers giving all relevant details. However, there were often vague statements which omitted the observations. Common incorrect answers included sodium oxide as a product; sodium bursts into flames or explodes; iron rusts or the iron melts and forms bubbles.

(b) Many candidates omitted the use of a stop clock or did not mention timing the reaction. The majority of candidates did not measure the volume of gas released and just suggested adding the iron to the acid until it dissolved, often omitting a mention of timing the disappearance. Some candidates drew a graph of rate against volume of gas rather than against time. A considerable number of weaker candidates suggested a titration.

(c) Stronger candidates realised that the rate of reaction was faster when the particle size was smaller. However, many candidates incorrectly stated that the iron powder reacted more slowly than the large or medium sized pieces of iron.

(d) (i) Very few candidates commented on the shape of the graph.

(ii) A majority of the candidates determined the rate of reaction correctly. The most common incorrect answer was 17 cm^3. A few candidates gave 24 cm^3 or 26 cm^3.

(e) Many candidates described the effect of concentration on rate of reaction correctly. A considerable minority did not appear to have read the question accurately and referred to the effect of temperature on rate or referred to time instead of rate.

Question 4

(a) This proved to be a challenging question for the majority of candidates. Many candidates did not discuss both the volatility and electrical conductivity of sodium chloride and nitrogen. A common error was to suggest that the more volatile a substance, the higher the boiling point is. Other common errors included the suggestion that sodium chloride is a simple covalent molecule or that sodium chloride conducts electricity as a solid. When referring to the electrical conduction of sodium chloride, many candidates did not mention the state. Stronger candidates mentioned that sodium chloride is a giant structure.

(b) (i) Nearly all candidates understood that a catalyst speeds up a reaction.

(ii) Many candidates balanced the equation correctly. The most common error was to balance the hydrogen with 2 rather than 3.

(iii) Many candidates completed the electronic structure. Common errors included: the addition of extra electrons on the hydrogen atoms; lack of two non-bonded electrons on the nitrogen atom (which did not have to be paired); one or three electrons in the bonding 'overlap' areas.

(iv) There was often a lack of precision in answers to this question. Many candidates gave copper as the answer, which was incorrect. Candidates also demonstrated that they were referring to the copper on the right hand side of the equation by writing incorrect answers such as 'the copper has reacted with the nitrogen'. A number of candidates suggested that either nitrogen or hydrogen or oxygen was being reduced.

Question 5

(a) (i) Many candidates were able to extract information from the table correctly and answered this question accurately. However, fewer gave a correct reason with density often given. Some answers were too vague and lacked reference to the good heat conduction. The most common incorrect metal selected was cobalt.

(ii) Most candidates selected a suitable property of a transition element from the table.

(iii) A significant minority selected copper or tin for use in aircraft bodies rather than magnesium and gave incorrect reasons such as good conductivity of heat. A few candidates gave imprecise answers such as 'less dense'.

(b) A majority of the candidates gave the correct order of reactivity. Weaker candidates reversed one pair of metals.

(c) The strongest candidates were able to give full answers to this question. Common errors included thinking that the residue after filtrate was cobalt(II) carbonate; suggesting heating the solution to dryness. Imprecise answers were also seen, such as 'crystallising the cobalt sulfate' or 'drying the crystals' without suggesting how to do these.

(d) (i) This was generally answered correctly.

(ii) Many candidates did not refer to the reaction shown in the question and wrote about hydration or dehydration without mentioning the chemicals involved or the colour change.

Question 6

(a) The strongest candidates made it clear that the Universal Indicator should be added to the lemon juice. Weaker candidates just referred to the citric acid turning red. Better answers related the range of colours to the pH, rather than just referring to a pH scale 1 to 14 and writing about colour matching. Many thought that the question was about the colour of the indicator in acid rather than finding the exact pH and gave answers referring to the indicator turning red. The indicator was also often confused, with litmus and methyl orange being mentioned.

