Exam

Name_____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) Consider the following reaction: 1) _____

$$3A \rightarrow 2B$$

The average rate of appearance of B is given by $\Delta[B]/\Delta t$. Comparing the rate of appearance of B and the rate of disappearance of A, we get $\Delta[B]/\Delta t$ = _____ × $(-\Delta[A]/\Delta t)$.

A) -2/3 B) +2/3 C) -3/2 D) +3/2 E) +1

2) Nitrogen dioxide decomposes to nitric oxide and oxygen via the reaction: 2) _____

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

In a particular experiment at 300°C, $[NO_2]$ drops from 0.0100 to 0.00650 M in 100 s. The rate of appearance of O_2 for this period is _____ M/s.

A) 3.5×10^{-5} B) 7.0×10^{-5} C) 3.5×10^{-3} D) 7.0×10^{-3} E) 1.8×10^{-5}

3) Which substance in the reaction below either appears or disappears the fastest? 3) _____

$$4NH_3 + 7O_2 \rightarrow 4NO_2 + 6H_2O$$

A) H_2O
B) O_2
C) NO_2
D) NH_3
E) The rates of appearance/disappearance are the same for all of these.

4) Consider the following reaction: 4) _____

$$A \rightarrow 2C$$

The average rate of appearance of C is given by $\Delta[C]/\Delta t$. Comparing the rate of appearance of C and the rate of disappearance of A, we get $\Delta[C]/\Delta t$ = _____ × $(\Delta[A]/\Delta t)$.

A) -1/2 B) -1 C) +1/2 D) +1 E) +2

A flask is charged with 0.124 mol of A *and allowed to react to form* B *according to the reaction* A(g) →B(g). *The following data are obtained for* [A] *as the reaction proceeds:*

Time (s)	1	10	20	30	40
Moles of A	0.124	0.110	0.088	0.073	0.054

5) The average rate of disappearance of A between 10 s and 20 s is _____ mol/s. 5) _____

A) 1.1×10^{-3}
B) 9.90×10^{-3}
C) 2.2×10^{-3}
D) 454
E) 4.4×10^{-3}

6) The average rate of disappearance of A between 20 s and 40 s is _____ mol/s. 6) _____

A) 1.4×10^{-3} B) 8.5×10^{-4} C) 1.7×10^{-3} D) 590 E) 7.1×10^{-3}

7) The average rate of appearance of B between 20 s and 30 s is _____ mol/s. 7) _____

A) $+5.0 \times 10^{-4}$
B) -1.5×10^{-3}
C) $+1.5 \times 10^{-3}$
D) -7.3×10^{-3}
E) $+7.3 \times 10^{-3}$

8) The average rate disappearance of A between 20 s and 30 s is _____ mol/s. 8) _____

A) 670
B) 5.0×10^{-4}
C) 0.15
D) 1.6×10^{-2}
E) 1.5×10^{-3}

A flask is charged with 0.124 mol of A *and allowed to react to form* B *according to the reaction* A(g) →B(g). *The following data are obtained for* [A] *as the reaction proceeds:*

Time (s)	1	10	20	30	40
Moles of A	0.124	0.110	0.088	0.073	0.054

9) How many moles of B are present at 10 s? 9) _____

A) 0.220 B) 0.110 C) 0.011 D) 0.014 E) 1.4×10^{-3}

10) How many moles of B are present at 30 s? 10) _____

A) 0.051 B) 0.15 C) 2.4×10^{-3} D) 1.7×10^{-3} E) 0.073

The peroxydisulfate ion ($S_2O_8^{2-}$) *reacts with the iodide ion in aqueous solution via the reaction:*

$$S_2O_8^{2-}\ (aq) + 3I^- \rightarrow 2SO_4\ (aq) + I_3^-\ (aq)$$

An aqueous solution containing 0.050 M *of* $S_2O_8^{2-}$ *ion and* 0.072 M *of* I^- *is prepared, and the progress of the reaction followed by measuring* [I^-]. *The data obtained is given in the table below.*

