CHEMISTRY

SUBJECT 9189

PAPER 1

GENERAL COMMENT

Overall performance was generally lower compared to that of the previous year. Most candidates scored low marks because they could not tackle those questions which involved numerical calculations and writing of balanced equations. However, it was pleasing to note that most candidates managed to answer six questions as per requirement of the paper.

COMMENTS ON INDIVIDUAL QUESTIONS

SECTION A

Question 1

This was the most popular question in section A and the performance was satisfactory.

1(a)(i) Most candidates were able to draw correct diagrams although some lost marks for: wrongly labelling the Mg electrode as the cathode and/or not giving correct state symbols for the electrolyte. A few candidates drew electrolyte cells.

(ii) Correct equations were picked from the data booklet but candidates went onto write answers with no sign or unit. Such candidates were penalised. Teachers should stress the need for inclusion of both sign and units in calculations.

(iii) On average it was well done with the majority of candidates getting all four marks. Those who did not score full marks either failed to multiply faraday constant by two or omitted the units in the final answer.

(iv) Very few candidates gave the correct reason that the very large -ve E value for reduction of Mg^{2+} to Mg makes it difficult to recharge the cell. In most cases the candidates mentioned the –ve E cell for the overall reaction and were penalised.

(b)(i) The equation for the discharging of a lead-acid cell was correctly deduced from the given equations. Some candidates incorrectly gave the equation involving formation of $PbSO_4$ which did not earn them the one mark.

(ii) Disadvantages of the lead acid cell were generally not known with a significant number of candidates indicating that the battery was heavy due to presence of lead electrodes.

Answers to numerical questions

1(a)(ii) +3.18V
(iii) +2.12Amp

Question 2

This was also a popular question though scores were generally low.

2(a)(i) The term dynamic equilibrium was often defined as state when forward reaction equals backward reaction without mention of the word rate or reference to a reversible reaction.

(ii) a significant number of candidates referred to shifting of an equilibrium to the left or right when they had not written any equations in their answers. Effect of varying pressure was discussed by some candidates with no reference to the gaseous states of either the reactants or products.

(iii) The majority of candidates simply gave the definition of catalyst without mentioning that it makes the equilibrium to be reached faster by increasing rates of both forward & backward reactions.

(b)(i) Most of the candidates who got the answer wrong did not indicate that moles of HCl were equal to moles of OH^- and gave final answer in terms of n(HCl).

(ii) Having obtained the correct number of moles of OH^- ions in the filtrate, the majority of the candidates failed to use it to calculate $[OH^-]$ from $M(OH)_3$.
Only outstanding candidates were able to perform this calculation.

(iii) Candidates from most centres failed to define the term solubility which is the amount of substance that dissolves in a specific volume of solvent at a specified temperature.

(iv) Calculation on Ksp was badly done.

Answers to numerical questions

2(b)(i) 0.0036 moles
(ii) 0.044 moles

(iii) 0.01467 moles
(iv) $1.5 \times 10^{-4}\ mol^4\ dm^{-12}$

Question 3

Section A

This was the least popular question from Section A and the performance was generally poor.

3(a)(i) The equations for complete ambustion of propane and butane were well known, though a few candidates gave wrong formulae of the two hydrocarbons. An extreme case was when $OH^3(OH_2)_3\ OH$ was given as the formula of butane.

(ii) The calculation involving the determination of percentage by volume of each gas in the mixture was a tall order to most candidates. Only very outstanding candidates got the correct answer.

(b)(i) A common error was using 22^0C as the value for ΔT or omitting to use the value 70% in calculating amount of heat absorbed by the water.

(ii) The assumption made was that water boils at 100^0C or that the density of water is $igcm^{-3}$.

(c)(i) Marks were lost for not including CO or C in the equation.

(ii) Effect of CO on the environment was well known by most candidates. For C soot the majority of candidates mentioned ozone layer depletion or acid rain formation, the required answer was smog.

Section B

Question 4

4(a) This was a very popular question but it scored the lowest marks especially in question 4(a) were the candidates wasted a lot of time writing long explanations in words when the question was supposed to be answered by means of appropriate equations. However, it was quite encouraging to note that the relative stabilities of the +4 and +2 oxidation states in the Gp IV oxides were well known.

