Candidates' Performance

Paper 1

Paper 1 consisted of two sections: Section A (multiple-choice questions) and Section B (conventional questions). Sections A and B each comprised two parts: Part I and Part II. Part I contained questions mainly on Topics I to VIII of the curriculum, while Part II contained questions mainly on Topics IX to XII. All questions in both sections were compulsory.

Section A (multiple-choice questions)

This section consisted of 36 multiple-choice questions. The mean score was 23.3. The performance of candidates was generally good. Some misconceptions were revealed by candidates in their performance on the following items:

1.   For Q.22, iron is a moderately reactive metal and it can react with 1.0 M nitric acid (solution A) and 0.5 M sulphuric acid (solution B). Thus, statement (1) is correct. It should be noted that 100 cm^3 of 1.0 M nitric acid and 100 cm^3 of 0.5 M sulphuric acid contain the same number of moles of $H^+(aq)$ ions. Therefore, solution A and solution B require the same number of moles of $OH^-(aq)$ ions for complete neutralisation. Thus, statement (2) is correct. Many candidates did not recognise that the insoluble calcium sulphate formed from the reaction of $CaCO_3(s)$ with sulphuric acid can stop further reaction. There should be a smaller number of moles of carbon dioxide gas evolved from the reaction of $CaCO_3(s)$ with solution A than from the reaction of $CaCO_3(s)$ with solution B. Thus, statement (3) is wrong.

Q.22.   Consider the following two solutions :

Solution A : 100 cm^3 of 1.0 M nitric acid
Solution B : 100 cm^3 of 0.5 M sulphuric acid

Which of the following statements are correct ?

(1)   Both solution A and solution B can react with iron.
(2)   Complete neutralisation of solution A and complete neutralisation of solution B require the same volume of 1.0 M potassium hydroxide solution.
(3)   When 0.05 mol of $CaCO_3(s)$ is separately added to solution A and to solution B, the same number of moles of gas is evolved in both cases.

A.*	(1) and (2) only	(25%)
B.	(1) and (3) only	(24%)
C.	(2) and (3) only	(7%)
D.	(1), (2) and (3)	(44%)

2.	For Q.27, about one third of the candidates correctly chose the answer D. Candidates should note that an increase in the concentration of Fe^{3+}(aq) ions would shift the equilibrium position to the right, thus the concentration of $Fe(SCN)^{2+}$(aq) ions would increase. Many candidates had the misconception that the rate of forward reaction increased and the rate of backward reaction decreased, so that the equilibrium position shifted to the right. According to the dynamic nature of a chemical equilibrium, an increase in the concentration of a reactant would increase the rate of forward reaction and the concentration of the product, and this would also lead to an increase in the rate of backward reaction. However, the increase in the rate of forward reaction is to an extent greater than the increase in the rate of backward reaction.

Q.27	Consider the following equilibrium system at room conditions :

Fe^{3+}(aq) + SCN^-(aq) $\rightleftharpoons$ $Fe(SCN)^{2+}$(aq)
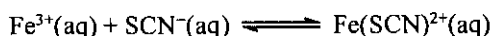
A small amount of $Fe(NO_3)_3$(s) is added to the equilibrium mixture, and a new equilibrium is finally attained at the same conditions. In comparison with the original equilibrium, which of the following combinations concerning this new equilibrium is correct ?

	Rate of *backward* reaction	Concentration of $Fe(SCN)^{2+}$(aq)	
A.	decreased	unchanged	(10%)
B.	decreased	increased	(50%)
C.	increased	unchanged	(10%)
D.*	increased	increased	(30%)

3.	For Q.28, candidates should note that there would be an immediate formation of white precipitate of silver chloride from the spontaneous reaction between $AgNO_3$(aq) and NaCl(aq). Many candidates did not consider Zn(s) to be a moderately reactive metal and wrongly thought that the reaction between Zn(s) and HCl(aq) is very fast. This may explain why just below half of the candidates wrongly chose option B as the answer.

