CHAPTER IV

(Chemical Kinetics)

Self Assessment A (Chemistry by Rymond Chang)

1. The units of "reaction rate" are

A. $L\,mol^{-1}\,s^{-1}$
B. $L^2\,mol^{-2}\,s^{-1}$
C. s^{-1}
D. s^{-2}
E. $mol\,L^{-1}\,s^{-1}$

2. For the following reaction, $\Delta P(C_6H_{14})/\Delta t$ was found to be -6.2×10^{-3} atm/s.

$$C_6H_{14}(g) \rightarrow C_6H_6(g) + 4H_2(g)$$

Determine $\Delta P(H_2)/\Delta t$ for this reaction at the same time.

A. 6.2×10^{-3} atm/s
B. 1.6×10^{-3} atm/s
C. 2.5×10^{-2} atm/s
D. -1.6×10^{-3} atm/s
E. -2.5×10^{-2} atm/s

3. For the hypothetical reaction $A + 3B \rightarrow 2C$, the rate of appearance of C given by $(\Delta[C]/\Delta t)$ may also be expressed as

A. $\Delta[C]/\Delta t = \Delta[A]/\Delta t$

B. $\Delta[C]/\Delta t = -(3/2)\,\Delta[B]/\Delta t$

C. $\Delta[C]/\Delta t = -(2/3)\,\Delta[B]/\Delta t$

D. $\Delta[C]/\Delta t = -(1/2)\,\Delta[A]/\Delta t$

4. For the overall chemical reaction shown below, which one of the following statements can be rightly assumed?

$$2H_2S(g) + O_2(g) \rightarrow 2S(s) + 2H_2O(l)$$

A. The reaction is third-order overall.
B. The reaction is second-order overall.
C. The rate law is, rate $= k[H_2S]^2[O_2]$.

D. The rate law is, rate = $k[H_2S][O_2]$.
E. The rate law cannot be determined from the information given.

5. The reaction A + 2B → products has the rate law, rate = $k[A][B]^3$. If the concentration of B is doubled while that of A is unchanged, by what factor will the rate of reaction increase?

A. 2 B. 4 C. 6 D. 8 E. 9

6. Appropriate units for a first-order rate constant are

A. M/s B. 1/M·s C. 1/s D. $1/M^2 \cdot s$

Answer: C
Difficulty: E

7. It takes 42.0 min for the concentration of a reactant in a first-order reaction to drop from 0.45 M to 0.32 M at 25°C. How long will it take for the reaction to be 90% complete?

A. 13.0 min B. 86.0 min C. 137 min D. 222 min E. 284 min

Answer: E
Difficulty: M

8. Nitric oxide gas (NO) reacts with chlorine gas according to the equation $NO + \frac{1}{2}Cl_2 \rightarrow NOCl$.

The following initial rates of reaction have been measured for the given reagent concentrations.

Expt. #	Rate (M/hr)	NO (M)	Cl_2 (M)
1	1.19	0.50	0.50
2	4.79	1.00	0.50
3	9.59	1.00	1.00

Which of the following is the rate law (rate equation) for this reaction?

A. rate = $k[NO]$
B. rate = $k[NO][Cl_2]^{1/2}$
C. rate = $k[NO][Cl_2]$
D. rate = $k[NO]^2[Cl_2]$
E. rate = $k[NO]^2[Cl_2]^2$

9. The following initial rate data apply to the reaction

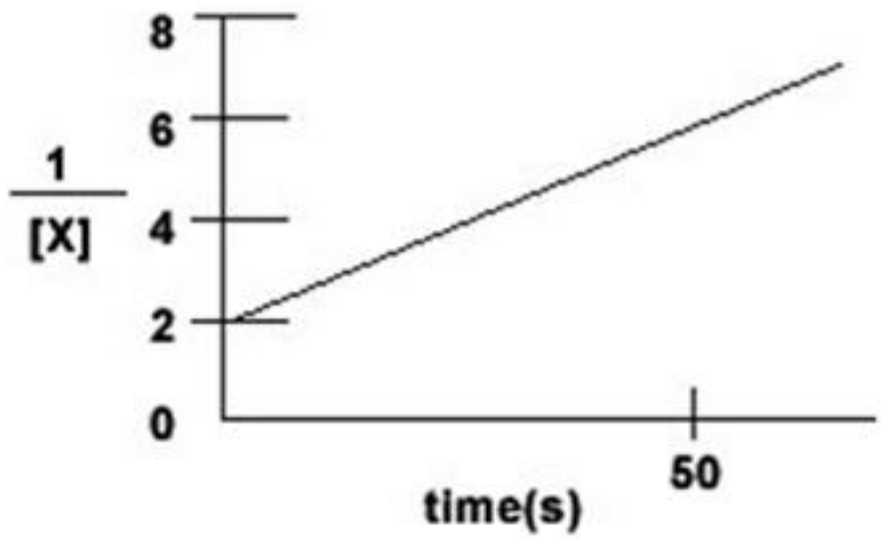
$F_2(g) + 2Cl_2O(g) \rightarrow 2FClO_2(g) + Cl_2(g)$.

