THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

132/2 **CHEMISTRY 2**

(For both School and Private Candidates)

Time: 2:30 Hours *Tuesday, 16th February 2010 a.m.*

INSTRUCTIONS

1. This paper consists of **ten (10)** questions in sections A, B and C.
2. Answer **five (5)** questions choosing at least **one (1)** question from each section.
3. Each question carries **twenty (20)** marks.
4. Mathematical tables and non-programmable calculators may be used.
5. Cellular phones are **not** allowed in the examination room.
6. Write your **Examination Number** on every page of your answer booklet(s).
7. For calculations you may use the following constants:

   Gas constant, $R = 8.31\ J\ mol^{-1}\ K^{-1}$ or $0.0082\ atm\ mol^{-1}\ K^{-1}\ dm^3$
   GMV = $22.4\ dm^3$
   1 litre = $1\ dm^3 = 1000\ cm^3$
   1 faraday = 95,500 coulombs
   Velocity of light, $C = 3.0 \times 10^8$ m/s
   Atomic masses: H = 1, O = 16, Cl = 35.5 K = 39.

This paper consists of 5 printed pages.

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SECTION A

1. (a) Explain the following terms:
   (i) Common ion effect
   (ii) Buffer solution
   (iii) Acid dissociation
   (iv) Ionic product of water
   (v) Salt hydrolysis. **(5 marks)**

   (b) Calculate the molar solubility of silver chromate in water at 25 °C. For silver chromate, the Ksp is 2.4×10^{-2} $mol^2 dm^{-6}$. **(6 marks)**

   (c) (i) Will the solubility of silver chromate in 0.1 M aqueous solution of potassium dichromate be greater or lower than that of water? Explain.
   (ii) What are the three limitations of solubility product? **(9 marks)**

2. (a) (i) State two laws which govern the depression of freezing point.
   (ii) What are the three uses of colligative properties? **(7 marks)**

   (b) Electrolyte A dissociates into B, C, D +...., as shown in the following equation: A □ B + C + D + ...
   If the degree of dissociation is α, express α through Vant Hoff's factor, i. **(5 marks)**

   (c) A solution of calcium nitrate containing 15 g of anhydrous salt in 1000 g of water freezes at – 0.435 °C. Calculate the degree of dissociation of the salt. **(8 marks)**

3. (a) (i) Define Kohlrauch's law of independent ionic mobilities.
   (ii) Give ionic representation of Kohlrausch's law of independent ionic mobilities. **(4 marks)**

   (b) (i) Give three applications of Kohlrausch's law of independent ionic mobilities.
   (ii) Show how you can obtain molar conductivity at infinite dilution (□$^{\infty}$) of ethanoic acid from molar conductivities at infinite dilution of hydrochloric acid and potassium chloride. **(8 marks)**

   (c) The electrolytic conductivity of saturated solution of silver chloride at 18 °C after deducting the electrolytic conductivity of water is 1.22×10^{-4} $s\ m^{-1}$. The molar conductivity of Ag^+ and Cl^- ions at infinite dilution at 18 °C are 0.54×10^{-2} and 0.652×10^{-2} $s\ m^{-2}\ mol^{-1}$. Calculate the solubility of silver chloride at 18 °C in mol/kg. (Assume the solution is dilute). **(12 marks)**

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4. (a) Describe the following:
   (i) Half life of chemical reaction
   (ii) Molecularity of chemical reaction
   (iii) Rate determining step
   (iv) Reaction mechanism
   (v) Order of reaction. **(5 marks)**

   (b) The reaction, $AB \rightarrow A + B$ is a first order reaction with $K = 2.02 \times 10^{-5}$ sec^{-1} at 540 K. Calculate the percentage of decomposition after heating AB at 540 K for 1 hour. **(6 marks)**

   (c) In the process of studying isomerisation of cyclopropane to propene in the gas phase at 433 °C the following data were obtained.

Time/hours	0	2	5	10	20	30
% cyclopropane remaining	100	91	79	63	40	25

   (i) Write an equation for the reaction involved.
   (ii) Show that the reaction is first order with respect to cyclopropane.
   (iii) Calculate the rate constant of the reaction. **(9 marks)**

SECTION B

5. (a) Give explanation for the following statements:
   (i) Only lithium reacts with nitrogen to form nitride in group I elements. **(2 marks)**
   (ii) Standard electrode potentials become more negative down the group, but the standard electrode potential of lithium is the most negative in the group. **(2 marks)**
   (iii) Group IV elements have in common the +2 and +4 oxidation states. **(2 marks)**
   (iv) B^{3+} does not exist. **(2 marks)**
   (v) Group III elements largely show covalency. **(2 marks)**
   (vi) Although it is hard to have Al^{3+}, $[Al(H2O)]^{3+}$ is stable. At the same time it is difficult to find $[B(H_2O)]^{3+}$. **(6 marks)**
   (vii) Nitrogen and phosphorus are non metals; arsenic and antimony are metalloids (semi- metals); bismuth is a true metal. Give explanation and show evidence for these statements. **(4 marks)**

6. (a) Describe the following terms:
   (i) Diamagnetism
   (ii) Coordination number
   (iii) Complex ion. **(6 marks)**