Q.28	Which of the following chemical reactions is the fastest at room conditions ?

A.*	$AgNO_3$(aq) + NaCl(aq) $\longrightarrow$ AgCl(s) + $NaNO_3$(aq)	(30%)

B.	Zn(s) + 2HCl(aq) $\longrightarrow$ $ZnCl_2$(aq) + H_2(g)	(44%)

C.	4Fe(s) + $3O_2$(g) $\longrightarrow$ $2Fe_2O_3$(s)	(6%)

D.	CH_4(g) + Br_2(in organic solvent) $\xrightarrow{\text{light}}$ CH_3Br(g) + HBr(g)	(20%)

Section B (conventional questions)

Question Number	Performance in General
1	The performance of candidates was good. In part (a), about two thirds of the candidates were able to write the correct name of Group II. A small number of the candidates wrongly gave 'alkali earth metal' as the answer. In part (b)(i), about three quarters of the candidates were able to give the correct chemical equation for the reaction between carbon dioxide and limewater ($Ca(OH)_2(aq)$). In part (b)(ii), about half of the candidates were able to give 'calcium hydrogencarbonate' or '$Ca(HCO_3)_2$' as the reaction product. A small number of the candidates wrongly gave '$CaHCO_3$' as the answer. In part (c), about three quarters of the candidates were able to calculate the relative atomic mass of strontium. A small number of the candidates wrongly wrote a unit in the answer. In part (d)(i), about three quarters of the candidates were able to draw the electron diagram for strontium chloride. A small number of the candidates gave incorrect charges for the ions. In part (d)(ii)(1), just below half of the candidates correctly stated that the bonding in solid strontium is the electrostatic attraction between 'strontium ions' and 'delocalised electrons'. About a third of the candidates wrongly stated that it is the electrostatic attraction between 'strontium ions' and 'chloride ions', or they failed to write 'delocalised electrons' correctly. In part (d)(ii)(2), about three quarters of the candidates were able to give the correct structure for solid strontium chloride. A small number of the candidates wrongly wrote 'giant metallic' structure as the answer. In part (d)(iii), just below half of the candidates were able to correctly state and explain that solid strontium can conduct electricity while solid strontium chloride cannot. Some candidates merely stated that solid strontium chloride does not have delocalised electrons but they did not mention that the ions are not mobile in solid strontium chloride.
2	The performance of candidates was satisfactory. In part (a), about two thirds of the candidates were able to state that oxygen can be obtained by fractional distillation of liquefied air. A small number of the candidates omitted 'liquefied' in their answers. In part (b)(i), a very high proportion of the candidates were able to state that gas X is sulphur dioxide. In part (b)(ii), just below half of the candidates were able to write a correct ionic equation for the reaction between gas X and acidified $K_2Cr_2O_7(aq)$. About a quarter of the candidates were not able to balance the ionic equation properly. In part (c), about half of the candidates were able to give the correct chemical equation for the reaction that occurred in the combustion tube. Some candidates were not able to balance this equation correctly. A small number of the candidates wrongly considered that Pb is formed in the reaction. In part (d), about a third of the candidates were able to state that the experiment should be performed inside a fume cupboard and give a correct explanation. About a third of the candidates did not give an explanation in their answers. In part (e)(i), just below half of the candidates were able to recognise that Pb(s) is formed and state the solid product as 'silvery' or 'shiny'. A small number of the candidates wrongly stated that 'a white solid' is formed. In part (e)(ii), about half of the candidates were able to state and explain the reaction in Stage II is a redox reaction in terms of oxidation number of Pb or C. A small number of the candidates wrongly stated that the oxidation number of oxygen changes from -2 to 0 in the reaction.
3	The performance of candidates was very good. In part (a), almost all of the candidates were able to arrange the three metals in the correct descending order of reactivity. In part (b), about three quarters of the candidates were able to suggest a correct test for gas Y. A small number of the candidates wrongly suggested that gas Y can be tested with 'a glowing splint'. In part (c)(i), about three quarters of the candidates were able to correctly state an expected observation when metal C reacts vigorously with water. In part (c)(ii), a very high proportion of the candidates were able to explain why it is dangerous to carry out the reaction of metal C with dilute hydrochloric acid. In part (d), just below half of the candidates were able to outline the experimental procedure to conduct a displacement reaction to confirm the relative reactivities of metal **A** and metal **B**, and state the corresponding expected observations. A small number of the candidates were able to suggest the correct experimental procedure but they failed to give the expected observations.