(b) (i) Most candidates were able to identify the carboxylic acid group. The most common error was to include one or more adjacent carbon atoms.

(ii) This was generally well answered with many candidates giving ethanoic acid or butanoic acid. The most frequently seen incorrect answers were a mineral acid e.g. hydrochloric acid. Other common errors included ethanol and ethane.

(c) (i) This was generally answered correctly. Common errors included carbonate or carbon instead of carbon dioxide and oxygen or hydrogen instead of water.

(ii) This was fairly well answered. However, weaker candidates suggested either distillation or evaporation, not realising that the solution when evaporated would also contain solid calcium citrate.

(d) This question was challenging, with only the strongest candidates understanding the energy level diagram.

(e) (i) Many candidates balanced the equation correctly. The most common errors were $3CO_2$ or $4CO_2$.

(ii) Only a few candidates gave two suitable conditions for fermentation. There were a number of answers which were too vague, such as ‘temperature’. High pressure was often mentioned and many candidates thought that oxygen was necessary.

(iii) This was answered well by many candidates. The most common incorrect answer was 201 obtained using eight carbon atoms and only one hydrogen atom.

Question 7

(a) Many candidates produced good answers to this question and described at least two physical properties of transition elements. Common errors included describing chemical properties, describing properties of transition element compounds such as oxides or describing their position in the Periodic Table.

(b) This was often well answered. Weaker answers left the formula as Re_3Cl_9 or miscounted the atoms and suggested incorrect formulae such as $ReCl_2$ or did not count the atoms at all and gave ReCl.

(c) Most candidates were able to describe sublimation. Weaker candidates suggested either that ‘solids are broken down’ or ‘liquid to gas’. A few wrote vaguely that ‘it is a change of state’.

(d) (i) Nearly all candidates identified the correct pH value. The most common error was to suggest pH 7.

(ii) Many candidates recognised that water is formed when an acid reacts with a hydroxide. The most common error was to suggest hydrogen.

(iii) Most candidates answered this correctly. The most common errors were to suggest that either hydrochloric acid or sodium carbonate react with perrhenic acid.

(e) Better candidates realised that the test for oxygen involved a glowing splint. However, weaker candidates suggested that the splint should be lit. A greater number of candidates gave the correct result. Very few candidates mentioned popping or explosions. A minority of the candidates gave vague or incorrect answers such as ‘mix with a gas’, ‘heat’ or ‘use litmus’.

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Paper 0620/42
Theory (Extended)

Key messages

- Candidates need to be aware of the distinction between intramolecular forces (which are covalent bonds) and intermolecular forces such as van der Waals forces. The terms were often used interchangeably or incorrectly.
- Candidates should learn how to name and draw the structures of organic molecules. The names and formulae of esters was required and it was evident that many candidates were unprepared for this.
- Candidates should learn how to write the formulae of ionic compounds. The incorrect formula of sodium carbonate was seen far more often than the correct version.
- Candidates should take more care in writing formulae. Upper case letters should be the same size as each other, e.g. Na_2CO_3 not Na_2co_3. Carbon dioxide is written CO_2 as opposed to Co_2.

General comments

- If a question asks for one answer, it is advisable for candidates to give one answer rather than more than one.
- Candidates are advised not to use abbreviations unless it is certain that they are recognised, e.g. atm for atmospheres is acceptable but atp is not recognised.
- Candidates who write outside the allocated space, e.g. on blank pages should indicate they have done so in the allocated space.
- When something is crossed out, candidates are advised not to write over the original.

Comments on specific questions

Question 1

(a) This question was usually answered very well.

(b) Some of the answers given were definitions of an atom rather than an element. Some candidates referred to elements as containing one atom rather than one kind of atom. Others thought that elements could not be broken down into anything smaller rather than simpler.

(c) This question was answered very well.

Question 2

(a) Candidates needed to recognise that all Group 1 elements have one electron in their outer shell rather than trying to deduce the electron configuration from the atomic number. Some candidates gave the answer 3 by attempting this.