   (b) Write the electronic configuration of the following:
   (i) Neutral scandium atom
   (ii) Scandium (III) ion
   (iii) Neutral nickel atom

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(iv) Nickel (II) ion. **(8 marks)**

(c) Name the following complex compounds:
(i) $[Ag(NH_3)_2]_3[Fe(CN)_6]$
(ii) $K[Co(H_2O)_2(NO_2)_2]$. **(3 marks)**

(d) Write the formula of the following complex compounds:
(i) Dichlorotetraaquocobalt (III) chloride
(ii) Tetraaquocopper (II) tetrabromoplatinate. **(3 marks)**

7. (a) What is the relationship between ideal gas equation and Van der Waals equation? **(2 marks)**

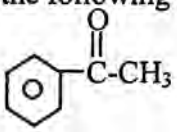
(b) 3.50 moles of a gas occupies 5.20 litres at 50 °C. Calculate the pressure of the gas in atmospheres using
(i) the ideal gas equation
(ii) the Van der Waals equation. **(8 marks)**

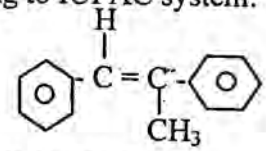
(c) In the light of the Dalton's law of partial pressures, establish a relationship which exists in a mixture of two gaseous substances A and B found in a container of volume V at a constant temperature T. **(4 marks)**

(d) Oxygen produced in the thermal decomposition of potassium chlorate at 25 °C and atmospheric pressure of 752 mm Hg is 150 ml. What is the mass in grams of oxygen produced during this reaction? **(6 marks)**

SECTION C

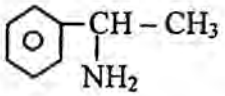
8. (a) Name the following compounds according to IUPAC system:

(i) 

(ii) 

(iii) $CH_3\text{-}CH{=}C(CH_3)\text{-}COOH$

(iv) $C_6H_5CH_2C_6H_5$

(v) 

(10 marks)

(b) Giving an example in each case define the following:
(i) Organic substitution
(ii) Addition reaction
(iii) Elimination reaction. **(6 marks)**

(c) Compound **B** is unsaturated hydrocarbon, (C_4H_6) which requires 2 moles of H_2 for hydrogenation using nickel catalyst. It forms white precipitate with $Ag(NH_3)_2^+OH^-$. It is acidic in nature. Identify compound **B** giving reasons for each step. **(4 marks)**

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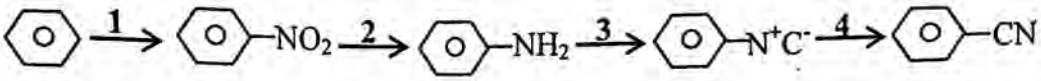
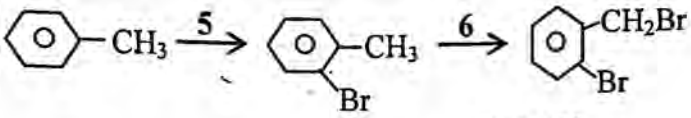
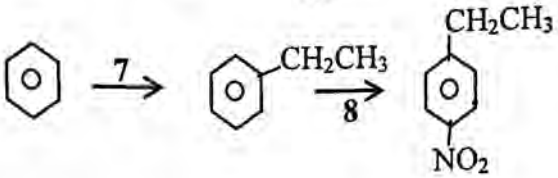
9. (a) Indicate the reagent(s) which would be appropriate to accomplish each of the following numbered conversions.

(i) 

(ii) 

(iii) 

(8 marks)

(b) What simple chemical test that would be used to distinguish the following compounds:

(i) Acetic acid and acetaldehyde

(ii) 2 – pentanone and 3 – pentanone

(iii) Benzyl alcohol and bezaldehyde. **(6 marks)**

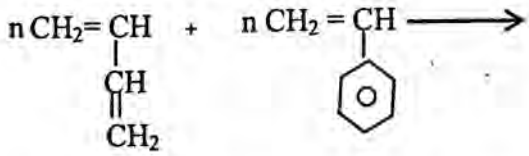
(c) Write all possible constitutional isomers of the following:

(i) $C_2H_4O_2$

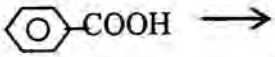
(ii) C_3H_8O. **(6 marks)**

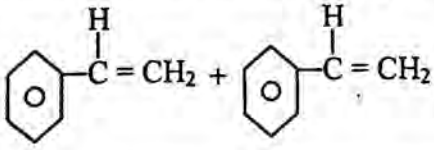
10. (a) Differentiate a PVC from a polyester. **(8 marks)**

(b) Give the products of the following polymerisation reactions and classify them as addition or condensation polymerisation.

(i) 

(ii) $HCOO\text{-}(CH_2)_4\text{-}COOH + NH_2\text{-}(CH_2)_6\text{-}NH_2 \rightarrow$

(iii) $CH_2OHCH_2OH + HCOO\text{-}$  $\rightarrow$

(iv) 

(8 marks)

(c) Explain at least two hazards of polymers. **(4 marks)**

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