UNIVERSITY OF MALTA

SECONDARY EDUCATION CERTIFICATE
SEC

CHEMISTRY

May 2014

EXAMINERS' REPORT

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

SEC Chemistry
May 2014
Examiners' Report

1. General Statistics

The number of candidates opting for Paper I and Paper IIA was 640, while 157 candidates opted for Paper I and Paper IIB. Thus a total of 797 candidates applied for SEC Chemistry in the May 2014 session. The details regarding the candidates' performance are shown in Table 1.

Table 1: Number and percentage of candidates per grade – May 2014

		1	2	3	4	5	6	7	U	abs	Total
PI & PIIA candidates	**N**	76	135	131	124	71	–	–	97	6	640
	%	11.9	21.1	20.5	19.4	11.1	–	–	15.2	0.9	100.0
PI & PIIB candidates	**N**	–	–	–	14	21	20	19	77	6	157
	%	–	–	–	8.9	13.4	12.7	12.1	49.0	3.8	100.0
All candidates	**N**	76	135	131	138	92	20	19	174	12	797
	%	9.5	16.9	16.4	17.3	11.5	2.5	2.4	21.8	1.5	100.0

The information in Table 1 is reported graphically and plotted in three separate graphs: the percentage of Paper I and Paper IIA per grade in Figure 1, the percentage of Paper I and Paper IIB per grade in Figure 2, and the percentage candidates considering the whole population of candidates in Figure 3.

