Your Name: _____ **Your ID:** _____

Course Name: CHE_107_General_Chemistry_2

Question #: 1

Given the reaction $C_5H_{12}(g) + 8\ O_2(g) \rightarrow 5\ CO_2(g) + 6\ H_2O(g)$, select **all** of the correct expressions of the rate law.

A.

$$\text{Rate} = -\frac{1}{8}\frac{\Delta[O_2]}{\Delta t}$$

B.

$$\text{Rate} = \frac{\Delta[C_5H_{12}]}{\Delta t}$$

C.

$$\text{Rate} = 5\frac{\Delta[CO_2]}{\Delta t}$$

D.

$$\text{Rate} = \frac{1}{6}\frac{\Delta[H_2O]}{\Delta t}$$

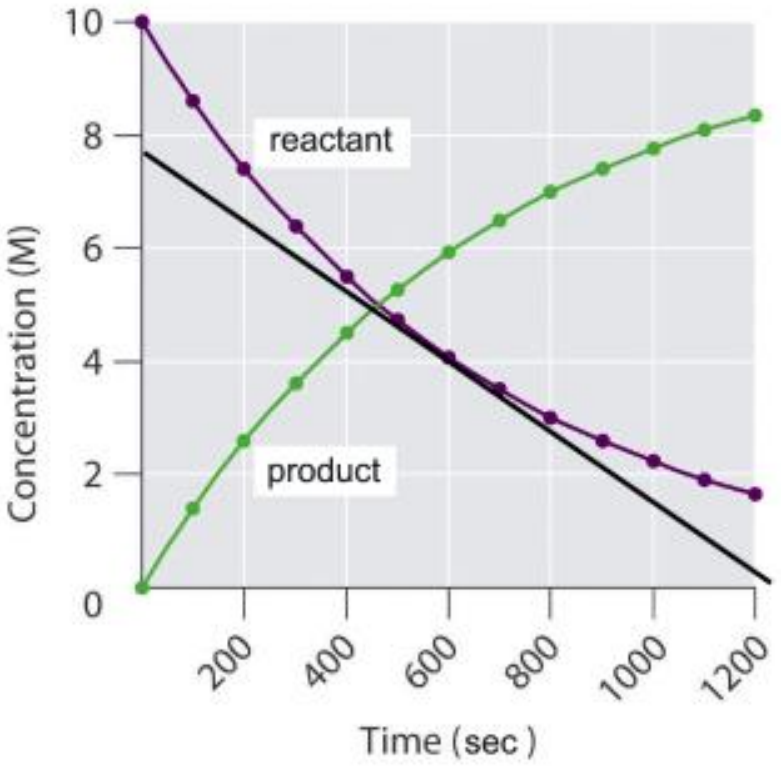
Question #: 2

Estimate the instantaneous rate of this reaction at time = 600 seconds.

rate = __1__ M/s

Report your answer with **one** significant digit, without units, using the form 2E-2 for scientific notation.

1. _____



Question #: 3

The rate constant for the gas-phase decomposition of N_2O_5 according to the reaction equation below is 7.0×10^{-3} s^{-1} at 335 K. What is the overall order of this reaction?

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

A. zero
B. first
C. second
D. third

Question #: 4

The table below shows the data collected for the reaction:

$$2\ NO_2(g) + Cl_2(g) \rightarrow 2\ NO_2Cl(g)$$

where rate = $k[NO_2]^x[Cl_2]^y$.

$[NO_2]$ (M)	$[Cl_2]$ (M)	Initial Rate $[NO_2Cl]$ (M/s)
0.100	0.100	0.026
0.200	0.100	0.051
0.200	0.200	0.103
0.400	0.400	0.411

What is the order of the reaction, x, with respect to NO_2? $x =$ 1
What is the order of the reaction, y, with respect to Cl_2? $y =$ 2
What is the overall order of the reaction, z? $z =$ 3

1. _____
2. _____
3. _____

Question #: 5

The reaction below is first-order in SO_2Cl_2 and has a rate constant of 1.9×10^{-4} s^{-1} at 25 °C. If the initial concentration of SO_2Cl_2 is 0.084 M, what would the SO_2Cl_2 concentration be after 700 s?

