Candidates' Performance

Paper 1

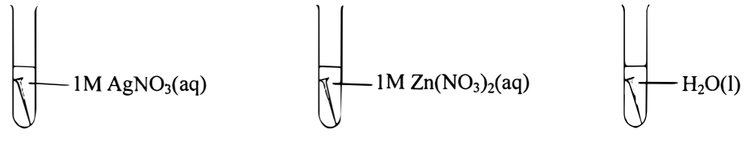
Paper 1 consisted of two sections, Section A (multiple-choice questions) and Section B (conventional questions). Sections A and B each comprised two parts, Part I and Part II. Part I contained questions set mainly on Topics I to VIII of the curriculum, while Part II mainly on Topics IX to XII. All questions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

Section A (multiple-choice questions)

This section consists of 36 multiple-choice questions. The mean score was 23. Candidates' performance was generally good. Some misconceptions of candidates were revealed from their performance in the following items.

1. For Q.3, nearly half of the candidates wrongly chose option B. It shows that they did not realise that iron corrodes faster in the presence of mobile ions (in the case of **Y**) than that just placed in water (in the case of **Z**). It should be noted that corrosion of iron, being a redox reaction, can be facilitated by mobile ions.

Q.3 The diagram below shows three iron nails of the same size and shape each immersed in a liquid.



Which of the following arrangements represents the ascending order of rate of corrosion of the iron nails ?

A.*	**Z** < **Y** < **X**	(19%)
B.	**Y** < **Z** < **X**	(46%)
C.	**Z** < **X** < **Y**	(20%)
D.	**X** < **Z** < **Y**	(15%)

2. For Q.7, it should be noted that electrical conductivity of an aqueous solution mainly depends on the concentration of mobile ions in the solution. Candidates not choosing the key B might indicate that they did not realise that $BaSO_4$ is insoluble and the ions in it are not free to move in water.

Q.7 Which of the following pairs of aqueous solutions, upon mixing, would have the lowest electrical conductivity ?

A.	20.0 cm^3 of 0.1 M HNO_3	and	20.0 cm^3 of 0.1 M KOH	(7%)
B.*	20.0 cm^3 of 0.1 M H_2SO_4	and	20.0 cm^3 of 0.1 M $Ba(OH)_2$	(32%)
C.	20.0 cm^3 of 0.1 M CH_3COOH	and	20.0 cm^3 of 0.1 M NH_3	(32%)
D.	20.0 cm^3 of 0.1 M HCl	and	20.0 cm^3 of 0.1 M $C_6H_{12}O_6$(glucose)	(29%)

3. For Q. 21, nearly half of the candidates wrongly chose option A. It can be deduced that they did not realise that the $K_3Fe(CN)_6(aq)$ in (3) is the main ingredient in rust indicator and can react with $Fe^{2+}(aq)$ to give a blue coloured substance.

Q. 21 Which of the following processes would show a blue colour ?

(1) adding litmus to NaOH(aq)
(2) mixing $CuSO_4(s)$ and $NH_3(aq)$
(3) mixing $K_3Fe(CN)_6(aq)$ and $FeCl_2(aq)$

A.	(1) and (2) only	(25%)
B.	(1) and (3) only	(26%)
C.	(2) and (3) only	(11%)
D.*	(1), (2) and (3)	(38%)

4. For Q.31, more than half of the candidates wrongly chose option B and did not know that (3) is also correct. They did not realise that decreasing the volume of the system would increase the concentration of all species in the system. As the concentration of $SO_3(g)$ increases, the rate of its decomposition would increase accordingly.

Q.31 The following system attained equilibrium at a certain temperature :

$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

Which of the following statements is / are correct when the volume of the system is decreased while the temperature remains unchanged ?

(1) The value of K_c increases.
(2) The equilibrium position shifts to the right.
(3) The rate of decomposition of $SO_3(g)$ increases.

A.	(1) only	(7%)
B.	(2) only	(56%)
C.	(1) and (3) only	(9%)
D.*	(2) and (3) only	(28%)

Section B (conventional questions)

