Name _____

AP Chemistry: Kinetics
Multiple Choice

25. Questions 25-26

$H_3AsO_4 + 3I^- + 2\ H_3O^+ \rightarrow H_3AsO_3 + I_3^- + H_2O$

The oxidation of iodide ions by arsenic acid in acidic aqueous solution occurs according to the stoichiometry shown above. The experimental rate law of the reaction is: Rate = k $[H_3AsO_4]$ $[I^-]$ $[H_3O^+]$

25. What is the order of the reaction with respect to I^-?

(A) 1 (B) 2 (C) 3 (D) 5 (E) 6

26. According to the rate law for the reaction, an increase in the concentration of hydronium ion has what effect on this reaction?

(A) The rate of reaction increases. (B) The rate of reaction decreases.

(C) The value of the equilibrium constant increases. (D) The value of the equilibrium constant decreases.

(E) Neither the rate nor the value of the equilibrium constant is changed.

28. $2\ A_{(g)} + B_{(g)} \rightleftarrows 2\ C_{(g)}$

When the concentration of substance B in the reaction above is doubled, all other factors being held constant, it is found that the rate of the reaction remains unchanged. The most probable explanation for this observation is that…

(A) the order of the reaction with respect to substance B is 1.

(B) substance B is not involved in any of the steps in the mechanism of the reaction.

(C) substance B is not involved in the rate-determining step of the mechanism, but is involved in subsequent steps.

(D) substance B is probably a catalyst, and as such, its effect on the rate of the reaction does not depend on its concentration.

(E) the reactant with the smallest coefficient in the balanced equation generally has little or no effect on the rate of the reaction.

Step 1) $N_2H_2O_2 \rightleftarrows N_2HO_2^- + H^+$	fast equilibrium
Step 2) $N_2HO_2^- \rightarrow N_2O + OH^-$	(slow)
Step 3) $H^+ + OH^- \rightarrow H_2O$	(fast)

82. Nitramide, $N_2H_2O_2$, decomposes slowly in aqueous solution. This decomposition is believed to occur according to the reaction mechanism above. The rate law for the decomposition of nitramide that is consistent with this mechanism is given by which of the following?

(A) Rate = k $[N_2H_2O_2]$ (B) Rate = k $[N_2H_2O_2]$ $[H^+]$ (C) Rate = (k $[N_2H_2O_2]$) / $[H^+]$

(D) Rate = (k $[N_2H_2O_2]$) / $[N_2HO_2^-]$ (E) Rate = k $[N_2H_2O_2]$ $[OH^-]$

57. rate = k[X]

For the reaction whose rate law is given above, a plot of which of the following is a straight line?

(A) [X] versus time (B) ln [X] versus time (C) 1/[X] versus time
(D) [X] versus 1/time (E) ln [X] versus 1/time

58. $(CH_3)_3CCl_{(aq)} + OH^- \rightarrow (CH_3)_3COH_{(aq)} + Cl^-$

For the reaction represented above, the experimental rate law is given as follows:

Rate = k $[(CH_3)_3CCl]$

If some solid sodium solid hydroxide is added to a solution that is 0.010-molar in $(CH_3)_3CCl$ and 0.10-molar in NaOH, which of the following is true? (Assume the temperature and volume remain constant.)

(A) Both the reaction rate and k increase. (B) Both the reaction rate and k decrease.
(C) Both the reaction rate and k remain the same. (D) The reaction rate increases but k remains the same.
(E) The reaction rate decreases but k remains the same.

17. Relatively slow rates of chemical reaction are associated with which of the following?

(A) The presence of a catalyst (B) High temperature (C) High concentration of reactants
(D) Strong bonds in reactant molecules (E) Low activation energy

Step 1: $Ce^{4+} + Mn^{2+} \rightarrow Ce^{3+} + Mn^{3+}$

Step 2: $Ce^{4+} + Mn^{3+} \rightarrow Ce^{3+} + Mn^{4+}$

Step 3: $Mn^{4+} + Tl^{+} \rightarrow Tl^{3+} + Mn^{2+}$

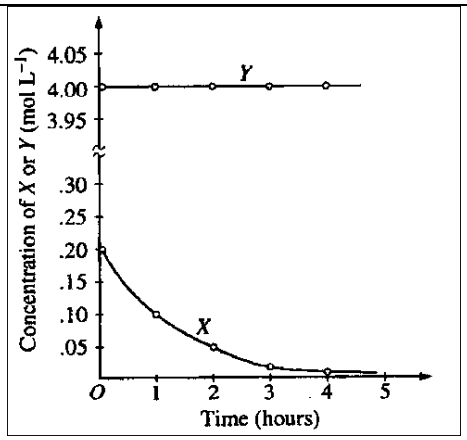
23. The proposed steps for a catalyzed reaction between Ce^{4+} and Tl^{+} are represented above. The products of the overall catalyzed reaction are…