Time (s)	0	400	800	1200	1600
[I^-] (M)	0.072	0.057	0.046	0.037	0.029

11) The average rate of disappearance of I^- between 400 s and 800 s is _____ M/s. 11) _____

A) 2.6×10^{-4} B) 1.4×10^{-5} C) 2.8×10^{-5} D) 5.8×10^{-5} E) 3.6×10^{4}

12) The average rate of disappearance of I in the initial 400 s is _____ M/s. 12) _____

A) 2.7×10^{4} B) 3.8×10^{-5} C) 6.00 D) 1.4×10^{-4} E) 3.2×10^{-4}

13) The average rate of disappearance of I between 1200 s and 1600 s is _____ M/s. 13) _____

A) 5.0×10^{4} B) 1.2×10^{-5} C) 1.8×10^{-5} D) 1.6×10^{-4} E) 2.0×10^{-5}

14) The concentration of $S_2O_8^{2-}$ remaining at 400 s is _____ M. 14) _____

A) +0.015 B) +0.035 C) +0.045 D) +0.057 E) -0.007

15) The concentration of $S_2O_8^{2-}$ remaining at 800 s is _____ M. 15) _____

A) 4.00×10^{-3}
B) 0.041
C) 0.046
D) 0.076
E) 0.015

16) The concentration of $S_2O_8^{2-}$ remaining at 1600 s is _____ M. 16) _____

A) 0.064 B) 0.014 C) 0.036 D) 0.043 E) 0.029

17) At elevated temperatures, dinitrogen pentoxide decomposes to nitrogen dioxide and oxygen: 17) _____

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

When the rate of formation of NO_2 is 5.5×10^{-4} M/s, the rate of decomposition of N_2O_5 is _____ M/s.

A) 1.4×10^{-4}
B) 2.8×10^{-4}
C) 10.1×10^{-4}
D) 5.5×10^{-4}
E) 2.2×10^{-3}

18) At elevated temperatures, methylisonitrile (CH_3NC) isomerizes to acetonitrile (CH_3CN): 18) _____

$$CH_3NC\ (g) \rightarrow CH_3CN\ (g)$$

At the start of an experiment, there are 0.200 mol of reactant and 0 mol of product in the reaction vessel. After 25 min, 0.108 mol of reactant (CH_3NC) remain. There are _____ mol of product (CH_3CN) in the reaction vessel.

A) 0.200 B) 0.540 C) 0.092 D) 0.022 E) 0.308

19) At elevated temperatures, methylisonitrile (CH_3NC) isomerizes to acetonitrile (CH_3CN): 19) _____

$$CH_3NC\ (g) \rightarrow CH_3CN\ (g)$$

At the start of the experiment, there are 0.200 mol of reactant (CH_3NC) and 0 mol of product (CH_3CN) in the reaction vessel. After 25 min of reaction, 0.108 mol of reactant (CH_3NC) remain. The average rate of decomposition of methyl isonitrile, CH_3NC, in this 25 min period is _____ mol/min.

A) 4.3×10^{-3} B) 3.7×10^{-3} C) 2.3 D) 0.54 E) 0.092

20) A reaction was found to be second order in carbon monoxide concentration. The rate of the reaction _____ if the [CO] is doubled, with everything else kept the same. 20) _____

A) doubles
B) triples
C) is reduced by a factor of 2.
D) increases by a factor of 4
E) remains unchanged

21) If the rate law for the reaction 21) _____

$$2A + 3B \rightarrow \text{products}$$

is first order in A and second order in B, then the rate law is rate = _____.