Question Number	Performance in General
1	The performance of candidates in part (a) was satisfactory. About two thirds of the candidates were able to apply their knowledge of bonding and structure of graphite. However, a majority of the candidates were not able to draw the electron diagram of CO_2. The performance of candidates was fair in part (b), but poor in part (c). Some candidates were able to describe the structural features of the C_{60} molecule, but failed to explain why it is soluble in some organic solvents.
2	The performance of candidates in this question was satisfactory. About half of the candidates were able to draw the structural formula of ethane-1,2-diol. However, most of them failed to explain why the molecule is soluble in water in terms of 'intermolecular hydrogen bond'. Only a few candidates were able to answer the question by means of the carbon chain of the molecule.
3	The performance of candidates in part (a) was satisfactory. However, a high proportion of the candidates were not able to state the correct means to do the 'test for unsaturation'. For example, some candidates incorrectly suggested the use of bromine liquid or bromine as the reagent, and many of them failed to state the correct colour change. The performance of candidates in part (b) was fair. Only a few of them were able to provide the systematic name for the compound and the correct name for the type of polymerisation. Many candidates failed to draw the structure of the polymer, and some wrongly added 'n' in their drawings. The performance of candidates in parts (c) and (d) was good. However, some of them failed to answer in terms of the correct type of intermolecular forces.
4	The performance of candidates in this question was good. Around three quarters of the candidates were able to describe the methods to be used. However, some candidates wrongly regarded that silver can be extracted by physical method. Moreover, only about a quarter of them were able to make logical and systematic presentations.
5	The performance of candidates in part (a) was satisfactory. About two thirds of the candidates were able to state the safety measure to be adopted. The performance of candidates in part (b) was fair. About half of the candidates gave the correct answer. However, some candidates wrongly related the strength of acid to some irrelevant factors like basicity and pH. The performance of candidates in part (c) was fair. However, some of them erroneously considered that 'comparing the rates of bubble formation from the reactions of copper with the three acids' could be used to distinguish the three acids. Moreover, some candidates failed to demonstrate the understanding that concentrated sulphuric acid and concentrated nitric acid are oxidising agents, and wrongly stated that hydrogen gas would be produced in their reactions with copper.
6	The performance of candidates in this question was fair. In part (a), about half of the candidates failed to mention the relationship between the boiling point and the molecular size/chain length of the alkene molecules. Some candidates wrongly stated that the separation was based on the melting point of the alkanes. Moreover, for the definition of standard enthalpy change of combustion, many candidates failed to give a complete answer including 'enthalpy change involved', 'one mole of substance', 'complete combustion' and 'under standard conditions'. For the chemical equation, many candidates did not write down the state symbols of the reactants and products. In part (b), about a third of the candidates failed to write correctly the word 'catalytic converter'. In the calculation of the standard enthalpy change, some candidates used incorrect '+ / –' signs for the enthalpy terms.

Question Number	Performance in General
7	The performance of candidates in this question was poor. In part (a), about half of the candidates were able to calculate the concentration of the acid by using the data of density and % by mass of HCl in the acid. However, when converting the density 1.18 g cm^{-3} into g dm^{-3}, some candidates wrongly divided 1.18 by 1000, but did not multiply it by 1000. In part (b), many candidates failed to recognise the correct procedure of preparing a standard solution from solid sodium carbonate. Commonly observed mistakes include treating the whole process as a dilution of a concentrated acid, failing to use distilled water / deionized water for dissolving Na_2CO_3, wrongly dissolving the sodium carbonate powder directly inside the volumetric flask, and using inappropriate apparatus for carrying out the process, etc. In part (c), a very high proportion of the candidates did not realise that HCl(g) would escape from concentrated hydrochloric acid.
8	The performance of candidates in this question was satisfactory. However, in part (a), some candidates failed to realise that hydrogen ions in the solution are easier to be reduced than magnesium ions, and hence wrongly stated that magnesium ion would be reduced at electrode X. In part (b), some candidates were confused about the anodic and cathodic changes which occurred in beaker B, and therefore gave the wrong half equations. The performance of candidates in part (c) was very good and that in part (d) was fair.
9	The performance of candidates in this question was satisfactory. In part (a), about half of the candidates were able to give the observation for the reaction. However, some of them gave a wrong colour for the copper(II) hydroxide that was formed. In part (b), some candidates failed to give a balanced equation for the reaction between acidified potassium permanganate solution and sodium sulphite solution, and some just wrote down the half equation for the reduction of permanganate ion, but did not give the ionic equation for the reaction.
10	The performance of candidates in this question was fair. Some candidates mentioned the use of more concentrated hydrochloric acids (e.g. 2 M or 4 M) instead of the dilution of the given 1 M HCl. Some candidates omitted the description of the process of diluting the given 1 M HCl to obtain solutions of different concentrations. Many candidates failed to mention how to perform a fair comparison. They did not mention that experimental conditions needed to be kept constant when varying the concentrations of the hydrochloric acid.
11	The performance of candidates was satisfactory in part (a) but poor in part (b). About half of the candidates failed to give the correct colour of the final solution. Many candidates only stated the colour of the solution without giving a reason and failed to point out that VO_2^+ received 2 electrons from SO_2.
12	The performance of candidates in part (a) was fair. Some candidates only gave H^+ but did not give a specific example for the reagent **Y**. Very few candidates were able to give an explanation for the higher solubility of sodium benzoate when compared with benzoic acid. Many of them were confused of the proper procedure of obtaining an insoluble substance from a mixture with that of obtaining a soluble compound from a solution. The performance of candidates in part (b) was satisfactory. However, some candidates wrongly suggested the use of Br_2 to carry out the final step. Moreover, some wrongly suggested treating the intermediate $C_6H_5CH_2OH$ with concentrated H_2SO_4 to give a non-existing alkene before adding HBr.