(b) Many candidates gave physical properties, such as hardness or melting point, in which rubidium would be expected to differ from transition elements.

(c) Although this was answered better than **(b)** there was some confusion between chemical and physical properties**.** Some weaker candidates thought reactivity was a physical property.

(d) (i) Many candidates thought that the names of the products and the fact that the reaction was fast, vigorous or even violent were examples of observations. Although fizzing, bubbling or effervescence are all acceptable alternatives to each other, they are not different from each other.

(ii) Many candidates were either unaware that the solution was alkaline after the reaction or unaware that methyl orange was yellow in an alkaline solution.

(iii) Those who used correct formulae usually managed to balance the equation. Rubidium oxide (with both correct and incorrect formulae) was seen as an alternative to rubidium hydroxide. Hydrogen was sometimes absent as a product or its formula was given as H.

(iv) There were many correct answers to this question. The most common errors were to reverse the order or to make potassium the most reactive element, possibly because potassium was the most reactive Group 1 metal that candidates have seen for themselves.

(v) There were many correct answers to this question, including excellent suggestions regarding carrying out the reaction in the open air.

(e) This question was answered very well.

Question 3

(a) Many candidates produced good answers to this question. However, the structure of carbon dioxide proved the most problematic. The word micromolecular was often seen as an answer and is not an appropriate description.

(b) (i) This question was answered well by most candidates.

(ii) This question proved challenging for many candidates with only the strongest candidates providing a clear answer.

(iii) This question proved challenging for many candidates. A number of answers referred to covalent bonding or bonds between atoms being weak.

(iv) Only the strongest candidates were able to provide the correct answer to this question. There was some confusion in some answers with free or delocalised being referenced instead of mobile.

(c) $NaCO_3$ was seen far more often than the correct formula, Na_2CO_3. Hydrogen was frequently seen as a product, possibly because candidates saw this as a method of ‘balancing’ an equation with incorrect formulae.

(d) All parts of **(d)** were answered extremely well and were amongst the best answered questions on the paper.

Question 4

(a) This was answered quite well. However, some answers stated that catalysts alter the rate of a reaction without saying that they speed up a reaction.

(b) (i) Many candidates did not show an awareness that rate of reaction depends on the concentration of solutions, and that the concentration of solutions is highest at the start before any of the solution is used up. Some candidates interpreted the graph as being rate plotted against time and thought the rate was highest when the graph levelled off, which was when there was no hydrogen peroxide left.

(ii) Heating or increasing the temperature were very common correct answers. Despite the instructions of the question, a number of candidates referred to increasing the amount of hydrogen peroxide or increasing the amount of catalyst.

(c) (i) (ii) and **(iii)** were answered correctly.

(iv) This question was usually answered correctly, but some candidates thought that the volume would increase**.**

(v) Many candidates achieved the correct answer, although their method of calculation seemed to be more complicated than multiplying their answer to **(c)(iii)** by two as was required by the question.

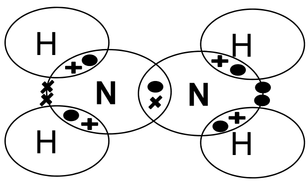
(d) Some candidates did not address the question in their answer and speculated which of the two catalysts would be the best. Either the volume or the concentration of hydrogen peroxide were often mentioned.

Question 5

(a) (i) There were many excellent answers to this question. Candidates did not always quote units for all physical quantities. Details of how hydrogen and nitrogen are obtained were not required. N and H were sometimes seen as incorrect formulae in the equation. Atp was seen occasionally as units of pressure instead of atm.

(ii) A range of correct answers were seen with fertilisers being a common response.

(b) Many excellent diagrams were seen. However, many candidates drew diagrams in which it was difficult to see which electrons were shared and which were not. Double bonds between the nitrogen atoms were drawn occasionally, despite the single 'stick' in the diagram referring to a single bond. Lewis structures of the type shown below are preferred and should be encouraged.