Question Number	Performance in General
4	The performance of candidates was good. In part (a)(i), about two thirds of the candidates were able to calculate the basicity of tartronic acid from the given information. A small number of the candidates were able to calculate the respective number of moles of NaOH and tartronic acid involved, but they were not able to conclude the basicity of tartronic acid. In part (a)(ii), about half of the candidates were able to write the correct structural formula of tartronic acid. In part (b), about a third of the candidates were able to perform the correct calculation to show that tartronic acid is not completely ionised in water. About a third of the candidates failed to use the basicity of tartronic acid as '2' in the calculation.
5	The performance of candidates was satisfactory. In part (a), just under half of the candidates were able to describe and explain the formation of hydrogen bonding using basic chemistry concepts like 'In a HF molecule, the F atom has a very high electronegativity and hence it forms a polar covalent bond with H atom.' and 'The lone pair of electrons on the F atom will have a strong intermolecular attraction with a H atom in another HF molecule.'. Some candidates provided wrong diagrams, such as '---:F---H---:F---H---' without indicating where the hydrogen bonding is. In part (b)(i), a very high percentage of the candidates were able to identify Q as CH_3F. In part (b)(ii), below half of the candidates were able to explain why Q is polar using the correct concept 'the polarities of the C-H bonds and C-F bond do not cancel out each other'. Some candidates provided wrong answers, such as 'the polar bonds cannot cancel out each other' and 'C–H bonds and C–F bond will cancel each other'.
6	The performance of candidates was satisfactory. In part (a), about three quarters of the candidates were able to calculate the enthalpy change of combustion of hexane using the given experimental data. A small number of candidates made a wrong step in the calculation : they added the mass of hexane (0.12 g) in calculating the energy absorbed by the water. In part (b)(i), about a third of the candidates were able to write the correct chemical equation. Quite a number of candidates gave a thermochemical equation instead of the chemical equation asked for in the question. In part (b)(ii), about half of the candidates were able to calculate the standard enthalpy change of combustion of hexane using the given data. In part (c), about half of the candidates were able to use concepts like 'The experiment was performed at different reaction conditions rather than standard conditions.', 'Some hexane was evaporated.' and 'There was incomplete combustion of hexane.' as the reason.
7	The performance of candidates was good. In part (a), about two thirds of the candidates were able to give the systematic name of X as dimethylpropane. A small number of the candidates gave incorrect answers like '2,2 dimethyl propane' or '2-dimethylpropane'. In part (b), about half of the candidates were able to suggest the difference between the burning characteristics of X and Y. Some candidates did not recognise that Y would burn with a more sooty and yellow flame than X. In part (c), about two thirds of the candidates were able to suggest the most appropriate testing reagent like bromine in organic solvent or acidified potassium permanganate solution for distinguishing X and Y and state the respective observations. In part (d), about two thirds of the candidates were able to draw the repeating unit of the polymer formed from Y. A small number of the candidates gave wrong answers as below :