A) $k[A][B]^2$ B) $k[A][B]$ C) $k[A]^2[B]^2$ D) $k[A]^2[B]^3$ E) $k[A]^2[B]$

22) The overall order of a reaction is 2. The units of the rate constant for the reaction are _____. 22) _____

A) M/s B) 1/M C) s/M^2 D) $M^{-1}s^{-1}$ E) 1/s

23) The kinetics of the reaction below were studied and it was determined that the reaction rate increased by a factor of 9 when the concentration of B was tripled. The reaction is _____ order in B. 23) _____

$$A + B \rightarrow P$$

A) zero B) first C) second D) third E) one-half

24) The kinetics of the reaction below were studied and it was determined that the reaction rate did not change when the concentration of B was tripled. The reaction is _____ order in B. 24) _____

$$A + B \rightarrow P$$

A) zero B) first C) second D) third E) one-half

25) A reaction was found to be third order in A. Increasing the concentration of A by a factor of 3 will cause the reaction rate to _____. 25) _____

A) remain constant
B) increase by a factor of 27
C) increase by a factor of 9
D) decrease by a factor of the cube root of 3
E) triple

26) A reaction was found to be zero order in A. Increasing the concentration of A by a factor of 3 will cause the reaction rate to _____. 26) _____

A) increase by a factor of 9
B) decrease by a factor of the cube root of 3
C) increase by a factor of 27
D) remain constant
E) triple

The data in the table below were obtained for the reaction:

$$A + B \rightarrow P$$

Experiment Number	[A] (M)	[B] (M)	Initial Rate (M/s)
1	0.273	0.763	2.83
2	0.273	1.526	2.83
3	0.819	0.763	25.47

27) The order of the reaction in A is _____. 27) _____

A) 1 B) 2 C) 3 D) 4 E) 0

28) The order of the reaction in B is _____. 28) _____

A) 1 B) 2 C) 3 D) 4 E) 0

29) The overall order of the reaction is _____. 29) _____

A) 1 B) 2 C) 3 D) 4 E) 0

30) For a first-order reaction, a plot of _____ versus _____ is linear. 30) _____

A) $\ln [A]_t$, t B) $[A]_t$, t C) t, $\frac{1}{[A]_t}$ D) $\frac{1}{[A]_t}$, t E) $\ln [A]_t$, $\frac{1}{t}$

31) The following reaction occurs in aqueous solution: 31) _____

$$NH_4^+ (aq) + NO_2^- \rightarrow N_2 (g) + 2H_2O (l)$$

The data below is obtained at 25°C.

$[NH_4^+]$ (M)	$[NO_2^-]$ (M)	Initial rate (M/s)
0.0100	0.200	3.2×10^{-3}
0.0200	0.200	6.4×10^{-3}

The order of the reaction in NH_4^+ is _____.

A) -2 B) -1 C) 0 D) +2 E) +1

32) The rate constant for a particular second-order reaction is 0.47 $M^{-1}s^{-1}$. If the initial concentration of reactant is 0.25 mol/L, it takes _____ s for the concentration to decrease to 0.13 mol/L. 32) _____

A) 7.9 B) 3.7 C) 1.7 D) 1.4 E) 0.13

33) A first-order reaction has a rate constant of 0.33 min^{-1}. It takes _____ min for the reactant concentration to decrease from 0.13 M to 0.088 M. 33) _____

A) 1.2 B) 0.13 C) 0.51 D) 1.4 E) 0.85

34) 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 (mol/L) of reactant after 1.5 s? 34) _____

A) 3.8 B) 8.8×10^{-2} C) 2.0×10^{-2} D) 1.7 E) 0.135

35) The rate constant for a second-order reaction is 0.13 $M^{-1}s^{-1}$. If the initial concentration of reactant is 0.26 mol/L, it takes _____ s for the concentration to decrease to 0.13 mol/L. 35) _____

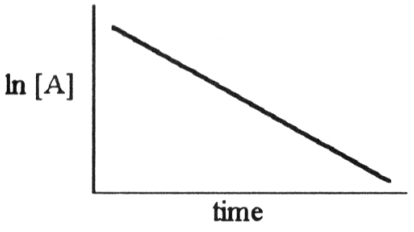
A) 0.017 B) 30 C) 4.4×10^{-3} D) 0.50 E) 1.0

36) The half-life of a first-order reaction is 13 min. If the initial concentration of reactant is 0.085 M, it takes _____ min for it to decrease to 0.055 M. 36) _____

A) 11 B) 0.048 C) 8.4 D) 8.2 E) 3.6

37) The graph shown below depicts the relationship between concentration and time for the following chemical reaction. 37) _____

$$2A \longrightarrow C$$



The slope of this line is equal to _____.