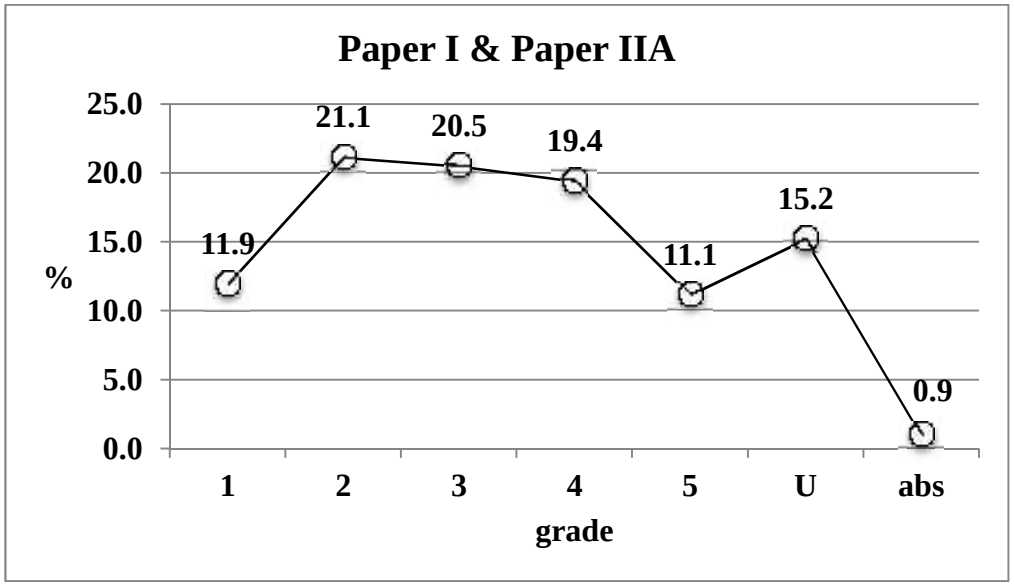

Figure 1: Percentage of Paper I and Paper IIA candidates per grade – May 2014

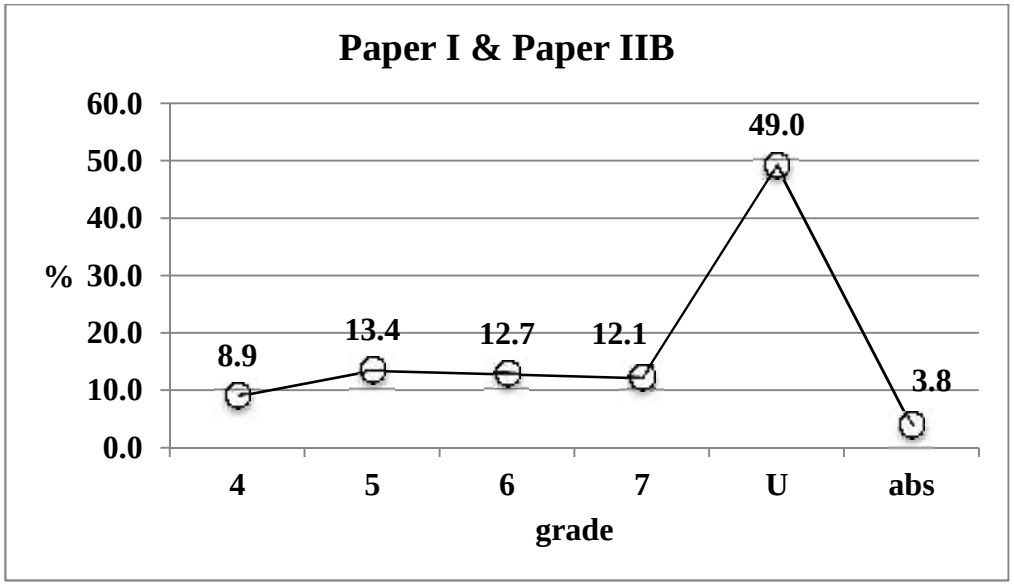

Figure 2: Percentage of Paper I and Paper IIB candidates per grade – May 2014

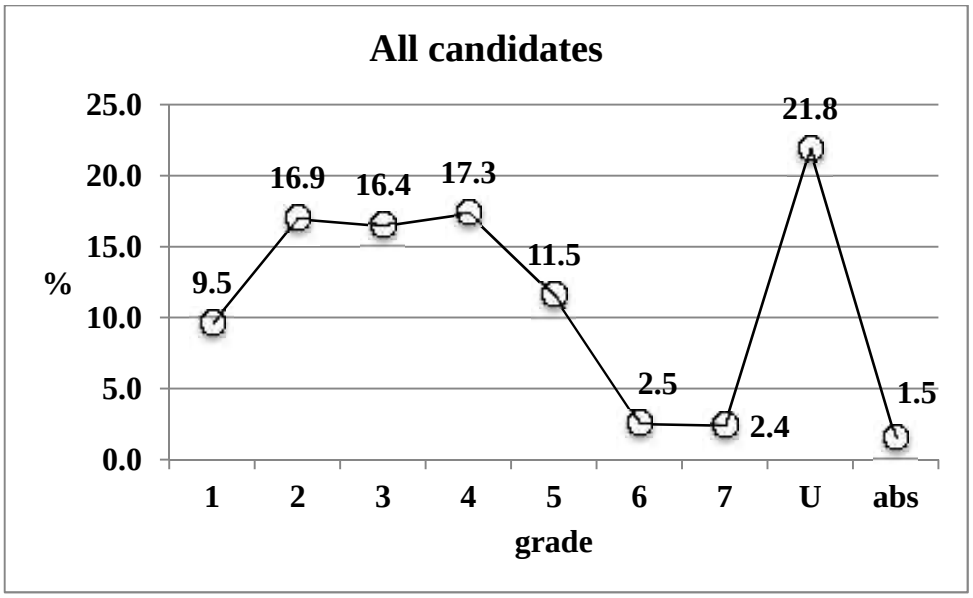

Figure 3: Percentage of candidates per grade for the whole population – May 2014

2. Candidates registering for the May session: 2006 to date

Table 2 shows the number of candidates (and respective percentages) registering for SEC Chemistry in the May session since 2006. The numbers of candidates registering for Option A and Option B respectively are shown for each year.

As can be seen from the data in Table 2, there was an increase in the number of candidates registering for SEC Chemistry from 863 in 2006 to 1009 on 2008, followed by yearly decreases in the number of candidates sitting for SEC Chemistry with the lowest number being this year's 797, where the total population was lower than 800 candidates for the first time since 2006. It is evident that the proportion of SEC Chemistry candidates choosing option A was always considerably higher than the fraction of those taking option B. The percentage of candidates choosing option A in May 2014 was at 80.3%, down from the highest percentage registered, in May 2013, at 85.5%.

Table 2: Number and percentage of candidates per option per year – 2006 to 2014

	PI & PIIA		PI & PIIB		Total
Year	**N**	**%**	**N**	**%**	**N**
2006	655	75.9	208	24.1	863
2007	779	78.1	218	21.9	997
2008	784	77.7	225	22.3	1009
2009	725	79.2	190	20.8	915
2010	721	79.4	187	20.6	908
2011	644	77.0	192	23.0	836
2012	698	84.6	127	15.4	825
2013	704	85.5	119	14.5	823
2014	640	80.3	157	19.7	797

