CH302 Unit7 Day 8 Activity
Unit 7 Readiness Assessment Activity
Spring 2013
VandenBout/LaBrake

Name:____________________________

UT EID:___________________________

Please work in small groups and be prepared to answer via clicker.

Discussion Point I: Thinking about nuclear change… what is the macroscopic observable, and what is the microscopic model?

1. Pt-200 undergoes beta emission. Please write the balanced nuclear decay equation.

2. Write the rate law and the integrated rate law for this decay.

3. The half-life of Pt-200 is 12 hours. Assuming you start with 2.0 Ci, how many Ci will be left after 2 hours?

4. Assume you have acquired 0.12 g of Pt-200. Assume that each time a certain mass of Pt-200 undergoes decay, 0.1 % of the mass is converted to energy. How much energy in units of kJ will be given off over one 24-hour period?

Discussion Point II: Thinking about the kinetics of chemical change, what is the macroscopic observable and what is the microscopic model?

The following questions will refer to the following gas phase reaction:

$$2NO + O_2 \rightarrow 2NO_2$$

5. Can you determine the rate law by inspecting this reaction? Why or Why not?

6. Predict the rate law based on the following data:

Initial μM NO	Initial μM O_2	Initial Rate $\mu M{*}s^{-1}$
100	100	2
300	100	18
250	250	31.3

7. Calculate the value of the rate constant for the predicted rate law.

8. Determine the rate laws for each of the proposed mechanisms below.

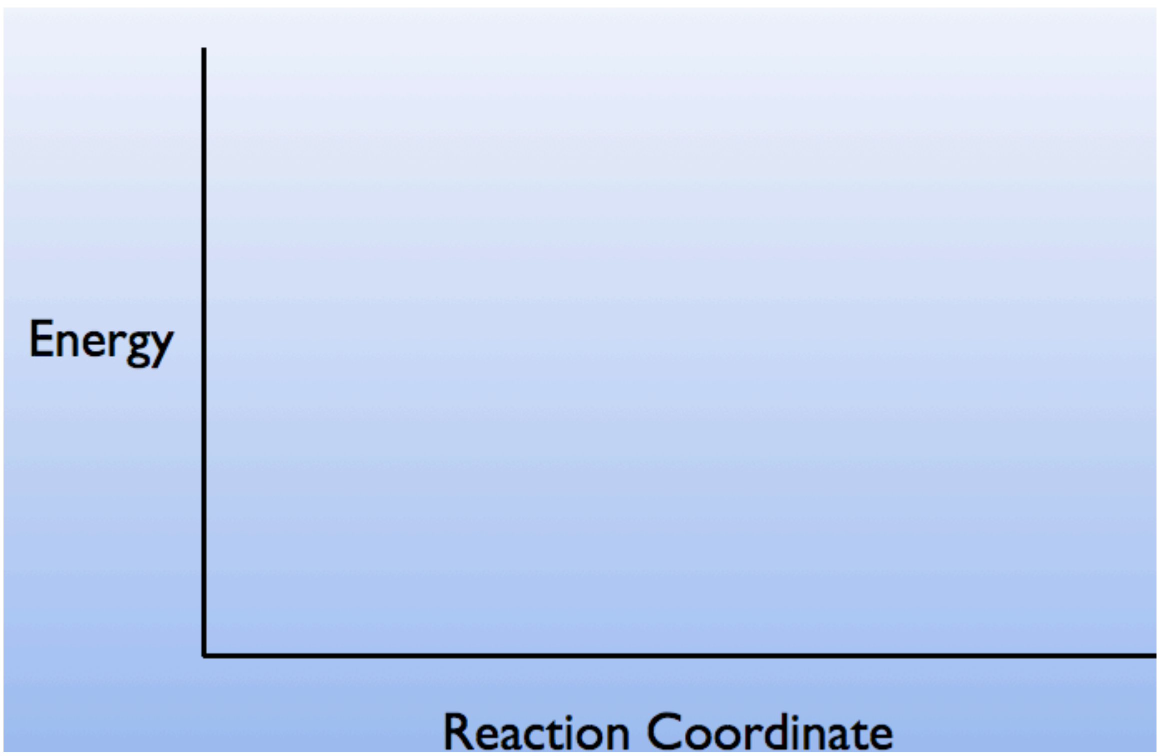
   a) $NO + NO \rightarrow N_2O_2$ (slow)
      $N_2O_2 + O_2 \rightarrow 2NO_2$ (fast)

   b) $NO + O_2 \rightarrow NO_3$ (slow)
      $NO_3 + NO \rightarrow 2NO_2$ (fast)

   c) $NO + O_2 \leftrightarrow NO_3$ (fast, eq)
      $NO_3 + NO \rightarrow 2NO_2$ (slow)

9. Which of the proposed mechanisms are possible given the experimentally determined rate law?

10. Given that the reaction is exothermic, draw a viable reaction coordinate diagram based on the experimentally supported reaction mechanism.



11. When Pt metal is used as a catalyst for this reaction, the mechanism changes and the reaction is much faster. With the catalyst the activation energy is found to be 80 kJ mol^{-1}. How much would you have to raise the temperature to get the reaction to run 100 times faster than it does at room temperature with the catalyst?