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University Examinations 2022/2023

FOURTH YEAR, SPECIAL/SUPPLEMENTARY EXAMINATION FOR THE DEGREE OF
BACHELOR OF SCIENCE IN CHEMISTRY

SCH 3400: ORGANOMETALLIC CHEMISTRY

DATE: AUGUST 2023

TIME: 2 HOURS

INSTRUCTIONS: *answer question one and any other two questions*

QUESTION ONE (30 MARKS)

- a) Briefly explain how Ziegler Natta catalyst is prepared (3 marks)
- b) By use of a catalytic cycle, demonstrate polymerization of ethane using Ziegler Natta catalyst (6 marks)
- c) Starting with MnO_2 , explain how potassium permanganate can be prepared in laboratory (5 marks)
- d) Explain why transition metals generally have higher m.p than the main group metals (2 marks)
- e) Distinguish between
 - i) A mineral and Ore (2 marks)
 - ii) Calcination and roasting (2 marks)
- f) Name one Ore from which each of the following transition metals can be extracted (4 marks)
 - i) Titanium
 - ii) Iron
 - iii) Silver

- iv) Copper
- g) Highlight three properties of titanium that make it suitable as white pigment (3 marks)
- h) Explain why CuCl is not stable in aqueous solution (3 marks)

QUESTION TWO (20 MARKS)

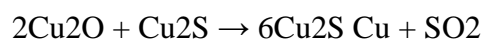
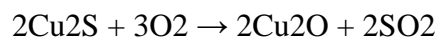
- a) What is bioinorganic chemistry? (2 marks)
- b) Living organisms store and transport metals to provide appropriate concentration of them for use in metalloproteins or cofactors and protect themselves against the toxic effect of metal excess
- (i) Define the terms metalloprotein and cofactor (4 marks)
- (ii) Explain how iron concentration is controlled in mammals (4 marks)
- c) What is polyoxometallate? (2 marks)
- d) Polyoxometallate anions can be made by careful adjustment of pH and concentration. Use equation to show how polyoxometallate $[\text{Mo}_6\text{O}_{19}]^{2-}$ formed by acidification of solution of the simple molybdate (3 marks)

QUESTION THREE (20 MARKS)

- a) Describe briefly any three classes transition metal clusters (6 marks)
- b) Why are transition metals considered as important elements in biological system? (14 marks)

QUESTION FOUR (20 MARKS)

- a) Explain any three requirements for a good catalyst (6 marks)
- b) Large amount of copper are obtained from copper pyrite by smelting ores containing 4% or more copper are obtained by pyrometallurgy process. Very poor ores are treated by hydrometallurgy process
- (i) Give chemical formula of copper pyrite (1 mark)
- (ii) What do you understand by Pyrometallurgy and Hydrometallurgy? (4 marks)
- (iii) What is suitable method for the concentration of this ore? Justify your answer (2 marks)
- c) Blast of air converts Cu_2S partly into Cu_2O which reacts with remaining Cu_2S to give molten copper according to equations:



- (i) Name the type of reduction manifested by these equations (1 mark)
- (ii) With examples differentiate between roasting and calcination? (4 marks)
- d) Show that $\text{Fe}(\text{CO})_5$ obeys the 18-electron rule (2 marks)