Question Number	Performance in General
13	The performance of candidates in this question was fair. In part (a), a small number of the candidates wrongly regarded the total volume of the container as 50 cm^3 instead of 50 dm^3. Some candidates failed to give a correct unit for the answer, while some failed to handle the numerical calculation relating to equilibrium constant. In part (b), many candidates just stated that the forward reaction is exothermic but did not give any reasons.
14	The performance of candidates in this question was fair. In part (a), a very high proportion of the candidates did not have any idea about the structure of a triglyceride. The performance of candidates in part (b) was poor. In part (c), many candidates were able to give the correct answer but some failed to realise that acidification was needed when using $K_2Cr_2O_7$ or $KMnO_4$ for carrying out the chemical test. In part (d), some candidates gave wrong answers like addition, hydrolysis, saponification and esterification, etc.

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	49	The performance of candidates in part (a) was satisfactory. However, some candidates were not able to state that activation energy is the minimum energy for a reaction to start, while more than half of the candidates neglected that enzymes would be denatured at high temperature. Moreover, some candidates wrongly suggested sodium chloride as one of the chemicals manufactured in chloroalkali industry. The performance of candidates in part (b) was fair. About three quarters of the candidates were not able to explain the term 'initial rate'. Only about a third of the candidates were able to suggest using colorimetry to follow the progress of the reaction but were not able to state that the solution is colourless at the start. A very small number of the candidates were able to give the initial rate of reaction with respect to BrO_3^-(aq). The performance of candidates in part (c) was fair. Almost all candidates were not able to state natural gas as a convenient source of hydrogen. Lastly, some candidates wrongly suggested a design such as dissolving ammonia in water for removing ammonia in part (c)(v).
Section B: 2	3	The performance of candidates in part (a) was fair. About a quarter of the candidates were not able to distinguish between common thermoplastics and thermosetting plastics. The performance of candidates in part (b), especially in (b)(i) and (b)(ii), was poor. The performance of candidates in part (c) was fair. About two thirds of the candidates provided wrong answers including making the plastic bottle through compression moulding, giving PVC / PS / PP as types of PE, and drawing incorrect structures of lactic acid.
Section C: 3	48	The performance of candidates in part (a) was satisfactory. Some candidates wrongly gave a chemical test for HCl(aq) instead of one for HCl(g). Moreover, some candidates wrongly interpreted that testing for carbonyl group is the same as testing for ketone. Lastly, about a third of the candidates failed to recognise anhydrous magnesium sulphate as the most suitable drying agent for ethyl ethanoate. The performance of candidates in part (b) was fair. About half of the candidates were able to calculate the percentage of $CaCO_3$ by mass but some wrongly calculated the formula masses of calcium carbonate and calcium oxalate as they were not familiar with the chemical formulae for these two compounds. Lastly, around three quarters of the candidates were not able to state the quantitative analysis method used in the experiment. The performance of candidates in part (c) was poor. Many candidates did not mention the use of a separating funnel and the subsequent use of fractional distillation for purifying sample **T**. Around three quarters of the candidates failed to identify the functional group that may be present in **T**. Lastly, some were not able to recognise the chemical species responsible for signals at m/z = 43 and 134 to be positively charged, and were not able to suggest a possible structure of **T**.

School-based Assessment

All school candidates have to participate in School-based Assessment (SBA). There were 14965 students from 435 schools submitted their SBA marks this year. This is the third year of implementation of SBA for the Hong Kong Diploma of Secondary School Education (HKDSE). With the experience acquired over the past two years, the implementation was generally smooth in most of the participating schools.

To ensure that teachers have a good understanding of the requirements and the principles of the assessment methods of the SBA, a SBA annual conference was held in October 2013. The conference provided teachers with general comments and summary about the SBA implementation, and up-to-date adjustments of the SBA requirements and administrative operations. The conference also introduced the resources and supports available to help teachers to integrate practical works into chemistry classes. Furthermore, the Education Bureau and the Hong Kong Examinations and Assessment Authority collaboratively provided training courses and useful resources for teachers, and helped them to enhance knowledge and skill, and build up confidence in implementing SBA in their classes.

