



KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2009/2010 INSTITUTE OF OPEN LEARNING EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE

SCH 400: COMPARATIVE STUDY OF TRANSITION ELEMENTS

DATE: Friday 19th February, 2010

TIME: 11.00 a.m. – 1.00 p.m.

Instructions to candidates

Attempt **All** Questions

1. Explain the following observations
 - a) Transition elements are hard metals with high electrical and thermal conductivities, high melting points and boiling points.
 - b) Most transition metals display numerous oxidation states which vary by steps of 1.
 - c) Transition elements have an unparalleled propensity for forming coordination compounds with Lewis bases.
 - d) The highest oxidation state possible for iron (Fe) is +6 as in FeO_4^{2-} . On the other hand the highest oxidation state of osmium (Os) is +8 as in OsO_4 and yet they belong in to the same group in the periodic table. (16 marks)
2. State and explain the general trends for each of the following properties down the groups and across the periods of the transition elements.
 - a) Density

- b) Atomic radii
c) Electronegativity (10 marks)

3. Give the Oxidation State, d-orbital occupation, co-ordination number and expected magnetic moment of the central metal ion in the following complexes. Draw the expected structure.

- a) $\text{K}_4[\text{Fe}(\text{C}_2\text{O}_4)_3]$
b) $\text{cis-}[\text{PtCl}_2(\text{en})_2]\text{Cl}$

where $\text{C}_2\text{O}_4^{2-}$ is the oxalate ion and en = ethylenediammine (Fe = 26, Pt = 78).

(12 marks)

4. Briefly describe how you may obtain

- (a) Potassium dichromate from the mineral FeCr_2O_4
(b) CrO_3 from the mineral FeCr_2O_4 .
(c) K_2CrO_4

List any two industrial applications and one laboratory application of chromium metal or its compounds citing the chemical or physical property utilized in each case.

(16 marks)

5. Discuss the following

- (a) The contribution of covalency to bonding and stabilization of high oxidation states of transition elements (6 marks)
(b) The stability of group oxidation state of the metals across the first transition series of the periodic table. (6 marks)
(c) Formation of metal-metal bonds in transition metal compounds (4 marks)

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