A) k B) -k C) 1/k D) $\ln[A]_0$ E) -1/k

38) The reaction below is first order in $[H_2O_2]$: 38) _____

$$2H_2O_2\,(l) \rightarrow 2H_2O\,(l) + O_2\,(g)$$

A solution originally at 0.600 M H_2O_2 is found to be 0.075 M after 54 min. The half-life for this reaction is _____ min.

A) 28 B) 54 C) 18 D) 14 E) 6.8

39) A second-order reaction has a half-life of 18 s when the initial concentration of reactant is 0.71 M. The rate constant for this reaction is _____ $M^{-1}s^{-1}$. 39) _____

A) 2.0×10^{-2} B) 1.3 C) 7.8×10^{-2} D) 3.8×10^{-2} E) 18

40) A burning splint will burn more vigorously in pure oxygen than in air because 40) _____

A) oxygen is a catalyst for combustion.
B) nitrogen is a product of combustion and the system reaches equilibrium at a lower temperature.
C) nitrogen is a reactant in combustion and its low concentration in pure oxygen catalyzes the combustion.
D) oxygen is a product of combustion.
E) oxygen is a reactant in combustion and concentration of oxygen is higher in pure oxygen than is in air.

41) Of the following, all are valid units for a reaction rate except _____. 41) _____

A) mol/L-hr B) mol/L C) M/s D) g/s E) mol/hr

42) Nitrogen dioxide decomposes to nitric oxide and oxygen via the reaction: 42) _____

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

In a particular experiment at 300°C, $[NO_2]$ drops from 0.0100 to 0.00650 M in 100 s. The rate of disappearance of NO_2 for this period is _____ M/s.

A) 0.35 B) 3.5×10^{-3} C) 1.8×10^{-3} D) 7.0×10^{-3} E) 3.5×10^{-5}

43) Which one of the following is <u>not</u> a valid expression for the rate of the reaction below? 43) _____

$$4NH_3 + 7O_2 \rightarrow 4NO_2 + 6H_2O$$

A) $\frac{1}{6}\frac{\Delta[H_2O]}{\Delta t}$

B) $-\frac{1}{7}\frac{\Delta[O_2]}{\Delta t}$

C) $-\frac{1}{4}\frac{\Delta[NH_3]}{\Delta t}$

D) $\frac{1}{4}\frac{\Delta[NO_2]}{\Delta t}$

E) All of the above are valid expressions of the reaction rate.

44) Of the units below, _____ are appropriate for a first-order reaction rate constant. 44) _____

A) $M\ s^{-1}$
B) mol/L
C) $M^{-1}\ s^{-1}$
D) s^{-1}
E) $L\ mol^{-1}\ s^{-1}$

45) The rate law of a reaction is rate = k[D][X]. The units of the rate constant are _____. 45) _____

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

The data in the table below were obtained for the reaction:

$A + B \rightarrow P$

Experiment Number	[A] (M)	[B] (M)	Initial Rate (M/s)
1	0.273	0.763	2.83
2	0.273	1.526	2.83
3	0.819	0.763	25.47

46) The magnitude of the rate constant is _____. 46) _____

A) 38.0 B) 2.21 C) 13.2 D) 42.0 E) 0.278

The data in the table below were obtained for the reaction:

$2\ ClO_2\ (aq) + 2\ OH^-\ (aq) \rightarrow ClO_3^-\ (aq) + ClO_2^-\ (aq) + H_2O\ (1)$

