TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF PURE & APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR:

DAC 15S

ACH 2305: **CHEMISTRY OF TRANSITION ELEMENTS**

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: SEPTEMBER2018

TIME: 2HOURS

DATE: Pick DateSep2018

Instructions to Candidates

You should have the following for this examination

Answer Booklet, examination pass and student ID

This paper consists of **FIVE** questions. Attemptquestion ONE (Compulsory) and any other TWO questions.

Do not write on the question paper.

Question ONE

a) State five differences between Ar (z = 18) and Mn(z=25) (5 Marks)

b) Determine the oxidation state of

(i) V in VO_2^+ (2 Marks)

(ii) Mn in MnO_4^{2-} (2 Marks)

(iii) Mn in Mn_2O_7 (2 Marks)

(iv) Ni in $[Ni(CN)_3]^{2-}$ (2 Marks)

c) For each of the following ores name the metallic element and give the corresponding formula of the compound (mineral) containing the metal.

(i) Hematite (2 Marks)

(ii) Pyrolusite (2 Marks)

(iii) Cassiterite (2 Marks)

(iv) Rutile (2 Marks)

d) Distinguish diamagnetic substance from paramagnetic substance and give one example for each. (4 Marks)

e) State five advantages of potassium permanganate as reagent in volumetric analysis. (5 Marks)

Question TWO

a) Discuss briefly the two theories of catalytic activity of transition element. (10 Marks)
b) Give the IUPAC names of the following
   (i) $[Fe(CN)_6]^{4-}$ (1 Marks)
   (ii) $[Cu(NH_3)_4\ (H_2O)_2]SO_4$ (1 Marks)
   (iii) $[Pt(NH_3)_4\ Cl_2]\ [PtCL_4]$ (1 Marks)
   (iv) $K_2\ [PtCI_6]$ (1 Marks)
   (v) $[CO(NH_3)_5C1]Cl_2$ (1 Marks)

Question THREE

a) The mechanism of a certain reaction involves the following two steps.
   $2\ Fe^{3+} + 21^- \rightleftharpoons 2Fe^{2+} + I_2$ $2Fe^{2+} + S_2O_8^{2-} \rightleftharpoons 2Fe^{3+} + 2SO_4^{2-}$
   (i) State the role played by Fe^{3+} and $S_2O_8^{2-}$ in the reaction give a reason in each case (6 Marks)
   (ii) Determine the equation of the overall reaction (2 Marks)
b) Given the following elements X(z=33) w(z=35) y(z=47)
   (i) Write the valence shell electron configuration for each (3 Marks)
   (ii) From your answer in b(i) identify Coinage metal and Metalloid (5 Marks)

Question FOUR

a) State three properties of cations that favour formation of stable complexes (3 Marks)
b) Out of the following pairs of complexes, identify the more stable complex and give reason for your answer.
   (i) $K_4[Fe(CN)_6]$ and $K_3[Fe(CN)_6]$ (2 Marks)
   (ii) $[Co(H_2O)_6]^{2+}$ and $[Co(NH_3)_6]^{2+}$ (2 Marks)
   (iii) $[Cu(en)_2]\ Cl_2$ and $[Cu(NH_3)_4]\ Cl_2$ (2 Marks)
   (iv) $[Co(NO_2)_6]^{4-}$ and $[Co(NO_2)_6]$ (2 Marks)
c) Identify the transition metal or its compound used as a catalyst in the following
   (i) Manufacture of polythene (1 Mark)
   (ii) Decomposition of H_2O_2 (1 Mark)
   (iii) Haber process (1 Mark)
   (iv) Contact process (1 Mark)

Question FIVE

The following table shows the ionization energies in $KJMoF1^{-1}$ of five elements lettered A,B.C,D and E

Element	1^{st} IE	2^{nd} IE	3^{rd} IE	4^{th} IE
A	500	4600	6900	9500
B	740	4500	7700	10500
C	630	1600	3000	4800
D	900	1800	14800	21000
E	580	1800	2700	11600

a) Identify
   i) The element that is most likely to form + 1 ion. Explain (2 marks)
   ii) The two element that are in the same group of periodic table state the group (5 marks)
   iii) The group of periodic table element F belongs. Explain (3 marks)
   iv) The element that would require the least energy to convert one mole of gaseous atoms into dipositive ions (2 marks)

b) Element A is a crystalline solid at room temperature. Write equations of steps involved in formation of $A^{2+}(g)$ ions (3 marks)