(c) (i) A considerable number of candidates knew that the definition of a base was as a proton acceptor. Some candidates included comments about hydroxide ions or reactions to this which was not required for the question.

(ii) This question proved challenging for most candidates. Hydrazine accepts a proton when it acts as a base. A proton has the symbol H^+. Therefore, N_2H_4 should have one H and one + charge added to it, therefore becoming $N_2H_5^+$. It was not unusual to see N_2H_5 without the positive charge. H_2O should have one H and one + charge removed from it, therefore becoming OH^-.

(d) (i) Most candidates knew that nitrogen dioxide caused acid rain, although there were many references to global warming and greenhouse gases.

(ii) There were many good answers to this question. However, several candidates thought that nitrogen came from the fuel rather than the air. In addition, catalytic converters were also thought to be involved in the production (rather than the removal) of oxides of nitrogen.

Question 6

(a) There were several correct answers, mainly S^-, although S^{2-} was also a common correct answer, possibly because of candidates' familiarity with the sulfide ion.

(b) A variety of methods were given to distinguish the two substances. Many candidates based their answers on comparison between iron and gold rather than by giving a differentiation between them.

(c) (i) There were several correct answers, although some candidates decided to use different formulae to those of the substances referred to in the question.

(ii) While many candidates answered correctly, a number of answers gave 'manufacture of paper' without giving enough detail.

Question 7

(a) (i) This was answered well, although some candidates did not state that the substances only contain carbon and hydrogen. Some weaker candidates thought that hydrocarbons were elements and others thought they were made from carbon and hydrogen molecules.

(ii) This question was answered very well.

(b) (i) Many candidates answered this question well. The most common error was not to divide by relative atomic masses and express the percentages as the smallest whole number ratio. The largest source of error was rounding up or down too much.

(ii) This question proved more challenging than **(b)(i)** but was answered correctly by stronger candidates.

(c) Candidates generally found this to be challenging and did not appear to be well prepared in this area. Many atoms with incorrect valencies were drawn. It was not unusual to see molecules with many more than three carbon atoms.

(d) This was answered much better than **(c)** by most candidates.

(e) (i) and **(ii)** Both of these questions were well answered by the majority of candidates.

(iii) Many represented the functional groups as –COOH and –OH. Although the C=O bond was occasionally shown, the O–H was very often missing.

CHEMISTRY

Paper 0620/52
Practical Test

Key messages

- When required to choose an appropriate scale for the *x* or y-axis of a graph, at least half of the grid should be involved to plot the points. The axis does not have to start at 0. Points should be clearly plotted; minute dots are not suitable. Straight line graphs should not be drawn when a smooth line graph is requested.

- Candidates should make full use of the **NOTES FOR USE IN QUALITATIVE ANALYSIS** page of the question paper. This gives the formulae of many ions and gases and will help to avoid confusion between, for example, ammonia and ammonium and iodine and iodide.

General comments

The majority of candidates successfully completed all questions and there was no evidence that candidates were short of time. The complete range of marks was seen with some candidates producing very strong answers.

The results obtained by some supervisors and candidates suggested that some Centres did not use materials specified in the Confidential Instructions.

Comments on specific questions

Question 1

(a) Almost all candidates completed the table of results. Good results were obtained by the majority of candidates, with higher temperatures giving shorter reaction times and generally agreeing well with those obtained by the supervisors. A minority of candidates incorrectly recorded the times in minutes instead of seconds. A significant number of candidates incorrectly recorded the initial temperatures as room temperature for all four experiments, while others were unable to work out the average temperatures as required.

(b) Most candidates plotted all points correctly; choosing an appropriate scale on the vertical axis of the graph caused some problems. Most curves were good attempts and some best-fit straight lines were provided where appropriate. Some candidates drew a best-fit straight line, when a smooth curve was a better choice.