Question Number	Performance in General
8	The performance of candidates was good. In part (a), about three quarters of the candidates were able to draw a labelled diagram for the experimental set-up. Some candidates did not give a clear indication of the positive and negative terminals of the d.c. power supply, while some candidates incorrectly included a salt bridge in the diagram. In part (b), about three quarters of the candidates were able to state the function of nickel(II) sulphate solution in the experiment. In part (c), about three quarters of the candidates were able to write the correct half equation. A small number of the candidates did not balance the half equation or gave a wrong positive charge to the nickel(II) ion. In part (d), about a third of the candidates were able to explain why there would not be any observable change in the solution during the experiment. Some candidates provided a correct answer such as 'The rate of formation of nickel(II) ions at the anode is the same as the rate of consumption of nickel(II) ions at the cathode, this results in no change in the concentration of nickel(II) ions in the solution.'. In part (e), a very high proportion of the candidates were able to demonstrate a good understanding of the main purpose of electroplating nickel on iron objects, such as 'rust prevention' or 'improving appearance'.
9	The performance of candidates was fair. Just below half of the candidates were able to demonstrate a complete understanding of the experimental procedure involved in the preparation of magnesium sulphate crystals from solid magnesium carbonate and dilute sulphuric acid. For the first step or the formation of magnesium sulphate, many candidates had mistaken concepts, such as 'magnesium carbonate is soluble in water', 'magnesium sulphate is an insoluble salt' and 'It is required to use an excess amount of sulphuric acid instead of an excess amount of magnesium carbonate.'. For the second step or the crystallisation process, many candidates wrongly stated that 'the crystals will be formed from just putting the magnesium sulphate solution on the bench' and they did not mention that 'crystallisation requires a definite period of time'. Quite a number of the candidates did not mention that it is necessary to heat up magnesium sulphate solution to make it become more concentrated or saturated. For the final step or the further treatment of the crude crystals, quite a number of candidates did not mention about 'filtering the crystals', 'washing the crystals with a small amount of cold distilled water' or 'drying the crystals using a filter paper or a desiccator'.
10	The performance of candidates was good. In part (a), about two thirds of the candidates were able to state that the concentrations of A(aq) and C(aq) do not change after the 30th minute. In part (b), about three quarters of the candidates were able to draw a correct curve to show the variation of the concentration of B(aq) with time. In part (c), about half of the candidates were able to correctly calculate the equilibrium constant for the reaction. A small number of the candidates used the wrong expression for the equilibrium constant in the calculation, or gave the wrong unit in their answers. In part (d), about a third of the candidates were able to write a complete deduction to show that T_1 is the higher temperature and recognise that the equilibrium position shifts to the left at T_2. About a third of the candidates did not give a complete deduction, they did not clearly state that lower temperature favours the backward reaction as the forward reaction is endothermic.

