



**DEDAN KIMATHI UNIVERSITY OF TECHNOLOGY**

**UNIVERSITY EXAMINATIONS 2021/2022 AY**

**YEAR ONE SEMESTER ONE EXAMINATION FOR DEGREE OF MASTER OF  
SCIENCE IN INDUSTRIAL CHEMISTRY**

**SCH 6105:ADVANCED ENVIRONMENTAL AND GREEN CHEMISTRY**

**DATE: 8<sup>TH</sup> OCTOBER 2021**

**TIME:10.00-01.00 P.M.**

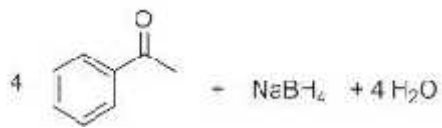
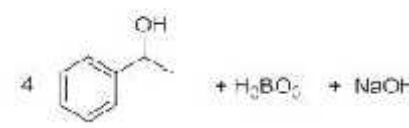
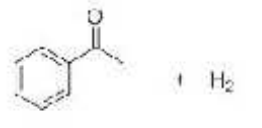
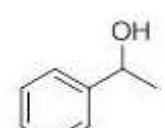
**INSTRUCTIONS: Answer ALL questions**

**Question One [15 Marks]**

a)

- i. Plastics are a nuisance and act as a major source of water pollution, give three reasons that justify this statement [3 marks]
- ii. Synthesis of green plastics has been explored to address some of the challenges. State three green chemistry principles addressed by use of green plastics. [3 marks]

b) With the help of the table provided below

S/No	REACTANTS	CATALYST	PRODUCTS
1		None	
2		Pd-on-C catalyst	

- i. Discuss the green chemistry principle of atom economy [3 marks]

ii. Calculate the % atom economy for the two reactions above [2 marks]

c) What is the environmental impact of building residential houses along riparian land (along river banks). Discuss any four of them. [4 marks]

### **Question Two [15 Marks]**

a) Discuss how the Montreal Protocol has progressed from the time it was established as it aims to achieve its goal. [6 marks]

b) According to the World Health Organization estimates, more than five million lives have been saved by DDT(para-dichlorodiphenyltrichloroethane), however its use has been banned in many countries.

i. What has informed the banning of DDT use [5 marks]

ii. You have been assigned a task to produce DDT for mosquito control with DeKUT. Explain FOUR green Chemistry principles that you would use to convince your supervisor against undertaking the task. [4 marks]

### **Question Three [15 Marks]**

a) You have been invited by the DeKUT chemistry club to give a talk on photochemical smog and mitigation measures. They would like you to clearly address the following;

i. Reactions that lead to production of Ozone by photochemical smog [2 marks]

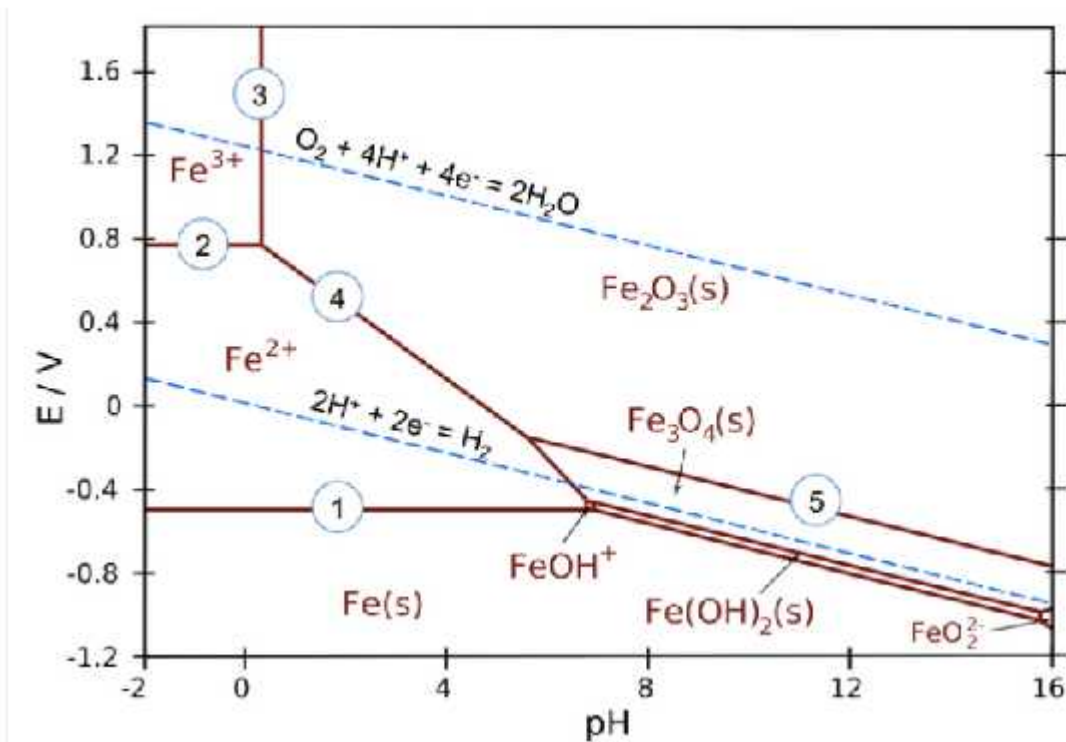
ii. Mitigation measures to be applied to reduce photochemical smog [3 marks]

b) Discuss the filtering of Sunlight's UV Component by Atmospheric O<sub>2</sub> and O<sub>3</sub>. [6 marks]

c) N<sub>2</sub>O is considered to be very significant with respect to Ozone depletion. Explain why this is so. [4 marks]

### **Question Four [15 Marks]**

a) Use the following Pourbaix diagram for iron at ionic concentrations of 1.0 mM to answer the following questions.



- i. What do the solid horizontal, solid vertical lines and broken(----) lines stand for? [ 3 marks]
  - ii. Write equations to show the equilibria in the iron Pourbaix diagram at number 1-5 as shown above. [5 marks]
  - iii. The corrosion of iron is indeed rapid in parts of the Pourbaix diagram where the element is oxidized to a soluble, ionic product such as  $Fe^{3+}(aq)$ . We have however had many experiences of Iron treasure boxes with intact treasures being unearthed from the surface of the Ocean, discuss. [5 marks]
- b) State FOUR ways by which we can reduce occurrence of acid rain [2 marks]