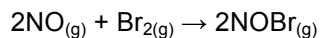


AP QUIZ 04C: Rate Laws and Mechanisms

Name: _____

Question 1 (BASED upon 2013 International Exam, question 3)



Tabulated below are kinetic data from experiments that investigate the reaction shown above.

Expt.	Initial [NO] in M	Initial [Br ₂] in M	Initial rate of consumption of Br ₂ in Ms ⁻¹
1	0.010	0.020	1.20
2	0.040	0.020	19.2
3	0.010	0.060	3.60

(a) Using the data in the table, determine the order of the reaction with respect to each of the following reactants. *In each case, justify your answer.* (2)

(i) Br₂

(ii) NO

(b) Write the rate equation (rate law) for the reaction. (1)

Question 1 (BASED upon 2013 International Exam, question 3) continued.

(c) Determine the value of the rate constant, k , for the reaction. Include units with your answer. (2)

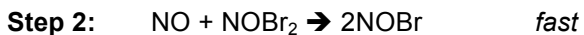
(d) Calculate the rate of consumption of NO in Expt. 2. (1)

(e) At a later time (after the initial concentration was recorded) during Expt. 2, the concentration of $\text{Br}_{2(g)}$ is determined to be 0.016 M.

(i) Determine the concentration of $\text{NO}_{(g)}$ at that time. (1)

(ii) Calculate the rate of consumption of $\text{Br}_{2(g)}$ at that time. (1)

A proposed, two-step mechanism for the reaction is shown below.



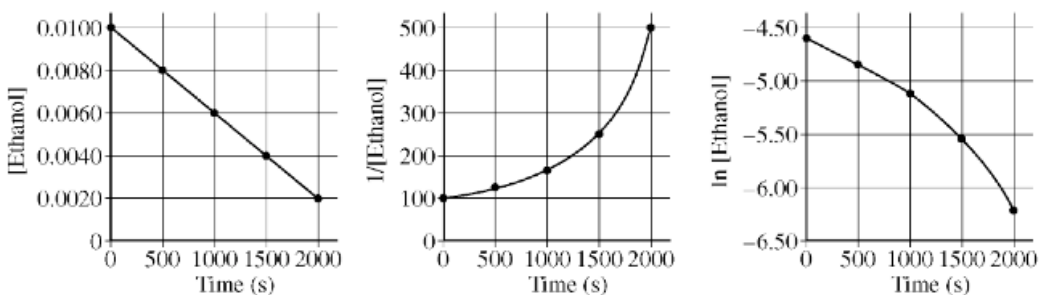
(f) Is the proposed mechanism consistent with the rate law determined in part (b)? Justify your answer. (2)

Question 2 (2011, 6(c))

A sample of ethanol gas and a copper catalyst are placed in a rigid, empty 1.0 L flask. The temperature of the flask is held constant, and the initial concentration of the ethanol gas is 0.0100 M. The ethanol begins to decompose according to the chemical reaction represented below.



The concentration of ethanol gas over time is used to create the three graphs below.



(c) Given that the reaction order is zero or one or two, use the information in the graphs to respond to the following.

(i) Determine the order of the reaction with respect to ethanol. Justify your answer. (1)

(ii) Write the rate law for the reaction. (1)

(iii) Determine the rate constant for the reaction, including units. (2)