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**TECHNICAL UNIVERSITY OF MOMBASA**  
**FACULTY OF APPLIED AND HEALTH SCIENCES**  
**DEPARTMENT OF PURE & APPLIED SCIENCES**  
**UNIVERSITY EXAMINATION FOR THE BACHELOR OF**  
**TECHNOLOGY IN APPLIED CHEMISTRY**  
**(BTAC 14S & BTAC 15S2)**  
**ACH 4201 : CHEMICAL KINETICS AND REACTION DYNAMICS**  
**END OF SEMESTER EXAMINATION**

**SERIES:** APRIL 2016

**TIME:** 2 HOURS

**DATE:** Pick Date Apr 2016

**Instructions to Candidates**

You should have the following for this examination

*-Answer Booklet, examination pass and student ID*

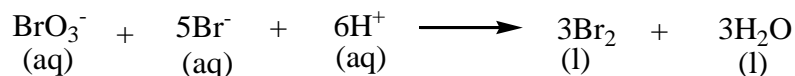
This paper consists of **FIVE** questions. Attempt question ONE (Compulsory) and any other TWO questions.

**Do not write on the question paper.**

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**QUESTION ONE**

- a) The reaction between bromate ions and bromide ions in acidic aqueous solution is given by the equation



The following data was obtained at 25°C.

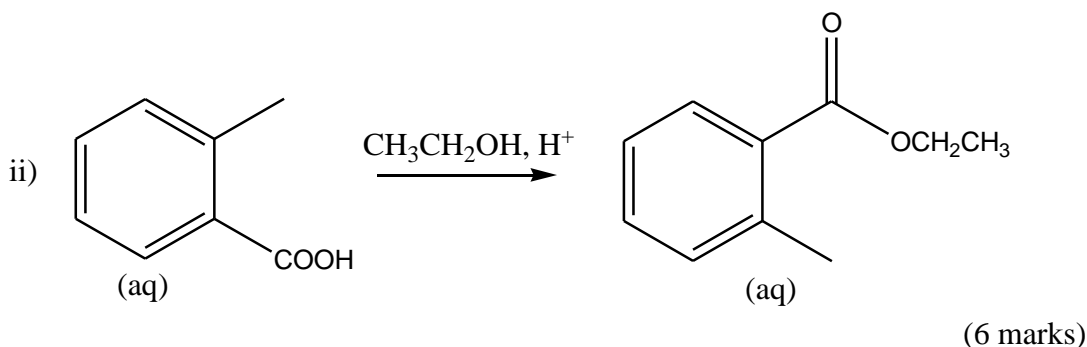
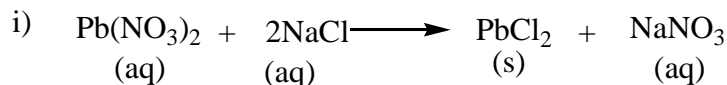




- c) Explain how each of the following affects rate of enzyme catalyzed reactions
- Coenzymes (2 marks)
  - Competitive inhibitors (2 marks)
  - Cofactors (2 marks)
  - Temperature (2 marks)

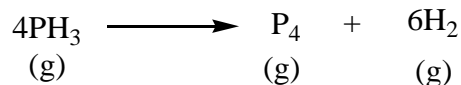
### QUESTION THREE

- a) Differentiate between each of the following:
- Positive and negative catalysis (3 marks)
  - Homogeneous and heterogeneous catalyst (3 marks)
- b) The second order rate constant for the decomposition of nitrogen dioxide to nitrogen monoxide and oxygen at 300°C is 0.54L/mol.s. Calculate the
- Time for an initial nitrogen dioxide concentration of 0.20M to decrease to one-tenth of its value (6 marks)
  - Half-life of the reaction from an initial nitrogen dioxide concentration of 0.20M (2 marks)
- c) Describe any suitable technique that can be used to measure the rate of each of the following reactions.



### QUESTION FOUR

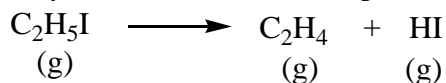
- a) Consider the reaction



Suppose that, at a particular moment during the reaction, molecular hydrogen is being formed at the rate of 0.078M/s.

- At what rate is P<sub>4</sub> being formed? (3 marks)
- At what rate is PH<sub>3</sub> reacting? (3 marks)

- b) Ethyl iodide (C<sub>2</sub>H<sub>5</sub>I) decomposes at a certain temperature in the gas phase as follows



The following data was collected at this temperature.

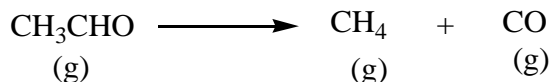
Time (min)	[C <sub>2</sub> H <sub>5</sub> I] (mol/dm <sup>3</sup> )
0	0.36
15	0.30
30	0.25
48	0.19
75	0.13

Determine the:

- Rate law (9 marks)
- Rate constant (2 marks)
- Half-life of the reaction (3 marks)

### QUESTION FIVE

- a) The rate constants for the decomposition of acetaldehyde

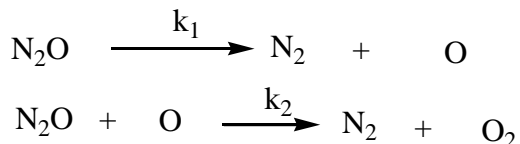


were measured at five different temperatures. The data is shown in the table below:

k (1/M <sup>1/2</sup> .s)	T (°C)
0.011	427
0.035	457
0.105	487
0.343	517
0.789	537

From this data assuming constant temperature, calculate the:

- Activation energy in kJ/mol (Given R=8.314J/K.mol). (11 marks)
  - Frequency factor (3 mark)
- b) The gas-phase decomposition of nitrous oxide (N<sub>2</sub>O) is believed to occur via two elementary steps.



Experimentally the rate law is found to be rate = k[N<sub>2</sub>O].

- Write the equation for the overall reaction (2 marks)

- ii. Identify the intermediates (1 mark)
- iii. What can you say about the relative rates of steps 1 and 2? (3 marks)