Question Number	Performance in General
11	The performance of candidates was satisfactory. In part (a)(i), about a quarter of the candidates were able to give the correct systematic name of **X**. Many candidates gave incorrect answers like 'but-2-ene' or '*cis* but-2-ene'. In part (a)(ii), about two thirds of the candidates were able to write the structural formula of **Y**. A small number of the candidates only wrote '$CH_3CH=CHCH_3$' without stating whether it is a *cis* or *trans* isomer, or they wrongly gave the structure of a *cis* isomer as the answer. In part (b)(i), about two thirds of the candidates were able to suggest the correct reagent and condition for carrying out the dehydration of **Z**. A small number of the candidates only gave 'H_2SO_4' without mentioning that it should be concentrated, or they failed to mention that heating is required for the reaction. In part (b)(ii), about two thirds of the candidates were able to give the correct structural formula of **Z**. In part (b)(iii), about half of the candidates were able to draw the correct three-dimensional diagrams for the structures of the pair of enantiomers of **Z**. A small number of the candidates were not able to draw the tetrahedral shape properly, or they drew the incorrect substituents in the structures. In part (b)(iv), just under half of the candidates were able to state that the two enantiomers can rotate the plane of plane-polarised light in opposite directions. Some candidates failed to state the term 'plane-polarised light' precisely, and a very small number of the candidates wrongly stated that when the enantiomers were placed under plane-polarised light, the molecules of the enantiomers would rotate in opposite directions.
12	The performance of candidates was good. Just under half of the candidates were able to give a complete and correct synthetic route for the conversion of $CH_3CH_2CH_2CH_2OH$ to $CH_3CH_2CH_2CONH_2$. About a third of the candidates were able to suggest the conversion route but made some mistakes as follows: 'giving an incorrect chemical formula such as KCr_2O_7 or $K_2Cr_2O_7^{2-}$ for the oxidising agent used in Step 1', 'missing the use of $H^+(aq)$ in Step 1', 'giving a structure with incorrect carbon chain length for the intermediate', 'NH_3 is chosen for the reagent in Step 2 but no heating is used.' and 'without stating that PCl_3 and NH_3 have to be used in two separate steps'.
13	The performance of candidates was fair. In part (a), about a third of the candidates were able to give a complete and correct explanation for the difference in the melting points of SiO_2, P_4O_{10} and SO_2. About two thirds of the candidates were able to recognise that SiO_2 has a giant covalent structure while P_4O_{10} and SO_2 have simple molecular structures. However, some candidates were not able to clearly state that there are strong covalent bonds between Si and O atoms in SiO_2, or there are weak van der Waals' forces between P_4O_{10} molecules and between SO_2 molecules respectively. A very small number of the candidates wrongly stated that there are strong covalent bonds between SiO_2 'molecules'. A very small number of the candidates wrongly stated that the van der Waals' forces between P_4O_{10} molecules are stronger than those between SO_2 molecules because the molecular 'mass' of P_4O_{10} is larger than that of SO_2. In part (b)(i), just under half of the candidates were able to write the correct chemical equation for the reaction between $Fe^{2+}(aq)$ and $H_2O_2(aq)$ in an acidic medium. A small number of the candidates failed to balance the equation properly. In part (b)(ii), a small number of candidates were able to precisely demonstrate that iron exhibits variable oxidation states and iron forms coloured ions using the given chemical reaction. Common mistakes included 'the oxidation number of Fe^{2+} is +2' and 'transition metals are coloured'.

Question Number	Performance in General
14	The performance of candidates was poor. A very small number of the candidates were able to give a correct and complete answer. About half of the candidates were able to explain why the progress of the reaction can be followed by measuring the colour intensity of the reaction mixture. They were able to state that 'the colour intensity of brown $Br_2(aq)$ decreases as the concentration of $Br_2(aq)$ gradually decreases' or 'the brown $Br_2(aq)$ is the only coloured species in the reaction mixture'. About two thirds of the candidates failed to mention that the colour intensity of the reaction mixture has to be measured at regular time intervals. About a third of the candidates were able to give a labelled graph to show the expected results. A small number of the candidates gave incorrect labels, or wrongly drew a straight line for the graph. About a quarter of the candidates were able to correctly explain the shape of the graph. Some candidates failed to state the relationship between the slope of the curve and the rate of the reaction. Some candidates merely stated that the colour intensity of the reaction mixture decreases because the concentration of $Br_2(aq)$ decreases, without mentioning the change in reaction rate.

Paper 2

Paper 2 consisted of three sections. Section A contained questions set on Topic XIII 'Industrial Chemistry', Section B on Topic XIV 'Materials Chemistry' and Section C on Topic XV 'Analytical Chemistry'. Candidates were required to attempt all questions in two of the sections.

Question Number	Popularity (%)	Performance in General
Section A: 1	97	The performance of candidates in part (a) was satisfactory. In part (a)(i)(1), nearly half of the candidates were able to suggest a reason why it is necessary to synthesise vitamin C in industry. In part (a)(i)(2), nearly half of the candidates were able to suggest a reason for the process of synthesising vitamin C not to be considered as 'green'. Some candidates mentioned that NaOH is harmful or toxic instead of corrosive as the reason. In part (a)(ii)(1), about two thirds of the candidates were able to suggest a source of methane. In part (a)(ii)(2), about half of the candidates were able to write the chemical equation for the formation of syngas from methane. Some candidates wrongly wrote CO_2 as one of the products in the chemical equation. In part (a)(iii), about half of the candidates were able to state two chemicals manufactured by the chloroalkali industry.