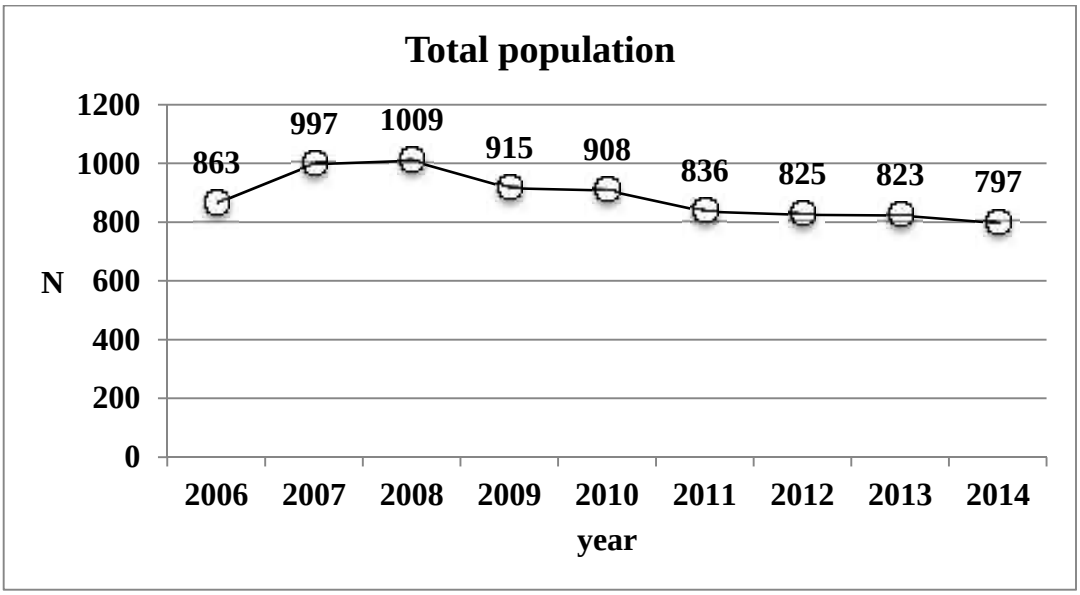

Figure 4: Number of candidates per May session – 2006 to 2014

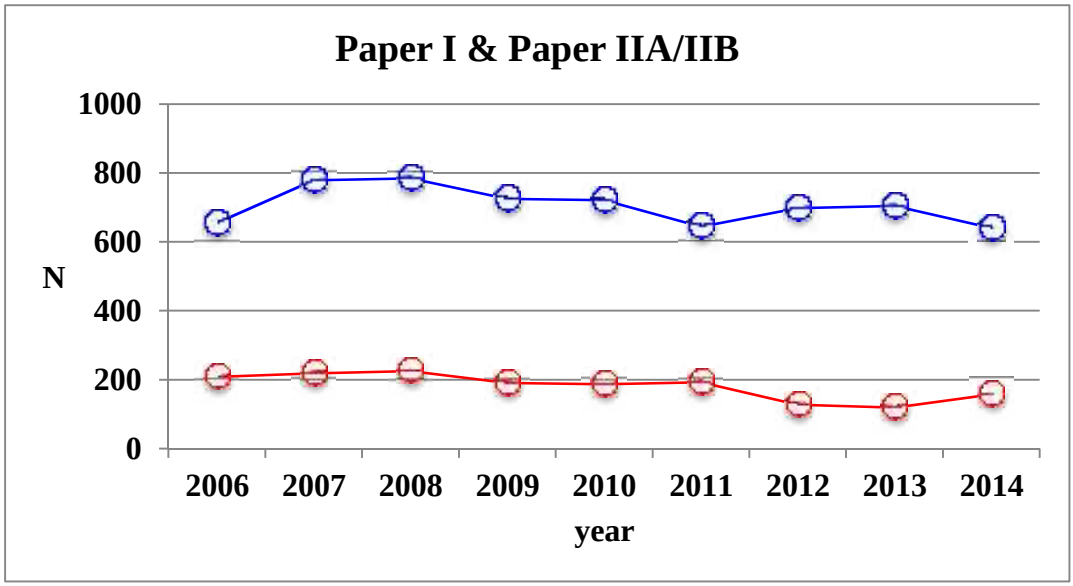

Figure 5: Percentage of candidates per paper type (option A in blue and option B in red) – 2006 to 2014

The data presented in Table 2 is plotted and represented in the graphs in Figures 4 and 5. The blue plot represent Paper I and Paper IIA candidates while the Paper I and Paper IIB populations are represented by the red plot.

3. Statistics for each individual paper

Tables 2 to 5 depict data for the Paper I and Paper IIA candidates:
(i) Table 2 reports general statistical information about Paper I, namely, the maximum mark, the number of candidates that scored zero marks, the three common measures of central tendency (mean, median and mode) and the standard deviation for every question;
(ii) Table 3 reports the same information and data about the questions in Paper IIA;
(iii) As candidates had to choose two questions out of four in Section B of Paper IIA, Table 4 gives the choice per question in Section B of Paper IIA (two out of four) in terms of raw numbers and as a percentage; and
(iv) Table 5 reports the number of Paper I and Paper IIA option candidates (excluding the absentees) that scored zero marks, together with the three common measures of central tendency (mean, median and mode) and the standard deviation when considering the candidates' global percentage mark.

