UNIVERSITY OF MALTA

THE MATRICULATION EXAMINATION
INTERMEDIATE LEVEL

CHEMISTRY
May 2014

EXAMINERS' REPORT

MATRICULATION AND SECONDARY EDUCATION
CERTIFICATE EXAMINATIONS BOARD

Chemistry

Intermediate Level

May 2014

Part 1: Statistical Information

The examination consisted of a three-hour paper with three sections: Section A, with fifteen compulsory questions requiring short answers; Section B with five compulsory structured questions; and Section C with four essay-type questions from which candidates were required to answer two.

Thirty-nine candidates registered for the examination but only thirty-six were present for the examination. A summary of the results is shown in Table 1.

GRADE	A	B	C	D	E	F	Abs	Total
Number	1	4	8	7	5	10	4	39
% of Total	2.56	10.26	20.51	17.95	12.82	25.64	10.26	100

The average mark scored in 2014 was 46%, slightly lower than that scored in 2013 (49%).

The highest average marks were scored in Q6 (properties of ammonia) and Q12 (redox). Both questions required candidates to fill in the blanks. The lowest average marks were scored in Q10 (organic chemistry) and Q19 (separation techniques and qualitative analysis).

The following are specific remarks on performance in individual questions, intended to be read in conjunction with the examination paper.

Part 2: Comments regarding candidate's performance

Section A

1. Most candidates identified the correct formulae for the different compounds and were able to calculate their relative molecular mass. In most cases, the number of moles in a given mass of compound (and vice-versa) was also calculated correctly.

2. Candidates wrote well-balanced chemical equations to represent given 'word equations'. Inaccurate answers were given in part (b) wherein candidates had to write a balanced equation for the reaction between calcium carbonate and dilute hydrochloric acid.

3. Candidates managed to answer this question correctly. Some difficulty was encountered with assigning the group of the given elements.

4. Some candidates gave an incorrect definition of the term '*isotope'.*

5. Candidates failed to identify chlorine as being a more powerful oxidizing agent than bromine. Candidates also made a few mistakes in part (c) - Period 1 elements.

6. Most candidates gave correct answers.

7. Candidates wrote a balanced reaction, including state symbols. However, many candidates found difficulty in completing calculations involving gas volumes, particularly parts (b)(ii) and (iii).

8. Answers to part (a) were mostly correct, but in part (b) some candidates failed to give a suitable explanation of why diamond is one of the hardest materials while graphite is not.

9. Answers to part (a) were mostly correct, but in part (b) some candidates did not indicate that, on addition of Blue Fehling's solution, the aldehyde gives a red *precipitate*.

10. Candidates found difficulty in drawing the correct repeating unit of the polymer resulting from ethene. Explanations of the terms *condensation reaction* and *difunctional* were also, in their majority, incorrect.

11. Most candidates gave the correct oxidation numbers for the different ions.

12. Candidates gave correct answers.

13. Candidates did not indicate all the correct shapes.

14. Most candidates did not indicate the correct polarities.

15. Although most candidates managed to rank given molecules according to volatility, the explanation given to support answers was inaccurate.

Section B

16. a. Most candidates aptly listed the bonds broken in the given reaction, and accurately calculated the energy required to break all the bonds in the reactants.
    b. Similarly, most candidates listed all the bonds that were present in the products, and, in their majority, correctly calculated the energy associated with the formation of bonds in the products.
    c. Candidates found difficulty in calculating the enthalpy change for the reaction.

17. a. Some candidates gave an inaccurate definition of the term '*isomers*'.
    b. Some candidates did not give an accurate explanation of why the alcohols were categorised as primary, secondary or tertiary. Most candidates gave the correct structural formula of the product of reaction between butan-2-ol and PCl_5.

18. a. Most candidates failed to give a correct explanation of the statement "*All alkalis are bases, but not all bases are alkalis".*
    b. The pH of hydrochloric acid was, in most cases, calculated correctly, but in part (b)(ii), candidates failed to calculate the concentration of OH^- ions present in the hydrochloric acid solution.
    c. Most candidates did not give accurate definitions of the terms '*acid'* and *'base'*, in terms of the Bronsted-Lowry Theory of acids and bases.
    d. Not all candidates fared well in this part of the question.

19. a. Answers in part (a) were inaccurate, incomplete or incorrect. In part a(i) some candidates mentioned that deionised water boils at 100 ^oC, but did not state that the boiling point of sodium chloride solution would be higher than 100 ^oC. The use of a separating funnel in part a(ii) was correct, but candidates failed to explain how the liquids are then separated based on density considerations.
    b. Most candidates failed to identify the correct cation present in each of the unknown substances in question.

20. a. Most candidates did not fill in the blanks with all the correct colours for the given ions.

b. In the second part of this question candidates did not give the correct explanation of the term '*complex ion*'. Furthermore, they failed to draw and give the systematic names of the two complex ions: $[Fe(H_2O)_6]^{2+}$ and $[CuCl_4]^{2-}$.

Section C

21. a. Candidates accurately calculated the empirical formula for the monobasic organic acid.
    b. In part (b)(i), candidates found difficulty in explaining the terms *'primary standard' and 'primary standard solution'.*
    In part (b)(ii) only some of the candidates wrote the correct general ionic equation (including state symbols) for the reaction between a monobasic organic acid and sodium hydroxide.
    Incorrect answers were given in part (iii), wherein candidates had to state the colour changes that take place during the titration (using phenolphthalein as indicator), and state how the end-point is reached.
    Answers to part (iv) were inaccurate, as candidates neglected to indicate the ± sign, and include units (cm^3).
    Candidates calculated part (v) well, but found difficulty in determining the molecular formula in part (vi).

22. a. Candidates gave an incomplete description of the bonding in benzene, and consequently an inaccurate explanation of why benzene is more stable than expected.
    b. Candidates did not give the correct structural formula of the organic product for the reaction of chlorine gas with cyclohexene.
    c. Candidates did not distinguish between the addition reaction between cyclohexane and chlorine, and the substitution reaction between cyclohexane and chlorine.
    d. Candidates deduced the correct structural formulae for the given compounds.

23. a. Candidates did not describe an adequate experimental method to obtain rate data. In particular, candidates did not mention that '*a* ***known quantity*** *of acid is to be added to the magnesium ribbon'* and that '*the gas volume is to be measured* ***at regular intervals***'.
    b. Sketches of '*volume of gas produced*' against '*time*' were well-drawn.
    c. Graphs in part (c) were also well-depicted.
    d. Some candidates identified Mn^{2+} ions as the catalyst, but did not give an apt reason why the reaction takes a very long time to start and requires initial heating.

24. a. Most candidates wrote the correct expression for the equilibrium constant, K_c, for the given reaction, but failed to calculate: the concentration of H_2, I_2 and HI at equilibrium in part (ii), the partial pressures of the gases at equilibrium in part (iii), and the Kp for the reaction in part (iv).
    b. Some candidates correctly identified how variables change the position of equilibrium, but many found difficulty in determining how the equilibrium constant would be affected.

Chairperson

2014 Examination Panel