Experiment Number	$[ClO_2]$ (M)	$[OH^-]$ (M)	Initial Rate (M/s)
1	0.060	0.030	0.0248
2	0.020	0.030	0.00276
3	0.020	0.090	0.00828

47) What is the order of the reaction with respect to ClO_2? 47) _____

A) 0 B) 1 C) 4 D) 2 E) 3

48) What is the order of the reaction with respect to OH^-? 48) _____

A) 0 B) 1 C) 2 D) 3 E) 4

49) What is the overall order of the reaction? 49) _____

A) 1 B) 2 C) 3 D) 0 E) 4

50) What is the magnitude of the rate constant for the reaction? 50) _____

A) 115 B) 230 C) 713 D) 4.6 E) 1.15×10^4

51) The rate law for a reaction is 51) _____

$$\text{rate} = k\,[A][B]^2$$

Which one of the following statements is false?
A) The reaction is second order overall.
B) If [B] is doubled, the reaction rate will increase by a factor of 4.
C) The reaction is first order in A.
D) The reaction is second order in B.
E) *k* is the reaction rate constant

52) The half-life of a first-order reaction _____. 52) _____
A) is the time necessary for the reactant concentration to drop to half its original value
B) does not depend on the initial reactant concentration
C) can be calculated from the reaction rate constant
D) is constant
E) All of the above are correct.

53) The reaction 53) _____

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

follows second-order kinetics. At 300°C, $[NO_2]$ drops from 0.0100- to 0.00650-M in 100 s. The rate constant for the reaction is _____ $M^{-1}s^{-1}$.
A) 0.81 B) 0.54 C) 0.65 D) 1.2 E) 0.096

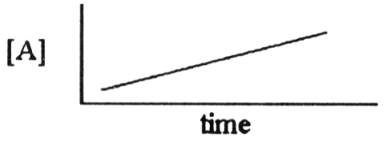
54) The reaction 54) _____

$$CH_3\text{-}N{\equiv}C \rightarrow CH_3\text{-}C{\equiv}N$$

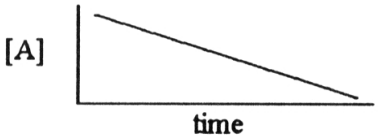
is a first-order reaction. At 230.3°C, $k = 6.29 \times 10^{-4}\ s^{-1}$. If $[CH_3\text{-}N{\equiv}C]$ is 1.00×10^{-3} initially, $[CH_3\text{-}N{\equiv}C]$ is _____ after 1.000×10^3 s.
A) 4.27×10^{-3}
B) 1.88×10^{-3}
C) 5.33×10^{-4}
D) 2.34×10^{-4}
E) 1.00×10^{-6}

55) Which one of the following graphs shows the correct relationship between concentration and time for a reaction that is second order in [A]? 55) _____

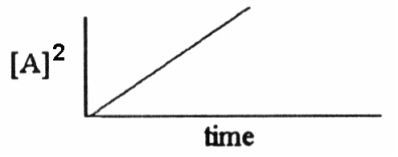
A)



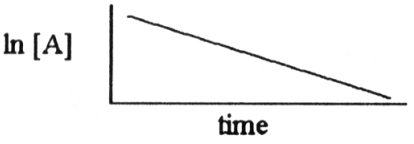
B)



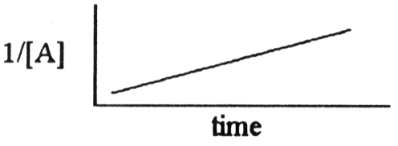
C)



D)



E)



56) The following reaction is second order in [A] and the rate constant is 0.039 $M^{-1}s^{-1}$: 56) _____

$$A \rightarrow B$$

The concentration of A was 0.30 M at 23s. The initial concentration of A was _____ M.