Table 2: Paper I and Paper IIA candidates – Data for Paper I

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Total
Max mark	6	8	4	6	6	5	6	6	6	7	20	20	100
No. of zeroes	3	0	25	27	1	34	4	53	25	70	5	7	17
Mean (raw)	3.9	6.8	3.2	3.8	5.3	3.7	4.6	2.9	3.8	4.7	11.5	13.1	65.6
Mean (%)	65.2	85.4	80.3	63.6	88.2	73.5	76.6	48.8	64.0	66.5	57.5	65.4	65.6
Median	4.0	7.0	4.0	4.0	6.0	4.0	5.0	3.0	4.0	6.0	12.0	14.0	70.3
Mode	5.0	8.0	4.0	6.0	6.0	4.0	6.0	3.0	3.0	7.0	16.0	15.0	84.0
SD	1.6	1.3	1.1	1.7	1.1	1.4	1.4	1.5	1.5	2.5	4.7	4.5	20.8

Table 3: Paper I and Paper IIA candidates – Data for Paper IIA

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Total
Max mark	6	6	6	6	6	6	6	8	4	6	20	20	20	20	100
No. of zeroes	43	11	75	6	43	50	69	11	121	60	2	3	1	0	18
Mean (raw)	3.0	3.7	2.6	4.1	4.1	2.6	4.0	5.4	2.6	3.1	5.0	11.1	9.3	14.4	55.7
Mean (%)	50.2	61.3	43.1	68.8	68.3	42.7	67.0	67.1	64.6	51.4	24.9	55.5	46.6	72.0	55.7
Median	3.0	4.0	3.0	4.0	5.0	2.5	5.0	6.0	4.0	3.0	5.0	12.0	9.0	15.5	58.0
Mode	3.0	5.0	3.0	6.0	5.0	1.0	6.0	6.0	4.0	4.0	5.0	12.0	11.0	17.0	0.0
SD	1.8	1.7	1.6	1.6	1.8	1.5	2.1	1.8	1.7	1.7	2.7	4.4	3.2	3.8	21.0

Table 4: Paper I and Paper IIA candidates – Choice in questions 11 to 14 in Paper IIA (excluding absent candidates)

Question number	**Q11**	**Q12**	**Q13**	**Q14**
Number of choices (N)	125	489	258	371
Number of choices (%)	19.7	77.1	40.7	58.5

Table 5: Paper I and Paper IIA candidates – Data for final global mark

Max mark	100
Number of zeroes	0
Mean (%)	65.5
Median (%)	68.7
Mode (%)	70.9
Standard deviation	16.6

Likewise, Tables 6 to 9 report the data for the Paper I and Paper IIB candidates, giving similar information as that depicted in Tables 2 to 5 respectively.

Table 6: Paper I and Paper IIB candidates – Data for Paper I

	Q1	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**	**Q11**	**Q12**	**Total**
Max mark	6	8	4	6	6	5	6	6	6	7	20	20	100
No. of zeroes	7	3	43	38	3	36	17	35	35	73	12	16	19
Mean (raw)	2.3	4.9	1.7	1.6	3.7	2.1	2.7	1.3	2.1	1.6	5.6	6.5	31.7
Mean (%)	38.8	61.0	41.7	26.8	61.8	42.9	44.9	22.2	34.2	22.9	28.2	32.3	31.7
Median	2.0	5.0	1.0	1.0	4.0	2.0	3.0	1.0	2.0	0.0	5.0	5.0	31.0
Mode	1.0	6.0	0.0	1.0	6.0	2.0	2.0	1.0	3.0	0.0	1.0	0.0	0.0
SD	1.6	1.8	1.5	1.5	1.7	1.6	1.7	1.1	1.6	2.2	4.3	4.9	21.0

Table 7: Paper I and Paper IIB candidates – Data for Paper IIB

	Q1	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**	**Q11**	**Q12**	**Q13**	**Q14**	**Total**
Max mark	14	30	65	1	59	89	48	56	94	5	10	12	6	5	23
No. of zeroes	6	5	6	6	4	6	8	6	6	7	20	20	20	20	100
Mean (raw)	2.9	1.8	0.8	3.8	1.2	0.5	1.8	1.7	0.8	3.1	4.4	5.8	5.3	4.3	24.4
Mean (%)	48.6	35.7	12.9	63.7	30.1	7.5	22.5	28.0	13.2	44.2	21.8	29.0	26.4	21.3	24.4
Median	3.0	1.5	0.5	4.0	1.0	0.0	1.0	1.0	0.0	2.0	4.0	5.0	4.0	2.3	21.0
Mode	2.0	0.0	0.0	4.5	0.0	0.0	0.0	0.0	0.0	2.0	0.0	2.0	1.0	0.0	0.0
SD	1.7	1.5	1.1	1.4	1.3	0.8	2.1	1.9	1.5	2.1	3.3	4.7	4.6	4.7	18.5