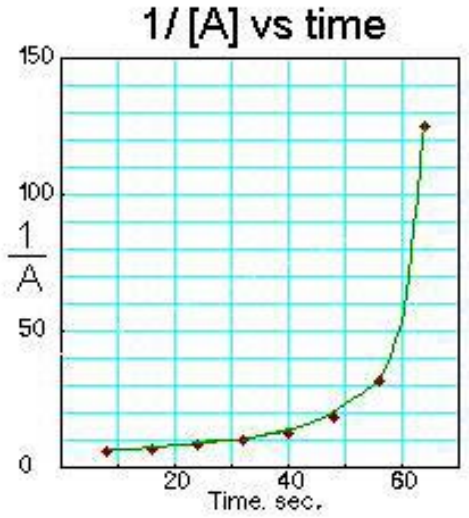
$$SO_2Cl_2(g) \rightarrow SO_2(g) + Cl_2(g)$$

A. 0.074 M
B. 0.036 M
C. 0.11 M
D. 0.056 M

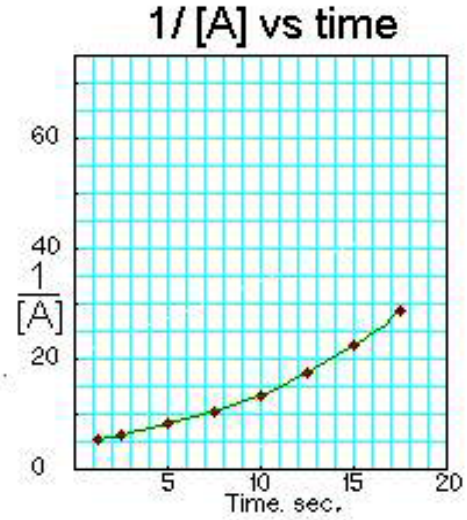
Question #: 6

Which plot shows 1/[A] vs. time for the **second-order** conversion of reactant A to products?

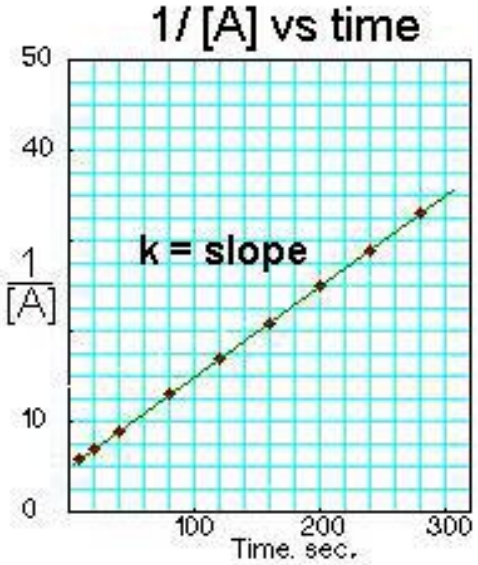
A.



B.



C.



Question #: 7

The decomposition of $COCl_2$ is first order in $COCl_2$ and has a rate constant of $8.90 \times 10^{-3}\ s^{-1}$ at a certain temperature. What is the half-life for the reaction?

$$COCl_2(g) \rightarrow CO(g) + Cl_2(g)$$

A. 111 s
B. 77.9 s
C. 224 s
D. 40.1 s

Question #: 8

According to the collision model, reaction rates increase with increasing temperature mainly because

A. the frequency factor (*A* in the Arrhenius equation) increases strongly with increasing temperature.

B. a larger fraction of intermolecular collisions occurs with the proper orientation to form products.

C. a larger fraction of intermolecular collisions occurs with sufficient energy to overcome the activation energy barrier, leading to products.