(A) Ce^{4+} and Tl^{+}
(B) Ce^{3+} and Tl^{3+}
(C) Ce^{3+} and Mn^{3+}
(D) Ce^{3+} and Mn^{4+}
(E) Tl^{3+} and Mn^{2+}

49. The isomerization of cyclopropane to propylene is a first-order process with a half-life of 19 minutes at 500 °C. The time it takes for the partial pressure of cyclopropane to decrease from 1.0 atmosphere to 0.125 atmospheres at 500 °C is closest to…

(A) 38 minutes (B) 57 minutes (C) 76 minutes (D) 152 minutes (E) 190 minutes

63. The graph to the right shows the results of a study of the reaction of X with a large excess of Y to yield Z. The concentrations of X and Y were measured over a period of time. According to the results, which of the following can be concluded about the rate of law for the reaction under the conditions studied?



(A) It is zero order in [X]. (B) It is first order in [X].

(C) It is second order in [X]. (D) It is the first order in [Y].

(E) The overall order of the reaction is 2.

Experiment	Initial [NO] (mol L^{-1})	Initial [O_2] (mol L^{-1})	Initial Rate of Formation of NO_2 (mol L^{-1} s^{-1})
1	0.1	0.1	2.5×10^{-4}
2	0.2	0.1	5.0×10^{-4}
3	0.2	0.4	8.0×10^{-3}

36. The initial-rate data in the table above were obtained for the reaction represented below. What is the experimental rate law for the reaction?

(A) rate = k[NO] [O_2] (B) rate = k[NO] [O_2]^2 (C) rate = k[NO]^2 [O_2]

(D) rate = k[NO]^2 [O_2]^2 (E) rate = k[NO] / [O_2]

57. Rate = k[M][N]^2

The rate of a certain chemical reaction between substances M and N obeys the rate law above. The reaction is first studied with [M] and [N] each 1×10^{-3} molar. If a new experiment is conducted with [M] and [N] each 2×10^{-3} molar, the reaction rate will increase by a factor of …

(A) 2 (B) 4 (C) 6 (D) 8 (E) 16

27. $2\ NO(g) + O_2(g) \rightarrow 2\ NO_2(g)$

A possible mechanism for the overall reaction represented above is the following:

(1) $NO(g) + NO(g) \rightarrow N_2O_2(g)$ *slow*
(2) $N_2O_2(g) + O_2(g) \rightarrow 2\ NO_2(g)$ *fast*

Which of the following rate expressions agrees best with this possible mechanism?

(A) Rate = $k[NO]^2$

(B) Rate = $k\dfrac{[NO]}{[O_2]}$

(C) Rate = $\dfrac{k[NO]^2}{[O_2]}$

(D) Rate = $k[NO]^2[O_2]$

(E) Rate = $k[N_2O_2][O_2]$

47. Which of the following is a correct statement about reaction order?

(A) Reaction order can only be a whole number
(B) Reaction order can be determined only from the coefficients of the balanced equation for the reaction
(C) Reaction order can be determined only by experiment
(D) Reaction order increases with increasing temperature
(E) A second-order reaction must involve at least two different compounds as reactants

54. Which of the following must be true for a reaction for which the activation energy is the same for both the forward and the reverse reactions?

(A) A catalyst is present.
(B) The reaction order can be obtained directly from the balanced equation.
(C) The reaction order is zero.
(D) $\Delta H°$ for the reaction is zero.
(E) $\Delta S°$ for the reaction is zero.

55.

Time (days)	0	1	2	3	4	5	6	7	…	10	…	20
% Reactant Remaining	100	79	63	50	40	31	25	20	…	10	…	1

A reaction was observed for 20 days and the percentage of the reactant remaining after each day was recorded in the table above. Which of the following best describes the order and the half-life of the reaction?

	Reaction Order	Half-life(days)
(A)	First	3
(B)	First	10
(C)	Second	3
(D)	Second	6
(E)	Second	10