Table 8: Paper I and Paper IIB candidates – Choice in questions 11 to 14 in Paper IIB (excluding absent candidates)

Question number	**Q11**	**Q12**	**Q13**	**Q14**
Number of choices (N)	67	115	57	28
Number of choices (%)	44.4	76.2	37.7	18.5

Table 9: Paper I and Paper IIB candidates – Data for final global mark (excluding absent candidates)

Maximum mark	100
Number of zeroes	0
Mean (%)	38.4
Median (%)	36.3
Mode (%)	37.6
Standard deviation	15.6

4. Markers' comments

4.1 School-based assessment: Practical reports

In general, the practical reports that were presented for school-based assessment were of the desired level and satisfied the requirements as exposed and expected in the syllabus. The examiners note with satisfaction that, in general, teachers are carrying out more thorough correction by indicating faults and mistakes, which induce successive better performance, even of errors in structure and general grammar present in candidates' reports. Although marks are not assigned, and are not deducted for the latter defects, one should realise that such indications consolidate the candidates' general competencies of written expression and consolidate teaching taking place in other areas.

Tables 10 and 11 show some general statistical data for the school-based assessment component (assigned 15% of the final global mark) for the option A and option B candidates respectively. The data reported is: the number of candidates who did not even present the practical reports, the number of candidates who scored zero, the mean (as a raw mark and as a percentage), the median, the mode and the standard deviation.

Table 10: Paper I and Paper IIA candidates (N = 640) – General statistics for the school-based assessment component

Maximum mark	15
Number of 'np's (practicals not presented)	18
Number of zeroes	2
Mean (raw)	13.0
Mean (%)	86.5
Median	14.0
Mode	14.0
Standard deviation	2.2

Table 11: Paper I and Paper IIB candidates (N = 157) – General statistics for the school-based assessment component

Maximum mark	15
Number of 'np's (practicals not presented)	15
Number of zeroes	1
Mean (raw)	11.3
Mean (%)	75.1
Median	12.0
Mode	13.0
Standard deviation	2.6

4.2 Paper I – Section A

Q1. (a) Most scored 1 mark for stating 'equilibrium' or 'reversible'. 'Reversible' was quite often spelled incorrectly.
(b) Several incorrect answers were given, although this was a straightforward application of the definition of efflorescence.
(c) $FeSO_4.7H_2O$ is not efflorescent. The question was specific, stating that the action of heat on the crystals was required. However several candidates incorrectly gave (aq) as state symbol for both $FeSO_4.7H_2O$ and for the $FeSO_4$ formed. A few candidates gave two state symbols within the same formula of $FeSO_4.7H_2O$, one for $FeSO_4$ and another for the H_2O component.
(d) Most scored 1 mark. Many failed to make the connection that silica, like sodium carbonate, absorbs water in a reversible reaction, and that it can be removed by heating. Several had no idea of silica gel and actually suggested adding water to it or closing it in a bag.

Q2. The answers ranged from very good to very poor. In the weaker answers it was obvious that the choice of words was very haphazard since the final sentences made no sense.

Q3. Most candidates fared well although some failed to use the information given in the introductory paragraph to deduce a suitable apparatus for collecting the hydrogen sulphide.
(a) Well-answered.
(b) 'In a gas jar' got no credit in part (i) since this term fails to specify 'upward' or 'downward' delivery. A few misunderstood the question. In part (ii), due to the high toxicity of H_2S, fume cupboard use is necessary.

Q4. (a) Very few of the candidates gave an equation for partial neutralisation. This of course did not gain them any credit since the question was very specific.
(b) Part (i) was mostly correct. For (ii) the correct terminology is 'acid salts'.
(c) Most gave correct answers involving other dibasic acids or even tribasic acids. However marks were lost when either the name or the formula was omitted from the answer.

Q5. In this question, students fared better in part (b) than in part (a), as the question involved recalling uses of chlorine. Most students were familiar with the reactions of acids, and scored full marks.

Q6. Students found some difficulty in determining the electronic configuration of ions, rather than neutral atoms. Some candidates used the mass number instead of the atomic number from the Periodic Table. The ions in parts (ii) and (iii) were treated as neutral atoms.

Q7. The majority scored very well on this question. However some structures given in part (a) were not really isomers but different spatial representations of the same compound. Some impossible structures for C_2H_6O were given in part (b). A number of students failed to recall that each alcohol has a corresponding structural isomer in the form of an ether.