D. the activation energy (E_a in the Arrhenius equation) decreases with increasing temperature.

Question #: 9

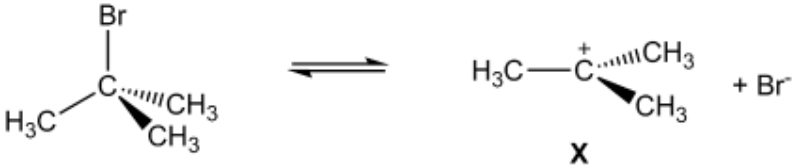
The activation energy of a reaction is 56.8 kJ•mol^{-1} and the frequency factor is 1.5 ×10^{11} s^{-1}. What is the rate constant of the reaction at 25 °C? k = __1__ s^{-1}

Report your answer with two significant digits. Use the form 2.2E-2 for scientific notation.

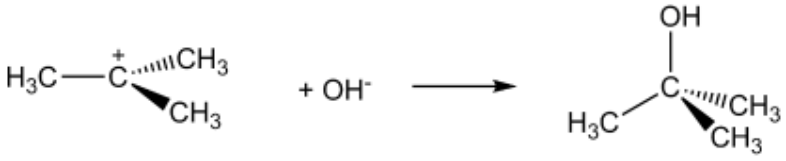
1. _____

Question #: 10

The hydrolysis of *tert*-butyl bromide follows the following reaction mechanism. The species labeled **X** is a(n) __1__ in this mechanism.



X



1. _____

Question #: 11

The overall reaction below is second order in A and first order in B:

$$A + B \rightarrow AB$$

Which of the following mechanisms is consistent with this observation?

A.

$$2\,B \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} B_2 \qquad \text{Slow}$$

$$B_2 + A \xrightarrow{k_2} AB + B \qquad \text{Fast}$$

B.

$$2\,A \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} A_2 \qquad \text{Slow}$$

$$A_2 + B \xrightarrow{k_2} AB + A \qquad \text{Fast}$$

C.

$$2\,A \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} A_2 \qquad \text{Fast}$$

$$A_2 + B \xrightarrow{k_2} AB + A \qquad \text{Slow}$$

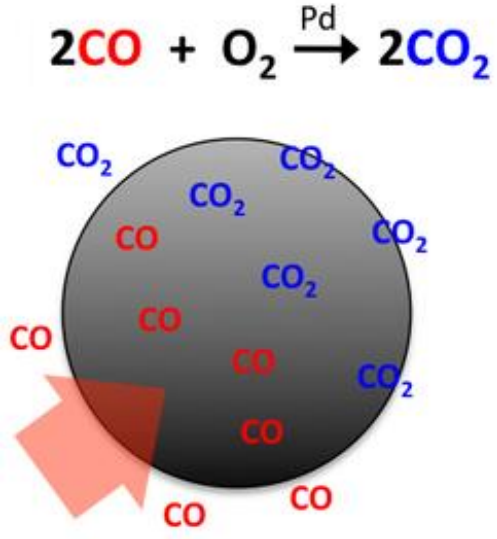
D.

$$2\,B \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} B_2 \qquad \text{Fast}$$

$$B_2 + A \xrightarrow{k_2} AB + B \qquad \text{Slow}$$

Question #: 12

In the figure below, palladium metal functions as a __1__ [homogeneous, heterogeneous] catalyst, which speeds up the reaction rate by __2__ [increasing, decreasing] the activation energy, E_a, for the reaction of oxygen gas with carbon monoxide gas to form carbon dioxide gas.



1. _____
2. _____

Question #: 13

Which of the following statements is/are **false** for a chemical reaction at dynamic equilibrium? Choose **all** that apply.

A. Only product(s) can be formed.
B. Concentrations of reactant(s) and product(s) no longer change.
C. Rate of forward reaction = rate of reverse reaction.
D. Rates of forward and reverse reactions equal zero.

Question #: 14

Initially, 0.50 atm each of $PCl_3(g)$ and $Cl_2(g)$ is added to a reaction vessel. Given the balanced chemical equation and K_P, what is true about the **equilibrium** concentrations of reactants and products?

$$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g) \quad K_P = 1.21 \times 10^{-2}$$

The equilibrium lies to the _____, so the concentrations of PCl_3 and Cl_2 will be significantly _____ than the concentration of PCl_5.

