

**UNIVERSITY OF MALTA**

**THE MATRICULATION EXAMINATION  
INTERMEDIATE LEVEL**

**CHEMISTRY  
May 2013**

**EXAMINERS' REPORT**

**MATRICULATION AND SECONDARY EDUCATION  
CERTIFICATE EXAMINATIONS BOARD**

**Chemistry**  
**Intermediate Level**  
**May 2013**

**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.

Forty-six candidates registered for the examination but only 42 were present for the examination. A summary of the results is shown in the table below.

GRADE	A	B	C	D	E	F	Abs	Total
Number	5	5	8	8	2	14	4	46
% of Total	10.87	10.87	17.39	17.39	4.35	30.43	8.70	100

The average mark scored in 2013 was 49% slightly higher than that scored in 2012 (47 %).

The highest average marks were scored in Q1 (atomic structure); Q4 (pH) and Q14 (valency). The lowest average marks were scored in Q8 and Q10 (organic chemistry) and Q21 (separation and purification techniques).

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**

- Most candidates identified correctly the proton number, number of neutrons and mass numbers.
- Most candidates failed to give the electronic configuration of Cr as  $[\text{Ar}] 3d^5 4s^1$  and instead gave  $[\text{Ar}] 3d^4 4s^2$ . Some candidates gave an incorrect electronic configuration of  $\text{Cl}^-$ .
- Most answers were correct. Some candidates made a few mistakes in  $\text{CO}_2$  since they did not realize that  $\text{CO}_2$  has double bonds between the carbon and oxygen atoms.
- Nearly all candidates managed to answer this question correctly.
- Some candidates did not know that a beta particles is a fast moving electron. A significant number of candidates gave an incorrect equation in part (ii) since they added a beta particle to iodine-131.
- Some candidates did not realize that in this equation  $\text{HNO}_3$  was the acid while ethanoic acid is acting as a base.
- Most candidates gave incorrect answers. Many gave a description of intramolecular bonding rather than the intermolecular bonding.
- Very few candidates gave correct answers. Some candidates gave conc.  $\text{H}_2\text{SO}_4$  in part a ii and correct answers to part b i.
- Most candidates gave correct answers. Some candidates did not manage to calculate correctly part iii.

10. Very few gave correct answers. Most candidates did not mention that the acids in the nitrating mixture have to be concentrated and hence lost marks.
11. Most candidates gave a correct answer except for part ii where the empirical formula was the correct answer.
12. Very few candidates chose all the correct compounds. Most candidates failed to list  $N_2$  as a molecule with a triple bond and  $BF_3$  as an electron-deficient compound.
13. Most candidates gave correct answers.
14. Most candidates gave correct answers. Nearly all the answers included the charge which was not required.
15. Most candidates did not list  $Na_2O$  and  $MgO$  as compounds with giant ionic lattice giving only ionic or ionic molecule as the answer. Few candidates mentioned that  $Al_2O_3$  and  $SiO_2$  have giant covalent structures. Describing their structure as covalent molecules was deemed to be incorrect. Some candidates listed the oxides of phosphorus as amphoteric.

### **Section B**

16.
  - a. Most candidates failed to explain that in dynamic equilibrium both forward and reverse reactions still occur but they do so at the same rate. Some candidates mentioned macroscopic and microscopic changes that have nothing to do with the chemical definition of dynamic equilibrium.
  - b. Most candidates gave the correct expression but some candidates gave  $\text{kJ mol}^{-1}$  as the units for  $K_c$ .
  - c. Many candidates worked out correctly the concentration of  $OH^-$  ions.
  - d. All candidates mentioned that  $K_c$  changes on changing concentration.  $K_c$  is only affected by temperature. Most candidates did not mention the change on  $K_c$  in part ii. On the other hand most candidates described correctly the effect of concentration and temperature on  $K_c$ .
17. Most structures were correctly drawn except that very few candidates used the hash-wedge notation. Some candidates mistakenly gave trigonal planar shapes for ammonia and the hydroxonium ion. Most candidates gave the correct answer to the polarity of methane, ammonia and water.
18.
  - a. Very few candidates gave correct general formula although more candidates identified the correct functional group.
  - b. Most candidates gave correct answers. Some candidates gave a description on how to chemically identify primary, secondary and tertiary alcohols instead of a description on how their structure varies.
  - c. Very few candidates gave a correct equation. Most common mistakes included giving propanoic acid instead of ethanoic acid and giving the alcohol, acid and ester as aqueous instead of liquids. Very few mentioned the fact that  $H^+$  ions are needed to catalyse the reaction. In part ii many candidates gave the correct name of the ester even when the incorrect structure was given in the equation!
19.
  - a. Very few candidates mention that groups have elements with the same number of electrons in their outermost shell while periods have elements with the same number of shells.
  - b. Most candidates did not mention that elements in the same group have similar properties due to similar chemical reaction since they have the same number of electrons in their outermost shell.
  - c. Most candidates knew that metallic character increases down a group but then failed to explain why.

- d. Most candidates mention the fact that metallic character decreases across a period but failed to explain why.
- 20. i. Some candidates did not know how to convert  $\text{cm}^3$  to  $\text{m}^3$ .
- ii. Some candidates incorrectly worked out the moles using stp conditions. The ideal gas equation had to be used for the calculation.
- iii. Most candidates worked out the RMM correctly although some candidates gave the answer in grams.
- iv. Most candidates identified correctly the gases as carbon dioxide and propane.
- v. Nearly all the candidates said that the two gases could be tested using limewater.

### **Section C**

- 21. Few candidates chose this question and only one candidate gave correct answers. Most candidates did not give the proper description of the separation technique required. The least problematic was filtration but crystallization, distillation and solvent extraction proved to be more challenging. Marks were lost since candidates left out important details and did not provide an explanation for the technique used.
- 22. a. Most candidates had difficulties in defining correctly the enthalpy of combustion and formation. Many did not realize that octane is a liquid at room temperature and hence lost some marks in the equation for the formation of octane. Very few candidates managed to give a correct Hess's cycle for the formation of octane and hence gave an incorrect value. Most candidates identified and explained correctly Hess's law.
- b. Most candidates gave correct structures although a significant number of candidates gave to the structure of  $\text{HO}_2$  for water ( $\text{H}_2\text{O}$ ). Some candidates did not list all the bond enthalpies in part ii and hence could not calculate correctly the enthalpy of combustion from the bond enthalpies.
- 23. a. Most candidates gave the correct oxidation numbers for the different chromium compounds.
- b. A significant number of candidates failed to balance the redox half equation correctly. Some candidates did not realize that an increase in O.N. is an oxidation while a decrease is a reduction.
- c. Most candidates managed to work out first part of the calculation but then did not realise that they had to use the stoichiometric ratio of the redox equation in part b to calculate the number of moles of chlorine gas. Another common mistake was using a molar mass of 35.5 instead of 71 to calculate the mass of chlorine gas.
- d. Most candidates gave correct oxidation numbers and identified the reaction as a disproportionation reaction.
- 24. a. Most candidates gave correct names to the hydrocarbons but very few gave the correct systematic name for 2,3-dimethylbut-2-ene. Again, most candidates identified 2,3-dimethylbut-2-ene and cyclohexane as isomers but then they did not give a simple test how to identify the two compounds.
- b. A significant number of candidates did not manage to write correct mechanisms for the chlorination of methane and the electrophilic addition of propene. Some candidates failed to give arrows to show how the electrons are transferred during the reaction, which is essential in a mechanism.

**Chairperson**

**2013 Examination Panel**