(c) Many candidates did not extrapolate their graph clearly and did not always show where they had read their answer from the grid. Some candidates misread their scale on the *y*-axis. Incorrect units were frequently given.

(d) (i) This question was generally correctly answered.

(ii) The strongest candidates were able to explain that the rate of reaction was greatest because particles had gained energy/moved faster with an increased chance or frequency of collisions. Most responses just referred to higher temperatures or less time of reaction.

(e) (i) Most candidates understood that using a burette to measure the volume of solution **J** would be more accurate. Better performing candidates made a comparison with a measuring cylinder. A minority of candidates thought that using a burette would be less accurate and that it would take a longer time to carry out the measurement.

(ii) Stronger candidates performed well on this question**.** However, in many answers the suggested improvements were not relevant to this experiment. Such answers included starting at a common temperature or using a regular swirling technique. Vague answers discussed using a stop watch instead of a stop clock or dipping the thermometer in a constant position in the conical flask, or using a different sized flask.

Candidates who performed well repeated the experiments and found the average/mean of the readings, or used insulation to reduce heat losses. Some candidates also used a pipette instead of a measuring cylinder, or a calorimeter or digital thermometer.

Question 2

(a) Most candidates correctly stated that the solid was green or blue. There were also some incorrect references to yellow.

(b) (i) The majority of candidates reported the formation of a blue precipitate, which dissolved in excess aqueous ammonia to form a deep blue solution. Some weaker answers referred to the blue precipitate dissolving to form a deep blue precipitate while others missed the initial formation of the blue precipitate.

(ii) The formation of a blue precipitate was often described as a blue solution. A number of candidates did not mention the blue precipitate and just described insolubility.

(iii) The formation of a white precipitate was often described. References to cloudy, solid formation were not relevant.

(iv) The formation of a white precipitate was often described, despite this being a test for sulfate ions. The expected observation was no change/precipitate or reaction. Many answers referred to the formation of a precipitate or coloured solution.

(c) Most candidates identified the presence of copper ions. However, a number stated that sulfate ions were present despite a positive test for chloride ions in **(b)(iii).** A number of candidates concluded that bromide ions were present.

(d) Candidates needed to record carefully during this qualitative analysis section and this was not always evident. Many candidates gave just one observation, usually that red litmus turned blue. Descriptions of sublimate formation and evolution of purple gas were rare. Some candidates described the pungent smell of the gas. Some candidates stated that ammonia was present and this is not an observation.

(e) (i) Many candidates did not mention the result of testing the gas and just stated that ammonia was formed.

(ii) The formation of a yellow precipitate was often stated. A significant number of candidates omitted precipitate and merely wrote a colour. Weaker candidates described the formation of a white or cream precipitate. This showed a possible lack of practical expertise and experience when carrying out the halide test.

(f) There were some strong answers to this question. Many candidates correctly identified both ions present in solid **M**, but there was some confusion between ammonia and ammonium. Other candidates confused iodine and iodide.

Question 3

There was a range of answers for this planning question with many candidates producing excellent responses. It was evident that many Centres had covered chromatography in great detail.

However, other candidates often failed to explain the use of the E number colours in the investigation. Many of these candidates made vague statements, such as ‘see if the orange drink contains two colours or only one colour’.

A minority of candidates used the wrong method, such as fractional distillation or testing with acid-base indicators. Some candidates tried mixing solutions of the E numbers and compared the colour obtained to the orange drink.

CHEMISTRY

Paper 0620/62
Alternative to Practical

Key messages

On graphs, points should be clearly plotted. Very small dots are not suitable. Candidates should be reminded to pay attention to the specific requirements of graphs. Straight line graphs should not be drawn when a smooth line graph is requested. Extrapolation of a graph line should follow the expected path and not deviate markedly.

Questions requiring candidates to plan an investigation should be answered with details of the apparatus to be used, the substances involved, and practical procedures clearly specified. Some idea of a conclusion should be given.