Q8. This question tested the candidates' knowledge of gas tests. Most students were familiar with these tests.

(a) Unfortunately several marks were lost on this question by candidates who read the question incorrectly and gave a method of preparation of each gas rather than a test for each gas. For hydrogen chloride misty fumes are observed since any hydrogen chloride produced would react with the humidity present in the air.

(b) This question required the reaction of ammonia gas with water, producing aquated ions, $NH_4^+(aq)$ and $OH^-(aq)$, illustrating the alkalinity of ammonia gas. Several candidates did not get any credit for part (b).

Q9.

(a) Several scored full marks. Marks were carelessly lost by candidates using atomic numbers instead of mass numbers, not including all the H atoms in the total molecular mass or not including both N atoms when working out the percentage mass, thus committing an error when calculating the percentage by mass of nitrogen.

(b) A number of candidates found part (b) more challenging, perhaps because they are more familiar with the acid and base neutralisation-type reactions. Notwithstanding, parts (b) and (c) were mostly well-answered.

Q10. Candidates who mastered the idea of molar concentration found no particular difficulty in answering this question.

(a) Most scored the 2 marks on this question.

(b) The question required the formula mass of magnesium oxide. Unfortunately several candidates worked out their calculation using magnesium instead of magnesium oxide. In recent years there has been an increased tendency for the molar volume of a gas at STP, i.e., 22.4 dm^3 to be used in any questions which require a volume, whether dealing with gases or not. This year was no exception and this typical question involving the concentration of a solution was attempted in terms of the molar volume of a gas.

(c) The better students scored the mark on this question. A number of students tried to work out the volume of sulfuric acid in part (c) rather than give an answer based on deduction, as the 1 mark allocation suggested.

4.3 Paper I – Section B

Q11. The answers to this question were very varied and showed up certain patterns when it comes to tackling experimental scenarios. The question aimed to correlate the theoretical work from a study of energetics with one of the suggested experiments in the SEC syllabus. The difficulties faced by the majority of candidates in parts (a)(i) and (ii) suggest that a number of students are not acquiring the necessary practical skills in the laboratory. When asked to draw a set up of the apparatus for determining the heat of combustion of lamp spirit in part (b)(i), a number of candidates seem to have been confused by the introductory statements of part (a) while some drew two set-ups, one involving charcoal and the other lamp spirit. A few candidates confused lamp spirit (a liquid fuel) with spirit lamp. It is evident that some candidates do not have previous knowledge of this topic since their answers indicated little or no

familiarity with a spirit lamp and how it can be utilised. Moreover knowledge of typical techniques in thermochemistry experiments was seriously lacking.
Many candidates fared much better in part (c), which involved a simple numerical calculation.

(a) (i) Most realised that some charcoal will stick to the filter paper but only the better candidates mentioned that it is not possible to transfer the charcoal quantitatively.
(ii) Most argued correctly that the test tube might roll off the pan of the balance also involving spillage of the fuel. The possibility that some spirit sticks to the side of the test tube was also widely mentioned.

(b) In this part of the question the better candidates, and those who are exposed to hands-on experimental work, scored well.
(i) Reference to some form of lagging or insulation was very often missing. Some diagrams were absolutely not appropriate, as those showing the lamp spirit in a test tube placed in a calorimeter and the whole set-up heated over a Bunsen flame. A bomb calorimeter is similarly not recommended.
(ii) Most candidates started with reasonable answers but then went completely off track by stating that changes of temperature with time were recorded, in a similar vein as for a kinetics experiment. The necessary mass measurements were very often not all included.
The question required the heat of combustion of the lamp spirit and not of the charcoal as well.
(iii) Heat losses to the surroundings and a possible evaporation of some of the water contribute to experimental errors. The distance between the spirit lamp and the water container is another factor.

(c) Most answers were correctly worked out and were awarded full marks.

Q12. (a) A number of candidates fared well in part (a) and could recall a set-up for the preparation of chlorine gas. There were some minor variants of the correct answer. Many candidates were familiar with the apparatus and chemicals needed for drying and collecting gases, although some did not relate the correct chemical to the specific apparatus. For instance, some candidates drew a U-tube and placed concentrated sulfuric acid in it. A common mistake was failing to mention that sulfuric acid has to be concentrated in order to act as a drying agent. Some diagrams were incorrectly labelled. Thistle funnels do not have a tap. Some answers showed manganese(IV) oxide placed inside the funnel. Possible ways of collection of chlorine include a gas syringe, by downward delivery or over brine.

(b) (i) Sulfuric acid will only act as a drying agent when used concentrated, whilst calcium chloride as a drying agent must be used anhydrous. Marks were lost when either the name or the formula was omitted.
(ii) A U-tube containing anhydrous calcium chloride or an absorption bottle with concentrated sulfuric acid can be connected between the reaction flask and the collection of the gas. When using the absorption bottle the delivery tube into the flask must be shown long enough to dip below the surface of the sulfuric acid.