A) 3.7 B) 1.2×10^{-2} C) 0.27 D) 0.41 E) 2.4

The reaction A → B *is first order in* [A]. *Consider the following data.*

time (s)	[A] (M)
0.0	1.60
10.0	0.40
20.0	0.10

57) The rate constant for this reaction is _____ s^{-1}. 57) _____

A) 0.013 B) 0.030 C) 3.0 D) 3.1×10^{-3} E) 0.14

58) The half-life of this reaction is _____ s. 58) _____

A) 7.1 B) 4.9 C) 3.0 D) 0.14 E) 0.97

The reaction A → B *is first order in* [A]. *Consider the following data.*

Time (s)	0	5	10	15	20
[A] (M)	0.20	0.14	0.10	0.071	0.050

59) The rate constant for this reaction is _____ s^{-1}. 59) _____

A) 14 B) 6.9×10^{-2} C) 3.0×10^{-2} D) 0.46 E) 4.0×10^{2}

60) The concentration of A is _____ M after 40.0 s. 60) _____

A) 0.025 B) 1.2×10^{-2} C) 0.17 D) 1.2 E) 3.5×10^{-4}

61) The rate constant of a first-order process that has a half-life of 225 s is _____ s^{-1}. 61) _____

A) 12.5
B) 3.08×10^{-3}
C) 1.25
D) 0.693
E) 4.44×10^{-3}

62) The reaction A (aq) → B (aq) is first order in [A]. A solution is prepared with [A] = 1.22 M. The following data are obtained as the reaction proceeds: 62) _____

Time (s)	0	6	12	18
[A] (M)	1.22	0.61	0.31	0.15

The rate constant for this reaction is _____ s^{-1}.

A) 0.23 B) 0.12 C) 0.17 D) -0.12 E) 1.0

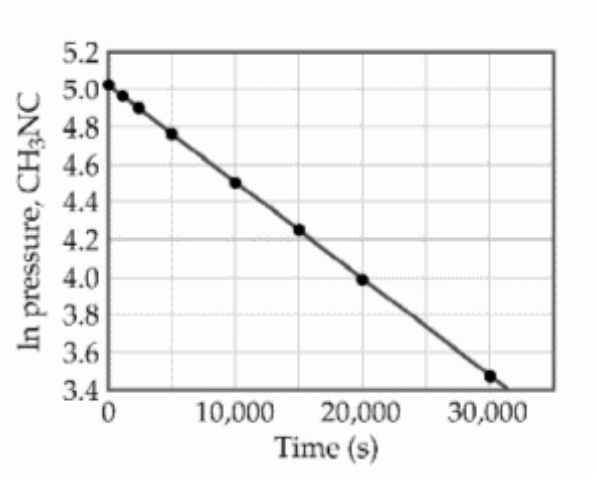
63) One difference between first- and second-order reactions is that _____. 63) _____

A) the rate of a first-order reaction depends on reactant concentrations; the rate of a second-order reaction does not depend on reactant concentrations
B) the half-life of a first-order reaction depends on $[A]_0$; the half-life of a second-order reaction does not depend on $[A]_0$
C) a first-order reaction can be catalyzed; a second-order reaction cannot be catalyzed
D) the rate of a first-order reaction does not depend on reactant concentrations; the rate of a second-order reaction does depend on reactant concentrations
E) the half-life of a first-order reaction does not depend on $[A]_0$; the half-life of a second-order reaction does depend on $[A]_0$

64) At elevated temperatures, methylisonitrile (CH_3NC) isomerizes to acetonitrile (CH_3CN): 64) _____

$$CH_3NC\ (g) \rightarrow CH_33CN\ (g)$$

The reaction is first order in methylisonitrile. The attached graph shows data for the reaction obtained at 198.9°C.



The rate constant for the reaction is _____ s^{-1}.