The performance of candidates in part (b) was fair. In part (b)(i), about half of the candidates were able to state the meaning of the term 'activation energy'. In part (b)(ii), about two thirds of the candidates were able to draw the energy profile for the reaction of the Haber process. Some candidates wrongly drew the Maxwell–Boltzmann distribution curve. Some candidates wrongly labelled the horizontal axis as 'reactant coordinate' or 'time'. In part (b)(iii), just under half of the candidates were able to calculate the activation energy of the backward reaction of the Haber process. In part (b)(iv), just under half of the candidates were able to state the optimal operation temperature and pressure used in the Haber process. About a third of the candidates were able to explain why such conditions were used. In part (b)(v), about a quarter of the candidates were able to suggest a reason why the use of more iron catalyst cannot increase the yield of ammonia in the Haber process.

The performance of candidates in part (c) was fair. In part (c)(i)(1), about two thirds of the candidates were able to suggest a way to increase the effectiveness of the palladium catalyst. In part (c)(i)(2), about a third of the candidates were able to suggest a reason why **Y** is recovered. Some candidates only mentioned that **Y** is regenerated in Step (2) without giving a reason. In part (c)(i)(3), a small number of the candidates were able to suggest a reason why hydrogen peroxide is not synthesised from hydrogen gas and oxygen gas in a single step. In part (c)(ii)(1), about two thirds of the candidates were able to deduce the order of reaction with respect to $I^-(aq)$ and that with respect to $H^+(aq)$. In part (c)(ii)(2), about half of the candidates were able to calculate the rate constant of the reaction by substituting the data in Trial 1 into the rate equation they deduced in part (c)(ii)(1). Some candidates wrongly gave '$mol^{-1}\ dm^3$' or '$mol^{-2}\ dm^6\ s^{-1}$' as the unit of the rate constant of the reaction. |

Question Number	Popularity (%)	Performance in General
Section B: 2	6	The performance of candidates in part (a) was very poor. In part (a)(i), a small number of the candidates were able to make a good comparison between the two methods used to prepare hexanedioic acid based on the principles of green chemistry. Some candidates mentioned the use of a catalyst in Method (II) without further elaboration. Similarly, some candidates mentioned the use of corrosive concentrated HNO_3 in Method (I), but did not compare this with Method (II). Some candidates erroneously considered N_2O to be an acidic gas, leading to the formation of acid rain in Method (I), or H_2O_2 is a catalyst in Method (II). In part (a)(ii), about a third of the candidates were able to correctly point out the long carbon chain, the benzene rings or the C=N group as the structural features making the substance exhibit liquid-crystalline behaviour. In part (a)(iii), a very small number of the candidates were able to draw the correct repeating unit of urea-methanal. Some common wrong drawings for the repeating unit are shown as below : The performance of candidates in part (b) was poor. In part (b)(i), about a quarter of the candidates were able to write the name of the type of crystal structure. The most common wrong answer was 'body-centred cubic'. In part (b)(ii), about a quarter of the candidates were able to deduce the number of silver atoms in the unit cell shown. The most common wrong answer was 13. In part (b)(iii)(1), a small number of the candidates were able to explain why the melting point of sterling silver is lower than that of pure silver by comparing the sizes of copper and silver atoms and the weakening of metallic bond strengths in the alloy. In part (b)(iii)(2), just below half of the candidates were able to suggest that sterling silver is harder or more lustrous than pure silver. In part (b)(iv), about a third of the candidates were able to calculate the diameter of the spherical cluster and subsequently point out that the size of the spherical cluster is in the range of the typical size of a nanoparticle. The performance of candidates in part (c) was very poor. In part (c)(i), about a quarter of the candidates were able to state the meaning of 'condensation polymer'. Quite a number of the candidates simply mentioned 'loss of small molecules' without further elaboration. In part (c)(ii), a very small number of the candidates were able to write the balanced chemical equation for the formation of poly(ethylene terephthalate) (PET). Common mistakes included 'writing wrong formulae for the reactants and the polymer chain' and 'missing H_2O in the equation'. In part (c)(iii), a small number of the candidates were able to mention 'no cross-linkage between PET polymer chains' as the reason for why PET is a thermoplastic. In part (c)(iv), a very small number of the candidates were able to explain why water evaporates more easily from a wet 'cooling towel' when compared with a wet cotton towel of the same size using their structural features. In general, precise and concise answers, such as 'cellulose chains consist of many −OH groups leading to stronger hydrogen bonds between cellulose and water molecules, while PET chains consist of ester groups leading to only weaker van der Waals' forces between PET and water molecules' were not commonly found. In part (c)(v), about a quarter of the candidates were able to suggest 'extrusion moulding' as the correct answer. In part (c)(vi), a very small number of the candidates mentioned that it is difficult to remove additives from the 'cooling towel'. The most common wrong answer was 'PET is biodegradable'.

