Name_____ AP Chem ___/___/___

Chapter 12 HW – Kinetics

1. _____Iodide ion is oxidized by acidified dichromate ions as shown in this equation.

$Cr_2O_7^{2-}(aq) + 9I^-(aq) + 14H^+(aq) \rightarrow 2Cr^{3+}(aq) + 3I_3^-(aq) + 7H_2O(l)$

These data were obtained when the reaction was studied at a constant pH.

Experiment	$[Cr_2O_7^{2-}]$, M	$[I^-]$, M	Rate, $M \cdot s^{-1}$
1	0.0040	0.010	0.00050
2	0.0080	0.010	0.0010
3	0.0120	0.020	0.0060

What is the order of the reaction with respect to $Cr_2O_7^{2-}(aq)$ and $I^-(aq)$?

(A) first order with respect to both $Cr_2O_7^{2-}$ and I^-

(B) second order with respect to both $Cr_2O_7^{2-}$ and I^-

(C) second order with respect to $Cr_2O_7^{2-}$ and first order with respect to I^-

(D) first order with respect to $Cr_2O_7^{2-}$ and second order with respect to I^-

2. _____The reaction A →B is first order in A. Which plot will be linear?

(A) [A] vs. time (B) ln [A] vs. time (C) $1/[A]^2$ vs. time (D) 1/[A] vs. time

3. _____One of the steps in the manufacture of nitric acid is the oxidation of ammonia shown in this equation.

$4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g)$

If gaseous water appears at a rate of 0.025 $mol \cdot min^{-1}$, at what rate does ammonia disappear?

(A) 0.0040 $mol \cdot min^{-1}$ (B) 0.017 $mol \cdot min^{-1}$ (C) 0.038 $mol \cdot min^{-1}$ (D) 0.150 $mol \cdot min^{-1}$

4. _____This reaction is first order with respect to N_2O_5.

$2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$

If the half-life for this reaction is 19.0 minutes, what is the rate constant, *k*?

(A) 0.0158 min^{-1} (B) 0.0263 min^{-1} (C) 0.0365 min^{-1} (D) 0.0526 min^{-1}

5. _____For the reaction $2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(l)$, the rate of disappearance of $C_2H_6(g)$

(A) equals the rate of disappearance of $O_2(g)$. (B) is seven times the rate of disappearance of $O_2(g)$.

(C) is twice the rate of appearance of $CO_2(g)$. (D) is one-third the rate of appearance of $H_2O(l)$.

6. _____The rate law for a certain reaction is found to be: rate = k [A] $[B]^2$

How will the rate of this reaction compare if the concentration of A is doubled and the concentration of B is halved? The rate will:

(A) remain the same. (B) be double the original rate.

(C) be triple the original rate. (D) be one-half the original rate.

7. _____Use the experimental data in this table to determine the rate law for the reaction of hydrogen iodide, HI, with ethyl iodide, C_2H_5I.

[HI], M	**$[C_2H_5I]$, M**	**Rate $mol \cdot L^{-1} \cdot s^{-1}$**
0.010	0.010	1.2×10^{-5}
0.010	0.020	2.4×10^{-5}
0.020	0.030	7.2×10^{-5}

(A) rate = k [HI] (B) rate = k [HI] $[C_2H_5I]$

(C) rate = k $[HI]^2[C_2H_5I]$ (D) rate = k $[HI]^2$ $[C_2H_5I]^3$

8. _____ Consider this reaction: $8A(g) + 5B(g) \rightarrow 8C(g) + 6D(g)$
If [C] is increasing at the rate of 4.0 mol $L^{-1}s^{-1}$, at what rate is [B] changing?
(A) -0.40 mol $L^{-1}s^{-1}$ (B) -2.5 mol $L^{-1}s^{-1}$
(C) -4.0 mol $L^{-1}s^{-1}$ (D) -6.4 mol $L^{-1}s^{-1}$
(E) None of these choices is correct, since its rate of change must be positive.