Based on the assessment data and samples of students' worksheets and reports submitted by participating schools, students' performance was in general satisfactory and within the expectations of the assessment requirements. To address the potential discrepancies in the marking standard among individual teachers and schools, mark moderation based on both statistical methods and professional judgment was performed. We are happy to report that 65.3% of schools fall into the 'within the expected range' category, while the marks of 13.0% of schools are higher than expected, and 21.7% lower than expected. It is observed that the majority of schools with deviations only differ slightly from the expected range. This is encouraging as the data show that the majority of the teachers have a good understanding of SBA implementation, and hence the marking standards are generally appropriate.

To provide continuing support for teachers and to ensure fair implementation of the SBA, two supervisors are assigned to supervise all the schools, and there is a total 24 district coordinators to address enquiries from teachers about SBA implementation, and to ensure that schools are running the scheme within the stipulated guidelines. Phone calls, email correspondences, district group meetings and school visits were conducted to establish close connections between the district coordinators and the teachers. The said communication channels between the supervisors / district coordinators / teachers are strengthened to enhance mutual understanding. Based on the feedbacks from various sources, both teachers and students understand the essence and the requirements of the SBA. Nonetheless, some comments and recommendations are given below so that further improvement on the implementation of SBA could be made:

1. Variety of Experiments
   Even though there is no strict stipulated requirement on the types of experiments selected for SBA tasks besides including volumetric analysis and qualitative analysis in the task list, it is definitely beneficial to students' learning if they are exposed to a wide variety of experiment types. It was observed that not many schools carried out preparative experiments (in particularly those involving organic reactions) for SBA tasks. Due to the lack of experience, many students have limited understanding about the correct procedure of carrying out an organic reaction and isolating the product from the reaction mixture. Conducting these types of experiments can strengthen students' abilities on basic laboratory skills.

2. Variety of Written Work
   Worksheets, quizzes and brief / detailed laboratory reports, etc. are all acceptable formats of written work. Teachers generally designed these tasks in a professional manner. Moreover, it is encouraging that most students can follow the instructions given by teachers in accomplishing the written work. Although there is no stipulated requirements in the SBA guidelines regarding the types of written reports to be submitted by a student, writing laboratory reports is definitely an important part of the training for students studying experimental sciences. Organising a laboratory report in the correct format and presenting the data and experimental findings properly are very important. Previous experience showed that students frequently omitted some essential items (such as date, experimental title, objectives, and reference, etc) in the first few times when they wrote laboratory reports. However, after gaining some experience, students were able to write a laboratory report in a proper manner.

3. Use of 'feedback' to promote learning
   Providing feedback to students through submitted reports is important for facilitating student learning. It

also helps students to avoid making the same type of mistakes in the future. Moreover, students are encouraged to discuss with their teachers to understand their own performance in carrying out experiments and finishing the related written tasks.

4. Students' performance in recording and analyzing the data obtained from experiments
   From the samples of students' work submitted by the schools, it was observed that students frequently made some mistakes in recording the experimental data, performing calculations and drawing set-up diagrams. These mistakes include using incorrect significant figures in data recording and calculations, using incorrect units for numerical data, and carrying out the calculations incorrectly. In particular, it was observed that quite a number of students recorded the burette readings in one decimal place in titrations, instead of writing down the burette reading in two decimal places by estimating the values of the second digit after decimal. Students are encouraged to pay more attentions in these areas.

5. Prevention of plagiarism
   Students should complete the assessment tasks honestly and responsibly in accordance with the stipulated requirements. They will be subject to severe penalties for proven malpractice, such as plagiarising others' work. The HKDSE Examination Regulations stipulate that a candidate may be liable to disqualification from part or the whole of the examination, or suffer a mark penalty for breaching the regulations. Students can refer to the information leaflet HKDSE Examination- Information on School-based Assessment (http://www.hkeaa.edu.hk/DocLibrary/Media/Leaflets/SBA_pamphlet_E_web.pdf) for guidance on how to properly acknowledge sources of information quoted in their work.

Conclusion

The implementation of SBA in the HKDSE 2014, the students' performance is generally satisfactory, and teachers run the SBA smoothly in their lessons. With the experience acquired in the first two cohorts, most teachers have a much clearer picture about the requirements and expected goals of SBA. Teachers are more experienced in selecting the appropriate practical tasks for their classes and assessing the abilities of their students. With the experience acquired in these several cohorts, most of the queries and challenges that teachers and students encountered were generally tackled successively.