A. right; higher
B. right; lower
C. left; lower
D. left; higher

Question #: 15

Given the reactions below and their equilibrium constants:

$NO(g) + 1/2\ Br_2(g) \rightleftharpoons NOBr(g)$ $K_p = 5.3$

$2\ NO(g) \rightleftharpoons N_2(g) + O_2(g)$ $K_p = 2.1 \times 10^{30}$

Predict the equilibrium constant for the following reaction:

$N_2(g) + O_2(g) + Br_2(g) \rightleftharpoons 2\ NOBr(g)$ $K_p =$ 1

Report your answer with **two** significant digits. Enter scientific notation in the form 2.2E-2.

1. _____

Question #: 16

What is the value of K_c for the reaction below?

$4\ NH_3(g) + 7\ O_2(g) \rightleftharpoons 4\ NO_2(g) + 6\ H_2O(g)$ $K_P = 52$ at 300. K

A. 5.0
B. 320
C. 1.3×10^3
D. 8.2×10^4

Question #: 17

At a certain temperature, phosphorus reacts with chlorine gas according to the equation

$P_4(s) + 6\ Cl_2(g) \rightleftharpoons 4\ PCl_3(l)$

What is the K_p expression for this reaction?

A.
$$K_p = (P_{Cl_2})^6$$

B.
$$K_p = \frac{(P_{P_4})(P_{Cl_2})^6}{(P_{PCl_3})^4}$$

C.
$$K_p = \frac{(P_{PCl_3})^4}{(P_{P_4})(P_{Cl_2})^6}$$

D.
$$K_p = \frac{1}{(P_{Cl_2})^6}$$

Question #: 18
Initially, 4.0 moles of NOCl gas are added to a 2.0 L reaction vessel. Once the reaction reached equilibrium, the concentration of NO was found to be 0.66 M. What is K_c for the reaction?

$$2\ NOCl(g) \rightleftharpoons 2\ NO(g) + Cl_2(g) \quad K_c = \underline{\quad 1 \quad}$$

Report your answer with two significant figures using the form 2.0E4 for scientific notation.

1. _____

Question #: 19
The reaction

$$2\ H_2S(g) \rightleftharpoons 2\ H_2(g) + S_2(g)$$

has an equilibrium constant, $K_p = 2.4 \times 10^{-4}$ at 1073 K. If the reaction quotient, $Q_p = 2.23 \times 10^{-5}$ at the same temperature,

A. the reaction will proceed towards the reactants (to the left) to reach equilibrium.
B. the reaction will proceed towards the products (to the right) to reach equilibrium.
C. the reaction has reached equilibrium and no changes in concentrations occur.

Question #: 20
When a reaction vessel contains 0.200 atm each of N_2O_4 and NO_2, is the mixture at equilibrium?

$$N_2O_4(g) \rightleftharpoons 2\ NO_2(g) \quad K_P = 0.133$$

A. The mixture **<u>is</u>** at equilibrium because $Q_P = 0.200$.
B. The mixture **<u>is not</u>** at equilibrium because $Q_P = 0.200$.
C. The mixture **<u>is</u>** at equilibrium because $Q_P = 0.133$.
D. The mixture **<u>is not</u>** at equilibrium because $Q_P = 0.133$.

Question #: 21
Given

$$N_2(g) + 3\ H_2(g) \rightleftharpoons 2\ NH_3(g) \quad K_c = 3.70 \times 10^{-3}$$

If $[N_2] = 0.350$ M and $[H_2] = 0.900$ M at equilibrium, what is the equilibrium concentration of NH_3?

A. 0.0307 M
B. 0.0789 M
C. 1.13 M
D. 2.11 M

Question #: 22
What is the equilibrium pressure of PCl_5 if 1140 torr of PCl_3 and 190 torr of Cl_2 are added to a reaction vessel at 298 K and allowed to reach equilibrium?

$$PCl_3(g) + Cl_2(g) \rightleftharpoons PCl_5(g) \quad K_P = 6.4 \times 10^{-3} \text{ at } 298 \text{ K}$$

A. 1600 torr
B. 170 torr
C. 22 torr
D. 1.8 torr

Question #: 23
For the reaction

$$PCl_3(g) + Cl_2(g) \rightleftharpoons PCl_5(g)$$

at equilibrium at a fixed temperature, which of the following is **true**?

