Technical University of Mombasa

Faculty of Applied and Health Sciences

DEPARTMENT OF **PURE AND APPLIED SCIENCES**

DIPLOMA IN ANALYTICAL CHEMISTRY
(DAC 10J)

ACH 2312: INORGANIC CHEMISTRY

SPECIAL/SUPPLEMENTARY: EXAMINATIONS

SERIES: February 2013

TIME: 2 HOURS

INSTRUCTIONS:

You should have the following for this paper
   - *Answer booklet*
This paper consists of *FIVE* questions.
Answer Question **ONE (compulsory)** and any other **TWO** questions
This paper consists of 3 PRINTED pages

Question ONE

a) (i) Define the term Lewis acid **(2marks)**

   (ii) Explain why authoboric acid (H_3BO_3) acts as a Lewis acid **(2marks)**

b) (i) Explain why a diagonal relationship between elements occurs in the periodic table

        (2marks)

   (ii) State THREE diagonal relationship between elements occurs in the periodic table

        (2marks)

c) State with reasons the compound with the least ionic character lithium chloride or potassium chloride **(2marks)**

d) The atomic number of carbon and tim are 6 and 50 respectively;

   (i) Write the electronic configuration for each atom. **(1mark)**

   (ii) Explain why tin shows typical metabllic behavior while carbon does not. **(2marks)**

e) The nitride (N^{3-}), hydride (H^-) and amide (NH_2) ions are basic. Write equations the their reaction with water. **(3marks)**

f) Explain the following observations

   (i) Reducing character reduces down the group in group VB hydrides **(3marks)**

   (ii) Aqueous solutions of hydrated transition metal ionis are acidic **(2marks)**

   (iii) When anhydrous copper (II) chloride is dissolved in water a blue solution is formed it when dissolved in concentrated hydrochloric acid a yellow-green solution is formed (Use equations to illustrate your answer as you explain this observation) **(4marks)**

   (iv) When SO_2 is bubbled into through the yellow – green solution in presence of excess hydrochloric acid, the colourless species $(CuCl_2)^{-1}$ is formed together with sulfate ions (Explain)

        (4marks)

Question TWO

a) Describe the Nitrogen cycle **(5marks)**

b) State TWO industrial applications of nitrogen.

c) Write equations for the reaction of water with the following

   (i) P_4O_6

   (ii) P_4O_{10}

   (iii) NH_3

   (iv) NO_2

        (6marks)

d) State TWO applications of ammonia **(1mark)**

Question THREE

a) With the aid of a well labeled diagram outline the extraction of sulfur by frasch process form sulfur underground beds. **(8marks)**

b) Sulfur forms Z-valent, 4-valent and 6 – valent compounds. Explain with acid of diagrams **(4 ½ marks)**

c) Explain the difference in solubility between NH_3 and PH_3. **(2 ½ marks)**

Question FOUR

a) Iron is a transition element with atomic number 26. State with reason(s) the most stable oxidations state of iron. **(3marks)**

b) Explain why a solution of an iron (III) salt in water has a pH less than 7. **(3marks)**

c) State any FIVE characteristics of transition metals **(5marks)**

d) Draw and name the structures of the following complexes

    (i) $[Co(NH_3)_6]^{3+}$ **(2marks)**

    (ii) $[Ag(NH_3)_2]^+$ **(2marks)**

Question FIVE

a) $^{214}_{83}Bi$ has a half-life of 20 minutes

    (i)   Using a suitable internal plot the graph of the percentage of $^{214}_{83}Bi$ remaining against time for a period of 1hour, 20 minutes **(5marks)**

    (ii)   State TWO the characteristics properties of Alpha and Beta particles **(4marks)**

    (iii) Deduce the nature of X in the following nuclear reaction

$$^{235}_{92}U \; + \; ^{1}_{0}n \rightarrow \; ^{95}_{42}Mo + \; ^{139}_{59}La + 2 \; ^{1}_{0}n + 7x$$

(4marks)

b) Outline any FOUR applications of radioactive isotopes **(2marks)**