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University Examinations 2015/2016

FOUTH YEAR, FIRST SEMESTER EXAMINATION FOR BACHELOR OF SCIENCE CHEMISTRY

SCH 2400: COMPARATIVE STUDY OF TRANSITION ELEMENTS

DATE: NOVEMBER, 2015 **TIME: 2HOURS**

INSTRUCTIONS: *Answer question **one** and any other **two** questions.*

QUESTION ONE – (30 MARKS)

a) Why do the transition elements exhibit higher enthalpies of atomization compared to main group elements. (2 Marks)

b) The transition metals are much hard and have low volatility (except mercury). In addition they have high melting point and boiling point. Account for the high melting point and boiling point observed in transition elements. (3 Marks)

c) Explain why Cr^{2+} act as a reducing agent and Mn^{3+} as an oxidizing agent when both have d^4 configuration. (4 Marks)

d) State three properties that allow transition metal to form complexes with different ligands. (3 Marks)

e) Why do transition elements act as good catalysts? (2 Marks)

f) Distinguish between ;

(i) Homogeneous catalyst and heterogeneous catalyst. (2 Marks)

(ii) Apoprotein and haloenzyme (2 Marks)

g) What do you understand by the term interstitial compound? (1 Mark)

h) State any four properties of interstitial compound. (4 Marks)

i) Name one principal mineral source from which each of the following transition metals can be extracted. (4 Marks)

(i) Chromium

(ii) Molybdenum

(iii) Cobalt

(iv) Nickel

j) Define a metal cluster and give one specific example. (2 Marks)

k) Define the term metalloprotein. (1 Mark)

QUESTION TWO (20 MARKS)

a) Describe the three common methods used to prepare metal clusters. (9 Marks)

b) How can bonding in the smaller cluster accounted for in terms of local M-M and M-L electron pair bonding and the electron rule? Use $Mn_2(CO)_{10}$ and $OS_3(CO)_{12}$ in your explanation. (6 Marks)

c) What are the qualities of a good catalyst? (5 Marks)

QUESTION THREE (20 MARKS)

a) One of the most studied catalytic system Wilkinson's catalyst which is the Rh(I) complex.

(i) Give formula for this complex. (1 Mark)

(ii) Provide a catalytic cycle for hydrogenation of alkene using wilkinson's catalyst. (5 Marks)

b) Describe the general mechanism of cobalt-carbonyl-catalysed hydroformylation proposed by Heck and Breslow. (7½ Marks)

c) Name any three biogenic metal ions and explain their role in Biological systems(6 Marks)

QUESTION FOUR (20 MARKS)

a) Explain how nitrogen fixing bacteria found in soil root nodules of leguminous plant manage to synthesize NH_3 at ambient conditions of temperature and pressure conditions required in Haber-Bosch process. (10 Marks)

b) What do you understand by the term fixed nitrogen? Give two examples of fixed nitrogen. (3 Marks)

c) Give a detailed explanation for extraction of titanium from ilmenite. (5 Marks)

d) State two uses of Titanium and its compounds. (2 Marks)