A) $+5.2 \times 10^{-5}$
B) +6.2
C) $+1.9 \times 10^{4}$
D) -1.9×10^{4}
E) -5.2×10^{-5}

65) At elevated temperatures, nitrogen dioxide decomposes to nitrogen oxide and oxygen: 65) _____

$$NO_2\ (g) \rightarrow NO\ (g) + \frac{1}{2}O_2\ (g)$$

The reaction is second order in NO_2 with a rate constant of 0.543 $M^{-1}\ s^{-1}$ at 300°C. If the initial $[NO_2]$ is 0.260 M, it will take _____ s for the concentration to drop to 0.100 M.

A) 3.34 B) 0.299 C) 8.8×10^{-2} D) -0.611 E) 11.3

66) The decomposition of N_2O_5 in solution in carbon tetrachloride proceeds via the reaction 66) _____

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

The reaction is first order and has a rate constant of $4.82 \times 10^{-3}\ s^{-1}$ at 64°C. The rate law for the reaction is rate = _____.

A) $k[N_2O_5]^2$
B) $k[N_2O_5]$
C) $k\dfrac{[NO_2]^4\,[O_2]}{[N_2O_5]^2}$
D) $k\dfrac{[N_2O_5]^2}{[NO_2]^4\,[O_2]}$
E) $2k[N_2O_5]$

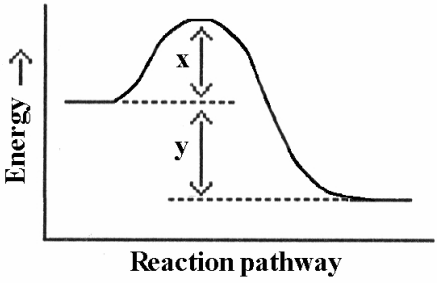
67) As the temperature of a reaction is increased, the rate of the reaction increases because the _____. 67) _____

A) reactant molecules collide with greater energy per collision
B) reactant molecules collide less frequently
C) reactant molecules collide more frequently with less energy per collision
D) reactant molecules collide less frequently <u>and</u> with greater energy per collision
E) activation energy is lowered

68) The rate of a reaction depends on _____. 68) _____

A) collision energy
B) collision frequency
C) collision orientation
D) all of the above
E) none of the above

69) Which energy difference in the energy profile below corresponds to the activation energy for the forward reaction? 69) _____



A) x B) y C) y - x D) x + y E) x - y

70) In the energy profile of a reaction, the species that exists at the maximum on the curve is called the _____. 70) _____

A) atomic state
B) product
C) activated complex
D) activation energy
E) enthalpy of reaction

71) In the Arrhenius equation, 71) _____

$$k = Ae^{-Ea/RT}$$

_____ is the frequency factor.

A) E_a B) R C) A D) e E) k

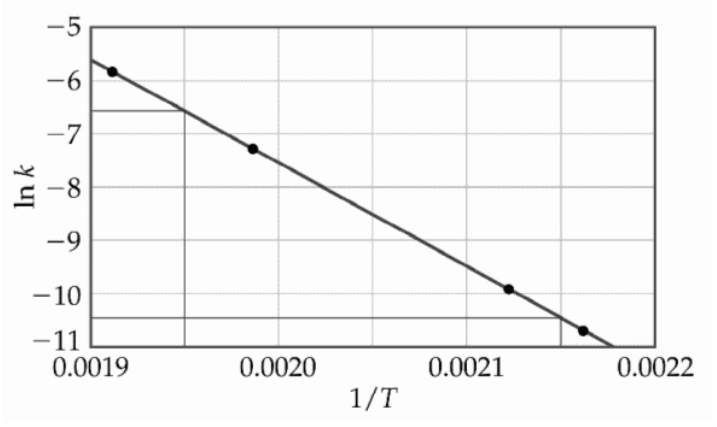
72) In general, as temperature goes up, reaction rate _____. 72) _____

A) stays the same regardless of whether the reaction is exothermic or endothermic
B) stays the same if the reaction is first order
C) goes up regardless of whether the reaction is exothermic or endothermic
D) goes up if the reaction is endothermic
E) goes up if the reaction is exothermic

73) At elevated temperatures, methylisonitrile (CH_3NC) isomerizes to acetonitrile (CH_3CN): 73) _____

$$CH_3NC\ (g) \rightarrow CH_3CN\ (g)$$

The dependence of the rate constant on temperature is studied and the graph below is prepared from the results.