(c) Parts (i) and (ii) If a large amount of gas is given off the gas syringe might need to be replaced. A common misconception seems to be that once the gas is collected in a gas syringe it cannot be used. Downward delivery can lead to some leakage of gas occurring whilst it is not recommended to

collect chlorine over water since, chlorine being soluble in water, an acidic solution results.
Unfortunately, several candidates misunderstood the question and instead of mentioning ways of collection of the gas gave methods of preparation.

(d) The examiners were very pleased to note that most answers obtained full credit. Most candidates applied their understanding of molar calculations fairly well to part (d), managing to obtain correct answers in the context given. For instance they extracted the correct mole ratios from the given equation and used it to find the number of moles of chlorine produced after finding the number of moles of hydrochloric acid used.

4.3 Paper 1 – Option B candidates

Candidates opting for paper B performed overall less well on Paper I than those opting for paper A. However, a small number of candidates scored very highly, matching their cohort in option A. Comments given per question for Option A candidates are applicable to the Option B candidates as well. Overall the performance in Section B was weak.

4.4 Paper IIA – Section A

Q1. Many students did not refer to mixture X as a suspension in part a(i), and although most had parts of this question answered correctly only some students realised that a new substance is formed in part b(ii).
This question tested the candidates' ability to apply the basic concepts of physical and chemical changes to explain observations. Students with a sound base of laboratory practical skills fared better than others whose laboratory experience was probably more limited. The latter could not easily relate the situations presented in the question to real life experience, depending more on rote learning.

Q2. This question involved the application of tests for the presence of water to an 'unfamiliar' substance named rubbing alcohol, which is actually a miscible mixture of alcohol and water. A high proportion of candidates answered question 2(a) correctly. In part (b), most identified the liquid to be water – through the test with anhydrous copper(II) sulfate – and quite a number of candidates were aware that the measurement of boiling point and freezing point are indicative of a liquid's purity. A minority mistook this for a test for water purity. Quite a few could not give the correct colour change when anhydrous cobalt chloride comes in contact with water.

Q3. This question tested the students' ability to apply their knowledge of properties of two compounds in order to infer why certain methods of separation were suitable and not others. In part (a)(i), quite a number of students did not realise that ammonium chloride sublimes while potassium chloride does not, and this affected the answers to most of Question 3. In part (b)(ii), many candidates could not give the correct equation for the thermal dissociation of ammonium chloride and 'invented' a reaction between ammonium chloride and potassium chloride. A number of students did not realise that both ammonium chloride and potassium chloride are soluble in water, while many students were familiar with the process of sublimation.

Q4. This question tested mostly the knowledge of students about group II elements. On the whole, candidates were quite familiar with the elements of group II. This question was answered correctly by many students, however quite a number of candidates lost marks when giving the correct equation for the reaction between calcium and water: one common, recurring in part (b)(i) was that many students gave calcium oxide as the main product for the reaction of calcium with water rather than calcium hydroxide.

Q5. This question was quite straightforward and based on knowledge of the reaction of silver ions with halide ions. Many students answered this question correctly, although quite a number of candidates got the colours of the precipitates in part (a) wrong or mixed them up. A very common error was the failure by candidates to realise that the silver halide precipitates tend to darken rapidly on standing in sunlight, due to a photocatalysed decomposition.

Q6. This question tested the candidates' ability to apply the concept of chemical equilibria and Le Chatelier's Principle applied to the chromate/dichromate equilibrium reaction. The ionic equation was given to the candidates eliminating the possibility of carrying over error if they had not memorised the equation. In addition, the students' mastery of the concept of molar concentration was necessary for them to deduce the changes to the concentration of reactants that were proposed in this question, which involved changes in the hydrogen ion concentration and a deduction of the resulting colour, depending on which side of the equilibrium was favoured.
The majority of students lost marks in this question. Several showed that they were not familiar with the colour change that takes place, and although most knew Le Chatelier's principle, many did not realise that it is the concentration of H^+ ions that alters the position of equilibrium. Many candidates did not did give a correct answer to part b(iii) suggesting a value which was either too high or too low.
The ability of candidates to give coherent and logical explanations with the use of correct terminology was not very high across the whole cohort.

Q7. Overall, students found this question straightforward as it involved mostly recall of some common reactions of alkanes and alkenes. Although several candidates gave incorrect formulae, many could give the correct type of reaction in part (b) and the correct test in part (c).