(b)(i) Most candidates gave the correct shapes though in some cases after having incorrectly described the bonding in tin IV iodide as ionic or metallic and the structure as also tetrahedral.

(ii) The reasons that an inert solvent was used to dissolve both I_2 & SnI_4 because they are both non-polar covalent substances was not well

known. The second reason was that use of other solvents such as water would result in hydrolyses of SnI_4.

Question 5

Was also popular but poorly done.

5(a) Very few candidates gave the correct equation and if correct, then it would not be balanced in most cases.
The fraction of $\frac{5}{6}$ was not obtained by many candidates because of unbalanced equations.

(b) the majority of the candidates answered the question by comparing Hl and HCL when in actual fact the question required the group trend. A significant number of candidates lost marks for not quoting the relevant H-X bond energies.

(c) Candidates who attempted to draw the shapes lost marks for incorrect types of bonds though most of them gave correct names and bond angles.

(d) The definition of the term disproportionation was well known though a significant number of candidates failed to write the correct equation for the disproportionation of $NaClO_3$ or gave wrong state symbols of reactants and / or products.

Section C

Question 6

This was the most popular question in the organic chemistry section and was highly scoring.

6(a) Most candidates knew the correct tests to distinguish between the two alkenes though a few lost marks for not giving correct conditions for the two steps. Use of cold dilute $KMnO_4$ or Br_2 (eg in the first step were common answers.

(b)(i) Most candidates performed well in this question. However, a significant number gave HCN as the reagent for step II instead of the completely ionized KCN/NaCN.

(ii) Correct structures of C and D were given by most candidates. A significant number of candidates incorrectly gave $CH_3\,CH_2\,C(CH_3)_2$ 04 or CH_3 CH (CN) $CH(CA_3)_2$ as the structure of D.

(iii) Although most candidates were able to give the different physical properties between a and B, they were unable to give correct explanations for the differences. In extreme cases candidates failed to realise that A and B are isomers and gave differences in Mr as the reason for the difference in m.p / b.p of the two alkenes. Some candidates incorrectly thought that as trans isomerism was a physical property.

Question 7

Was also a popular question in section C

7(a)(i) Candidate's responses showered that they were not well versed with the two types of structural isomerism namely positioned and functional group.

(ii) Most candidates failed to arrange the three isomers in correct order of increasing boiling points which was supposed to be E<F<G. There was need to mention intra-molecular hydrogen bonding in E to give weaker VDW forces between molecules and also that inter molecular Hydrogen bonds between molecules of G are stronger than those in F.

(b)(i) Structure of product was well known though most candidates lost the mark for formation of a white ppl as an observation.

(ii) A few candidates confused this with reaction of f and Felilings's solution which would give a red-brown ppl of Cu_2O as a product.

(iii) Correct structures and observations were generally given by most candidates.

(c) Type of reaction was frequently given as nucleophilic substitution, eliminates or dehydration instead of condensation.

Question 8

Was also a popular question but scores were low.

(a) Reference was made to shifting of the equilibrium for the dissociation of HCN to the left or to the right when no equation had been given. The scores were generally low.

(b) Those candidates who wrote the reaction mechanism showing the movement in most cases got full marks whilst those who attempted to describe the mechanism in words hardly obtained any marks. A common error was mentioning that Cl^- is more electronegative than Br^-.

(c) It is quite encouraging to note that most candidates gave correct differences between electronegativities of F and I and their –I effects on strength of the O-H bonds in the two acids.

(d) The majority of candidates gave the correct formula of the product formed which has a chiral centre and should therefore be optically active. However, only a few candidates correctly explained the absence of optical activity as being done due to presence of equimolar quantities of D and L isomers / racemic mixture.

(e) Expected response was $CH_3\,CH_2\,NH_2$ can accept a proton via the lone pair of electrons on the nitrogen atom.

(f) A significant number of candidates lost marks for giving the equation for partial ionization of $CH_3\,CO_2H$ without reversible arrows. It is quite amazing to find out that most candidates thought that CH_3COCl is more acidic because it produces two acids namely CH_3CO_2H and HCl whilst CH_3CO_2 it is only one acid and would be less acidic. There was need to mention complete ionisation of HCl as the reason for more acidic nature of CH_3COCl in aqueous solution.