Name:_____ Class:_____

AP Chemistry Chapter 12 Test Kinetics

Multiple Choice (4 pts each)

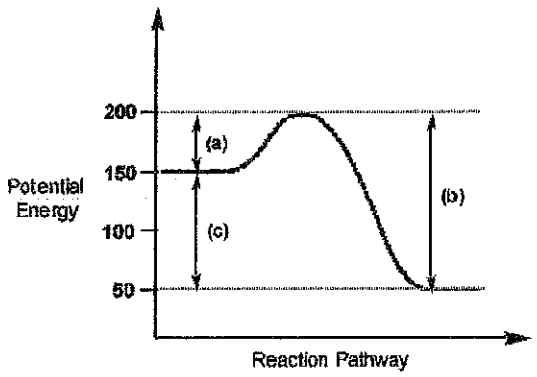
1. The initial concentration of reactant in a first-order reaction is 0.27 M. The rate constant for the reaction is 0.75 s-1. What is the concentration of reactant after 1.5s
   a) 3.8 M
   b) 1.7 M
   c) 8.7 E -2 M
   d) 2.0 E -2 M
   e) 0.135 M

2. One difference between first- and second- order reactions is that
   a) The half-life of a first-order reaction does not depend on $[A]_0$, whereas the half-life of a second-order reaction does depend on $[A]_0$.
   b) The rate of a first-order reaction does not depend on reactant concentrations, whereas the rate of a second-order reaction does depend on reactant concentrations.
   c) The rate of a first-order reaction depends on reactant concentrations, whereas the rate of a second-order reaction does not depend on reactant concentrations.
   d) A first-order reaction can be catalyzed, whereas a second-order reaction cannot be catalyzed.
   e) The half-life of a first-order reaction depends on $[A]_0$, whereas the half-life of a second-order reaction does not depend on $[A]_0$.

3. The rate constant *k* for ~~the reaction shown below~~ is 2.6E-8 L/mols when the reaction proceeds at 300 K. The activation energy is 98000J/mol. If the temperature changed to 310 K the rate constant *k* would change. The ratio of *k* at 310 K to *k* at 300 K is closest to what whole number?
   a. 2 b. 4 c. 6 d. 8 e. 5

4. Which of the following statements is typically true for a catalyst?
   a. The concentration of the catalyst will go down as a reaction proceeds.
   b. The catalyst provides a new pathway in the reaction mechanism.
   c. The catalyst speeds up the reaction.
   d. a and b
   e. b and c

Use the following diagram for questions 5 and 6.



5. Why is the reaction considered to be exothermic?
   a. Because energy difference B is greater than energy difference is C
   b. Because energy difference B is greater than energy difference A
   c. Because energy difference A is greater than energy difference C
   d. Because energy difference B is greater than energy difference C plus energy difference A
   e. Because energy difference A and energy difference C are about equal

6. If the reaction were reversible, would the forward or the reverse reaction have a higher activation energy?
   a. The diagram shows no indication of any activation energy.
   b. The forward and reverse activation energies are equal.
   c. The forward activation energy
   d. The reverse activation energy
   e. None of these

7. The decomposition of ozone may occur through the two-step mechanism shown:
   step 1. $O_3 \rightarrow O_2 + O$
   step 2. $O_3 + O \rightarrow 2O_2$
   The oxygen atom is considered to be
   a. a reactant
   b. a product
   c. a catalyst
   d. an intermediate
   e. an activated complex

8. A reaction is found to be third order in A. Increasing the concentration of A by factor of 3 will cause the reaction rate to
   a. Remain constant
   b. Increase by a factor of 27
   c. Increase by a factor of 9
   d. Triple
   e. Decrease by a factor of the cube root of 3

9. The rate law for the reaction is rate=k[A][B]^2, which of the following statements is **NOT** true.

a) The reaction is first order in A
b) The reaction is second order in B
c) The reaction is second order over all
d) K is the reaction rate constant
e) If B is doubled, the reaction rate will increase by a factor of 4

10. Assume a reaction occurs by the mechanism given below. What is the rate law for the reaction?

$A + B \leftrightarrow C$ fast

$C \rightarrow D$ slow

a) Rate = k[A][B][C]
b) Rate = k[A]^2
c) Rate = k[A][B]
d) Rate = k[A][B]/[D]
e) Rate = k[A]

11. The reaction $3O_2 \rightarrow 2O_3$ is proceeding with a rate of disappearance of O_2 equal to 0.60 mol/L·s. What is the rate of appearance of O_3, in mol/L·s?

a) 0.60
b) 0.40
c) 0.10
d) 0.90
e) 1.20

Essay

12. For a certain second-order reaction, $k = 0.452\ M^{-1}s^{-1}$. If the initial concentration of a reactant is 2.43 M, what is the half-life of the reaction? (4 pts)

13.

$$A(g) + B(g) \rightarrow C(g) + D(g)$$

For the gas phase reaction above, the following experimental data were obtained.

Experiment	Initial [A] M	Initial [B] M	Initial Reaction Rate M/s
1	0.033	0.034	6.67×10^{-4}
2	0.034	0.137	1.08×10^{-2}
3	0.136	0.136	1.07×10^{-2}
4	0.20	0.233	?

a. Determine the order of the reaction with respect to A and justify your answer (3pts).

b. Determine the order of the reaction with respect to B and justify your answer (3pts).

c. Write the rate law for the reaction (3pts).

d. Determine the value of the rate constant, k, for the reaction. Include units in your an answer (3pts).

e. Calculate the initial reaction rate for experiment 4.Include units in your answer (3pts).

f. The following mechanism has been proposed for the reaction.

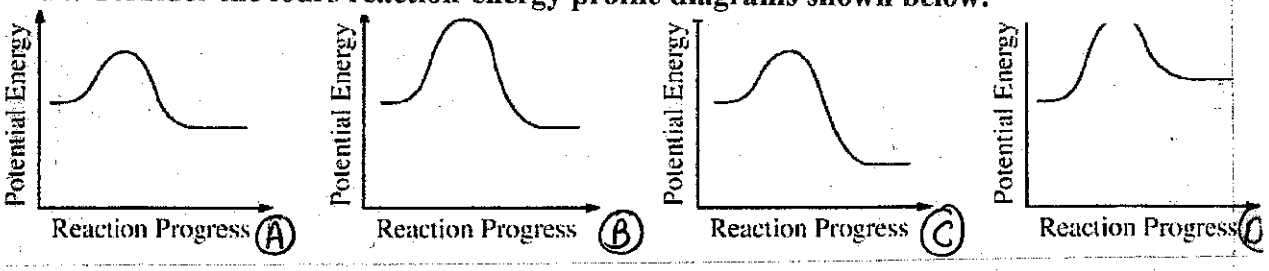
Step 1: $B + B \rightarrow E + D$ **(slow)**

Step 2: $E + A \rightarrow B + C$ **(fast)**

Provide <u>two</u> reasons why the mechanism is acceptable (4 pts).

g. In the mechanism in part (f), is species E a catalyst, or is it an intermediate? Justify your answer (3pts).

14. Consider the fours reaction-energy profile diagrams shown below.



a. Identify the diagrams that could represent a catalyzed and uncatalyzed reaction pathway for the same reaction. Indicate which of the of diagrams is the catalyzed reaction and which is the uncatalyzed reaction. (4 pts)

b. Indicate whether you agree of disagree with the statement below. Support your answer with a short explanation. (4 pts)

"Adding a catalyst to a reaction mixture adds energy that causes the reaction to proceed more quickly."