9. _____ The rate constant for a reaction is 4.65 L $mol^{-1}s^{-1}$. What is the overall order of the reaction?
(A) zero (B) first (C) second (D) third
(E) More information is needed to determine the overall order.

10. _____ Which of the following sets of units could be appropriate for a zero-order rate constant?
(A) s^{-1} (B) L mol^{-1} s^{-1} (C) L^2 mol^{-2} s^{-1} (D) L^3 mol^{-3} s^{-1} (E) mol L^{-1} s^{-1}

11. _____ Ammonium cyanate (NH_4CNO) reacts to form urea (NH_2CONH_2). At 65°C, the rate constant, *k*, is 3.60 L $mol^{-1}s^{-1}$. What is the rate law for this reaction?
(A) Rate = 3.60 L $mol^{-1}s^{-1}[NH_4CNO]$ (B) Rate = 3.60 L $mol^{-1}s^{-1}[NH_4CNO]^2$
(C) Rate = 0.28 mol $L^{-1}s^{-1}[NH_4CNO]$ (D) Rate = 0.28 mol $L^{-1}s^{-1}[NH_4CNO]^2$
(E) Rate = 3.60 L $mol^{-1}s^{-1}[NH_2CONH_2]^{-1}$

12. _____ A study of the decomposition reaction $3RS_2 \rightarrow 3R + 6S$ yields the initial rate data below. What is the rate constant for the reaction?

$[RS_2]$(mol L^{-1})	Rate (mol/(L·s))
0.150	0.0394
0.250	0.109
0.350	0.214
0.500	0.438

(A) 0.0103 L $mol^{-1}s^{-1}$ (B) 0.263 L $mol^{-1}s^{-1}$
(C) 0.571 L $mol^{-1}s^{-1}$ (D) 1.17 L $mol^{-1}s^{-1}$
(E) 1.75 L $mol^{-1}s^{-1}$

13. _____ A reaction is first-order with respect to the reactant R. Which of the following plots will produce a straight line?
(A) [R] vs. 1/time (B) 1/[R] vs. time
(C) $[R]^2$ vs. time (D) $1/[R]^2$ vs. time
(E) ln[R] vs. time

14. _____ The reaction $X \rightarrow Y$ is first-order overall and first-order with respect to the reactant X. The result of doubling the initial concentration of X will be to
(A) shorten the half-life of the reaction. (B) increase the rate constant of the reaction.
(C) decrease the rate constant of the reaction. (D) shorten the time taken to reach equilibrium.
(E) double the initial rate.

15. _____ Cyclopropane is converted to propene in a first-order process. The rate constant is 5.4×10^{-2} hr^{-1}. If the initial concentration of cyclopropane is 0.150 *M*, what will its concentration be after 22.0 hours?
(A) 0.0457 *M* (B) 0.105 *M*
(C) 0.127 *M* (D) 0.492 *M*
(E) None of these choices is correct.

16. _____ The rate law for the reaction $3A \rightarrow 2B$ is rate = *k*[A] with a rate constant of 0.0447 hr^{-1}. What is the half-life of the reaction?
(A) 0.0224 hr (B) 0.0645 hr
(C) 15.5 hr (D) 22.4 hr
(E) 44.7 hr

13. The rate constant for the reaction $3A \rightarrow 4B$ is 6.00×10^{-3} L $mol^{-1}min^{-1}$. How long will it take the concentration of A to drop from 0.75 *M* to 0.25 *M*?
A. 2.2×10^{-3} min
B. 5.5×10^{-3} min
C. 180 min
D. 440 min
E. 5.0×10^{2} min

14. A reaction has an activation energy of 195.0 kJ/mol. When the temperature is increased from 200.°C to 220.°C, the rate constant will increase by a factor of:
A. 1.1
B. 4.3×10^{4}
C. 3.2
D. 7.5
E. None of these choices is correct.

15. What is the molecularity of the following elementary reaction?
$NH_2Cl(aq) + OH^-(aq) \rightarrow NHCl^-(aq) + H_2O(l)$
A. unimolecular
B. bimolecular
C. termolecular
D. tetramolecular
E. Need to know the reaction order before molecularity can be determined.