The energy of activation of this reaction is _____ kJ/mol.

A) 160 B) 4.4×10^{-4} C) 1.6×10^{5} D) 4.4×10^{-7} E) 1.9×10^{4}

74) The mechanism for formation of the product X is: 74) _____

$A + B \rightarrow C + D$ (slow)
$B + D \rightarrow X$ (fast)

The intermediate reactant in the reaction is _____.

A) A B) B C) C D) D E) X

75) The overall reactions and rate laws for several reactions are given below. Of these, only _____ could represent an elementary step. 75) _____

A) $A + B \rightarrow P$ rate = $k[A][B]$
B) $A + B + C \rightarrow P$ rate = $k[A][C]$
C) $A + 2B \rightarrow P$ rate = $k[A]^2$
D) $2A \rightarrow P$ rate = $k[A]$
E) $A + 2B \rightarrow P$ rate = $k[A][B]$

76) For the elementary reaction 76) _____

$$NO_3 + CO \rightarrow NO_2 + CO_2$$

the molecularity of the reaction is _____, and the rate law is rate = _____.

A) 2, $k[NO_3][CO]$
B) 4, $k[NO_2][CO_2]/[NO_3][CO]$
C) 2, $k[NO_2][CO_2]$
D) 2, $k[NO_3][CO]/[NO_2][CO_2]$
E) 4, $k[NO_3][CO][NO_2][CO_2]$

77) The first step of a mechanism involving the reactant I_2 is shown below, where the equilibrium is established. 77) _____

$$I_2\,(aq) \rightleftharpoons 2I\,(aq) \qquad (1, -1)$$

The expression relating [I] to $[I_2]$ is [I] = _____.

A) $k_1[I_2]$
B) $(k_1/k^{-1})^2[I_2]^2$
C) $(k_1/k^{-1})^{1/2}[I_2]^{1/2}$
D) $(k_1/k^{-1})^2[I_2]^{1/2}$
E) $k_1[I_2]^{1/2}$

78) A possible mechanism for the overall reaction 78) _____

$$Br_2\,(g) + 2NO\,(g) \rightarrow 2NOBr\,(g)$$

is

$$NO\,(g) + Br_2\,(g) \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} NOBr_2\,(g) \qquad \text{(fast)}$$

$$NOBr_2\,(g) + NO\,(g) \xrightarrow{k_2} 2NOBr \qquad \text{(slow)}$$

The rate law for formation of NOBr based on this mechanism is rate = _____.

A) $(k_1/k^{-1})^2[NO]^2$

B) $(k_2k_1/k^{-1})[NO]^2[Br_2]$

C) $(k_2k_1/k^{-1})[NO][Br_2]^2$

D) $k_1[Br_2]^{1/2}$

E) $k_1[NO]^{1/2}$

79) Of the following, _____ will lower the activation energy for a reaction. 79) _____

A) raising the temperature of the reaction
B) adding a catalyst for the reaction
C) increasing the concentrations of reactants
D) removing products as the reaction proceeds
E) increasing the pressure

80) The rate law of the overall reaction 80) _____

$$A + B \rightarrow C$$

is rate = $k[A]^2$. Which of the following will <u>not</u> increase the rate of the reaction?

A) increasing the concentration of reactant B
B) increasing the temperature of the reaction
C) adding a catalyst for the reaction
D) increasing the concentration of reactant A
E) All of these will increase the rate.

81) A catalyst can increase the rate of a reaction _____. 81) _____

A) by lowering the activation energy of the reverse reaction
B) by changing the value of the frequency factor (A)
C) by lowering the overall activation energy (E_a) of the reaction
D) by providing an alternative pathway with a lower activation energy
E) All of these are ways that a catalyst might act to increase the rate of reaction.