General comments

This was the first time that this Question Paper has been taken for the revised 0620 syllabus and the standard of answers was high. The majority of candidates successfully completed all questions and there was no evidence that candidates were short of time. Stronger candidates were able to demonstrate their ability well.

Comments on specific questions

Question 1

(a) This was well answered. Some candidates identified the tripod as a stand. A minority of candidates named the glass rod / stirrer as a thermometer, spatula or rod.

(b) (i) Weaker candidates described the steps in detail, often wrongly.

(ii) This was very well known and clearly understood.

(c) (i) Weaker answers referred to the calcium compounds instead of water.

(ii) Filtrate or solution was credited for the general name given to the liquid in the dish. Common wrong answers were solute, solvent, water and residue.

(d) Stronger candidates described the appearance of crystals, often describing the glass rod technique. A large number of candidates described evaporation to dryness which was not credited. There were a number of vague responses such as “the liquid starts to boil” or “when a gas is given off”.

Question 2

(a) Almost all candidates completed the table of results. A minority of candidates incorrectly recorded the time for Experiment 1 in minutes instead of seconds. Some candidates were unable to work out the average temperatures.

(b) Most candidates plotted all points correctly. Most curves were good attempts and dot-to-dot straight lines drawn with a ruler were rare. Some candidates drew a best fit straight line when a smooth curve was the correct choice.

(c) Many candidates clearly extrapolated their graph and showed where they had read their answer from the grid. Weaker candidates misread the scale on the *y*-axis. Incorrect units were frequently given.

(d) (i) This was generally correctly answered with Experiment 4 given.

(ii) Only the stronger candidates could explain that the rate of reaction was greatest because of the higher temperature and that particles had gained energy / moved faster resulting in an increased chance or frequency of collisions. Most responses referred to a shorter reaction time and were not be credited.

(e) (i) Most candidates understood that using a burette to measure the volume of solution **J** would be more accurate and scored partial credit. A minority of candidates thought that using a burette would be less accurate and that it would take a longer time to carry out the measurement.

(ii) Stronger candidates suggested repeating the experiments and found the average / mean of the readings, or used insulation to reduce heat losses. Using a pipette instead of a measuring cylinder, or a calorimeter or digital thermometer were common suggestions which scored partial credit.

Often suggested improvements were not relevant to this experiment such as starting at a common temperature or using a regular swirling technique. Weaker answers discussed using a stopwatch instead of a stop-clock or using a different sized flask.

Question 3

(a) Many candidates correctly stated that the solid was green or blue. References to white and black were common and were not credited. Some candidates described solid **L** as a precipitate or as a solution.

(b) (i) The majority of candidates reported the formation of a blue precipitate which dissolved in excess aqueous ammonia to form a deep blue solution. Some confused answers referred to the blue precipitate dissolving to form a deep blue precipitate, while others missed the initial formation of the blue precipitate.

(ii) The formation of a blue precipitate was often described as a blue solution. A number of candidates failed to mention the blue precipitate and just described insolubility.

(iii) The formation of a white precipitate was often described. References to “no reaction” were seen.

(iv) The formation of a white precipitate was often described, despite this being a test for sulfate ions. The expected observation was no change. A number of answers incorrectly referred to the formation of a precipitate.

(c) Many candidates correctly identified both ions present in solid **M**, but there was some confusion between ammonia and ammonium. Other candidates confused iodine and iodide. Solid **M** was ammonium iodide.

Question 4

A number of Centres had covered chromatography in great detail and there were some very strong answers to this question. Other candidates gained partial credit but often failed to explain the use of the E110 and E129 in the investigation. Many of these candidates made vague statements such as, “see if the orange drink contains two colours or only one colour”.

A minority of candidates used the wrong method such as fractional distillation or testing with acid-base indicators. Some candidates tried mixing solutions of E110 and E129 and compared the colour obtained to the orange drink.

Some clear and explicit diagrams were drawn and often full credit was given for these.

References to the use of a locating agent were ignored.