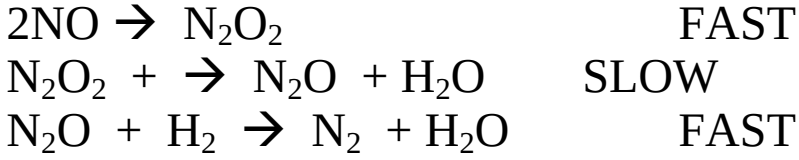
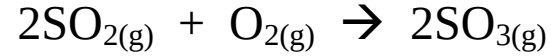
SCH 4UI Rates Assignment

1) An exothermic reaction has the following mechanism in the gas phase:



a) What is the overall equation for this reaction?
b) Sketch a potential energy diagram for this mechanism, identifying the reaction intermediates. Explain your diagram.
c) Write the rate law expression for the overall reaction.

2) Two gaseous reactants, sulfur dioxide and oxygen, react to form sulfur trioxide according to the following reaction.



Assume that a 1.0 litre flask has been filled with equal numbers of moles of the two reactant gases. The reaction represents a one step reaction.

a) Write the rate expression for the forward reaction.
b) By what factor would the rate change if the partial pressure of the sulfur dioxide gas were tripled?
c) How would a change in the temperature of the reactants affect the rate of the reaction? (Explain in terms of collision theory.)

3) The following data were obtained for the single step reaction of 2-bromo-2-methylpropane with hydroxide ion at 55'C.

Initial Concentrations (mol/L)		Initial rate (mol/Ls)
$[(CH_3)_3CBr]$	$[OH^-]$	
0.10	0.10	$1.0*10^{-3}$
0.20	0.10	$2.0*10^{-3}$
0.30	0.10	$3.0*10^{-3}$
0.10	0.20	$1.0*10^{-3}$
0.10	0.30	$1.0*10^{-3}$

a) Write the rate law for this reaction.
b) What is the value of the rate constant at this temperature? (include correct units)

4) In an experiment to study the rate of a reaction, 6.5g of metallic zinc was reacted with varying concentration of hydrochloric acid solutions. The gas generated was collected in a graduated cylinder by the downward displacement of water, and times were recorded as the gas volume reached 10mL, 20mL, 30mL, 40mL and 50mL. The data is shown.

Concentration of HCl (mol/L)	Time for indicated volume of gas to be collected (s)				
	10mL	20mL	30mL	40mL	50mL
0.78	14	24	33	42	51
0.60	18	34	49	65	81
0.40	40	75	116	155	195

4a) Write a balanced chemical equation for the reaction.

b) What information about the rate of this reaction may be determined from the balanced equation?

c) Plot a graph of the data for each concentration of acid, showing volume of gas vs. time. For each graph calculate the rate of the reaction, showing your method, and include the correct units with your values. Use one set of axes for all three graphs.

d) Plot a graph to determine the connection between the rate of this reaction and the concentration of acid used. (plot rate vs. [HCl], $[HCl]^2$, $[HCl]^3$)

e) State the rate law expression for this reaction, as indicated by the data. State clearly what information was used to find the expression.

f) What factors must be kept constant in this reaction to be sure that the reaction rate is affected only by variations in the acid concentration?

5) Using the 3 microscopic factors affecting rate (collision theory) explain how the five macroscopic factors affect rate.