



CRAWFORD UNIVERSITY
COLLEGE OF NATURAL AND APPLIED SCIENCES
DEPARTMENT OF PHYSICAL AND EARTH SCIENCES
(INDUSTRIAL CHEMISTRY UNIT)
HARMATTAN SEMESTER EXAMINATIONS 2013/2014 SESSION

COURSE CODE: ICH 347

COURSE TITLE: INTRODUCTION TO CATALYSIS

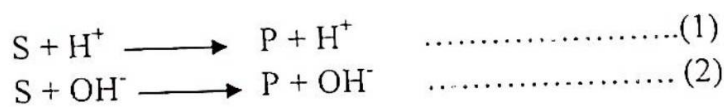
UNITS: 2

TIME ALLOWED: 2 HOURS

DATE: FEBRUARY, 2014

INSTRUCTION: ATTEMPT ONLY THREE QUESTIONS

1. (a) Define the following terms with ONE example each:
 - (i) Homogeneous catalysis
 - (ii) Heterogeneous catalysis.
 - (b) (i) Differentiate between the terms "Catalytic Turnover Number (TON) and Catalytic Turnover Frequency (TOF)".
 - (ii) State the basis for the classification of catalysts.
 - (c) (i) Describe the range of the types of catalysts using diagram only.
 - (ii) Briefly explain the term "Autocatalysis". Support your explanation with one suitable example.
 - (d) Mention factors that must be considered in choosing a catalyst for a commercial purpose.
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2. (a) Explain the following terms:
 - (i) Inhibitor.
 - (ii) Selectivity
 - (iii) Active agent
 - (b) (i) State the attributes of a good catalyst.
 - (ii) Mention three possible types of homogeneous catalysis.
 - (c) Consider the catalyzed reactions:



Show that
$$K' = K_o + K_H + [H^+] + \frac{K_{OH} \cdot K_w}{[H^+]}$$

3. (a) Derive the Michaelis-Menten equation:
$$V_o = \frac{V_{max} [S]}{K_m + [S]}$$
- (b) (i) Mention four applications of enzyme catalyzed reactions.
(ii) What is the full meaning of ECIUB as related to the classifications of enzymes?
(c) What is the Lineweaver-Burk plot?
4. (a) Write short notes on any three of the following:
(i) Hydroformylation
(ii) Wilkinson's catalyst
(iii) Monsanto acetic acid synthesis
(iv) Wacker oxidation alkenes
- (b) Mention five industrial applications of catalysis, stating the processes and the catalyst system involved.
- (c) Draw the structures of the following catalysts:
(i) C_6H_{11} = cyclohexyl (Grubbs catalyst 2)
(ii) Schrock catalyst
(iii) Tricyclohexyl phosphate (Grubbs catalyst 3)
(iv) Metallocene catalyst
- (d) Distinguish between the terms "Chemosorption and Physisorption".
5. (a) Using the catalytic cycle, show the mechanism of reaction below:

$$2H_2 + O_2 \xrightarrow{NO_2} 2H_2O$$
- (b) Outline the types of elementary steps that are possible with organometallic catalysts.
(c) Differentiate between integral selectivity and differential selectivity.