Question Number	Popularity (%)	Performance in General
Section C: 3	96	The performance of candidates in part (a) was satisfactory. In part (a)(i), about half of the candidates were able to suggest a test to distinguish between $Ca(NO_3)_2(s)$ and $Mg(NO_3)_2(s)$. Some candidates wrongly stated that $Mg(NO_3)_2(s)$ would give a bright white flame in flame test. Some candidates wrongly suggested the use of $NaOH(aq)$ and overlooked that both would have similar observations. In part (a)(ii), about two thirds of the candidates were able to point out that solid sodium hydroxide can absorb water vapour and carbon dioxide from air. In part (a)(iii), below half of the candidates were able to suggest the use of a separating funnel in separating the mixture by liquid-liquid extraction. About a quarter of the candidates were able to suggest the use of $NaOH(aq)$ or $Na_2CO_3(aq)$ to convert hexanoic acid into a water-soluble compound, sodium hexanoate, and thus hexan-1-ol could be obtained from the mixture by liquid-liquid extraction. The performance of candidates in part (b) was good. In part (b)(i), a very high proportion of the candidates were able to name an apparatus that should be used in Step (1). In part (b)(ii)(1), just below half of the candidates were able to state the colour change at the end point of the titration. In part (b)(ii)(2), about half of the candidates were able to calculate the actual concentration of NaOCl in the bleach. In part (b)(ii)(3), about half of the candidates were able to determine whether the bleach fulfills the quality control standards based on their results obtained in part (b)(ii)(2). In part (b)(iii), a very high percentage of the candidates were able to suggest a reason why the titration was repeated several times in Step (4). The performance of candidates in part (c) was satisfactory. In part (c)(i)(1), about two thirds of the candidates were able to deduce the molecular formula of **A**. Some candidates wrongly proposed $CH_3COCH_2CH_2CH_3$ as the molecular formula of **A**. Some candidates wrongly stated the relative molecular mass of **A** was 43 with reference to the peak at $m/z = 43$. In part (c)(i)(2), just under half of the candidates were able to deduce the structural formula of **A** by referring to the mass spectrum of **A**. Some candidates wrongly stated **A** was an aldehyde. In part (c)(ii), about half of the candidates were able to draw a possible structure of **B**. Some candidates wrongly drew the structure of a ketone with a branched alkyl group. In part (c)(iii), about half of the candidates were able to suggest a chemical test to distinguish between **B** and **C**. Some candidates suggested the use of potassium dichromate solution but did not mention that acidic condition is required. Some candidates wrongly considered **B** to be an aldehyde and **C** to be a ketone, and thus the expected observations of the chemical tests are mis-matched. In part (c)(iv), about half of the candidates were able to state the characteristic absorption peaks in the infra-red spectra of **C** and **D** respectively. Some candidates mentioned the specific absorption peak in the infra-red spectrum of one species but did not mention whether this peak would be absent in the infra-red spectrum of the other species.