Expt. #	$[F_2]$ (M)	$[Cl_2O]$ (M)	Initial rate (M/s)
1	0.05	0.010	5.0×10^{-4}
2	0.05	0.040	2.0×10^{-3}
3	0.10	0.010	1.0×10^{-3}

Which of the following is the rate law (rate equation) for this reaction?

A. rate $= k[F_2]^2[Cl_2O]^4$
B. rate $= k[F_2]^2[Cl_2O]$
C. rate $= k[F_2][Cl_2O]$
D. rate $= k[F_2][Cl_2O]^2$
E. rate $= k[F_2]^2[Cl_2O]^2$

10. For the reaction $X + Y \rightarrow Z$, the reaction rate is found to depend only upon the concentration of X. A plot of 1/X verses time gives a straight line.



What is the rate law for this reaction?

A. rate $= k[X]$ B. rate $= k[X]^2$ C. rate $= k[X][Y]$ D. rate $= k[X]^2[Y]$

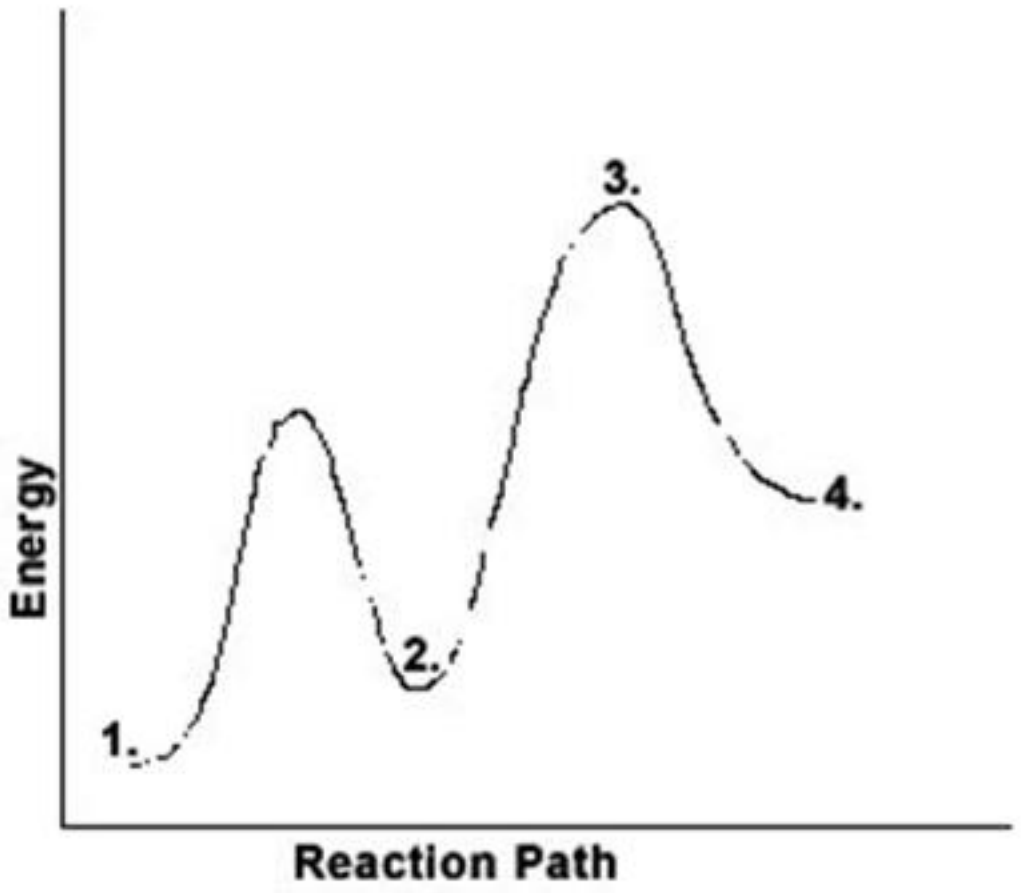
11. Which of the following statements is *false*?

A. A catalyst increases the rate of the forward reaction, but does not alter the reverse rate.
B. A catalyst alters the mechanism of reaction.
C. A catalyst alters the activation energy.
D. A catalyst may be altered in the reaction, but is always regenerated.
E. A catalyst increases the rate of reaction, but is not consumed.

12. Complete the following statement: A catalyst

A. increases the activation energy.
B. alters the reaction mechanism.
C. increases the average kinetic energy of the reactants.
D. increases the concentration of reactants.
E. increases the collision frequency of reactant molecules.

13. With respect to the figure below, which choice correctly identifies all the numbered positions?



	1.	2.	3.	4.
A.	catalyst	intermediate	activated complex	product
B.	reactants	activated complex	intermediate	product
C.	reactants	activated complex	catalyst	product
D.	reactants	intermediate	activated complex	product
E.	reactants	intermediate	activated complex	catalyst

14. The activation energy of a certain uncatalyzed reaction is 64 kJ/mol. In the presence of a catalyst, the E_a is 55 kJ/mol. How many times faster is the catalyzed than the uncatalyzed reaction at 400°C? Assume that the frequency factor remains the same.

A. 5.0 times B. 1.16 times C. 15 times D. 2.0 times E. 0.2 times