Q8. This question involved numerical calculations related to the production of sulfur dioxide gas in the laboratory. In parts (a) to (c) the candidates fared well. However there were several candidates who did not attribute the loss in volume in part (c) to the sulphur dioxide dissolving in the water. They fared worse in parts (d) to (f) which went beyond simple understanding of common calculations and in which the students had to suggest explanations for results that were not as expected. In part (e) many students did not realise that the flask contained air and that this will ultimately go into the syringe. This showed a general lack of practice in the candidates' critical thinking skills. The many candidates who failed to answer part (f) correctly demonstrated that many are not mastering the idea of molar volumes of gases (that is the same for any gas provided that it is kept under specified physical conditions).

Q9. This question involved the application of the gas equation to solve a numerical problem. Most of the candidates fared well, although there were quite a few candidates who did not use absolute temperature in their calculations.

Q10. This question tested the candidates' knowledge of two polymers that are stated in the syllabus. Candidates fared generally quite well except in part (b), where they had to draw the structures of each showing a chain of two monomer units. Surprisingly there were several students who confused the names (switching them round) for materials A and B. Many candidates could not give the correct formulae for either PVC or PTFE, although most could state some use for each.

4.5 Paper IIA – Section B

Q11. The vast majority of candidates avoided choosing this question, and those who did scored quite poorly throughout. This question tested the candidates' knowledge and understanding of the processes involved in the simple cell. The set-up given was a variant of the normal equipment, with a lemon substituting a beaker containing a solution of an acid. Although part (a)(i) was answered correctly by most, the majority gave superficial answers to parts (ii) and (iii), showing lack of mastery in this topic. In part (b)(i) many students could not correctly identify which electrode becomes the cathode and which becomes the anode. The few who did invariably made a mistake in one of the half equations for the reactions that take place at the electrodes, in part (b)(ii). Overall, candidates were not very conversant with the processes occurring in a simple cell, as indicated by their widespread difficulty in formulating correct ionic half-equations in part (b)(ii).
Candidates who had practical laboratory experience of the simple cell fared much better when it came to predicting the voltage output when the electrodes were both made of copper and when and iron and copper electrodes were used.
Only a few candidates could answer part (c) correctly.

Q12. This was one of the most popular questions with candidates and involved the chemical and physical properties of the transition metals iron and copper. Candidates fared well in part (a) that involved mostly recall and understanding of the properties of iron and copper. It was surprising how many students gave incorrect answers to part (a)(ii) but correct answers to part (a)(iii), or vice versa. Candidates found part (b)(iii) particularly difficult, and they had difficulty explaining why iron reacts to form different oxidation states with chlorine and hydrogen chloride, even though some got parts (b)(i) and (ii) correct. Some students gave incorrect equations for the reaction of iron with chlorine and could not give a suitable explanation as to why chlorine gives iron(III) chloride. This exposed the acquisition of superficial knowledge but not the understanding of the concept of redox reactions.
The majority of candidates fared well in part (c) that was a numerical calculation.

Q13. This question was relatively less popular with the candidates and those who answered this question scored relatively average marks. While the majority of students could give the order of reactivity of the metals, many left out important details in parts (a)(i) and (a)(ii). In general, candidates fared

relatively well in part (a), showing that they have acquired some skills in the investigative approach to chemistry practicals. This perhaps highlights the fact that students need to make some sort of plan before starting to answer questions of this type.

In part (b)(i) however, where the candidates had to compare the reactions of magnesium with hydrochloric and ethanoic acid, the great majority highlighted one difference that resulted from the difference in strength of the two acids. Few actually sought to elaborate on similarities such as the production of a salt, effervescence resulting from the production of hydrogen and the dissolution of magnesium in both cases. Many candidates did not realise that the allocation of 6 marks to this question was indicative of a more extended answer. Candidates fared well in writing a balanced chemical equation using hydrochloric acid but worse when it came to writing equations involving ethanoic acid in part (b)(ii).

A number of candidates failed to realise in part (c) that the reaction of calcium with sulfuric acid is short-lived due to the formation of a sparingly soluble coating of calcium sulfate on the calcium granules. Many answered that the reaction stops quickly as it occurs very fast, due to the high reactivity of the metal and the acid.

Q14. This question was quite popular with the students and candidates who chose this question in general fared fairly well, presumably having prepared themselves well on 'Qualitative Analysis'. The clues and observations given were clear enough to enable candidates to make informed deductions as to the identities of the unknown substances. Most candidates could identify most of the substances in part (a). There were only a few students who made mistakes in the equation for the reaction in part (b)(iii). Many students lost marks in the equation for the reaction in part (c)(ii). The equation for the thermal decomposition of most nitrates remains to be a source of difficulty for many students. Many students lost marks in part (d) because they could not identify a suitable chemical for salt Z or could not give the correct reasons for their choice.

Chairperson
2014 Examination Panel