A. Increasing the volume of the reaction vessel causes the reaction to shift to the left (reactants).
B. Decreasing the volume of the reaction vessel causes the reaction to shift to the left (reactants).
C. Increasing the pressure of Cl_2 causes the pressure of PCl_3 to increase.
D. Increasing the pressure by addition of an inert gas causes the reaction to shift to the left (reactants).

Question #: 24
Given the reaction

$$H_2(g) + I_2(g) \rightleftharpoons 2\ HI(g) \quad \Delta H = -51 \text{ kJ/mol}$$

which statement is correct?

A. Heating the reaction mixture causes a shift to more reactants because K decreases.
B. Heating the reaction mixture causes a shift to more products because K increases.
C. Cooling the reaction mixture causes a shift to more products because K decreases.
D. Cooling the reaction mixture causes a shift to more reactants because K decreases.

Question #: 25

The reaction below is best described by the ____ theory; ___ is the base and ___ is the acid.

$NH_3(g) + HBr(g) \rightarrow NH_4Br(s)$

A. Brønsted-Lowry; NH_3; HBr
B. Brønsted-Lowry; HBr; NH_3
C. Arrhenius; NH_3; HBr
D. Arrhenius; HBr; NH_3

Question #: 26

Which pair identifies a Brønsted-Lowry conjugate acid-base pair and the function of each substance in the reaction below?

$$CH_3COOH(aq) + H_2O(l) \rightleftharpoons CH3COO^-(aq) + H3O^+(aq)$$

A. H_2O, acid; H_3O^+conjugate base
B. H_3O^+, base; CH_3COO^-, conjugate acid
C. CH_3COOH, acid; CH_3COO^-, conjugate base
D. CH_3COO^-, base; H_2O, conjugate acid

Question #: 27

Which of the following is(are) **strong** acid(s)? Select all that apply.

A. HI
B. HClO
C. $HC_2H_3O_2$
D. HNO_3
E. HCN

Question #: 28

Considering the general acid equilibrium reaction with the equilibrium constant K_a,

$$HA(aq) + H_2O(l) \rightleftharpoons A^-(aq) + H_3O^+(aq)$$

A. if HA is a weak acid, A^- is pH-neutral.
B. if HA is a weak acid, A^- is a strong conjugate base.
C. if HA is a strong acid, A^- is a strong conjugate base.
D. a large value of K_a indicates that HA is a weak acid.

Question #: 29

What is the pH of an aqueous solution at 25 °C with $[OH^-] = 1.1 \times 10^{-9}$ M?

A. 8.95
B. 5.04
C. 6.21
D. 11.10

Question #: 30

Given the data below, how would you describe the enthalpy of the autoionization of water?

°C	K_w
0	0.114×10^{-14}
50	5.48×10^{-14}
100	51.3×10^{-14}

A. The autoionization of water is endothermic.
B. The autoionization of water is exothermic.
C. There is not enough information to describe the enthalpy of the autoionization of water.
D. The autoionization of water is not influenced by temperature.

CHE 107
Exam 2 Key
Fall 2015

Question #: 1

Given the reaction $C_5H_{12}(g) + 8\ O_2(g) \rightarrow 5\ CO_2(g) + 6\ H_2O(g)$, select **all** of the correct expressions of the rate law.

✓A.

$$\text{Rate} = -\frac{1}{8}\frac{\Delta[O_2]}{\Delta t}$$

B.

$$\text{Rate} = \frac{\Delta[C_5H_{12}]}{\Delta t}$$

C.

$$\text{Rate} = 5\frac{\Delta[CO_2]}{\Delta t}$$

✓D.

$$\text{Rate} = \frac{1}{6}\frac{\Delta[H_2O]}{\Delta t}$$

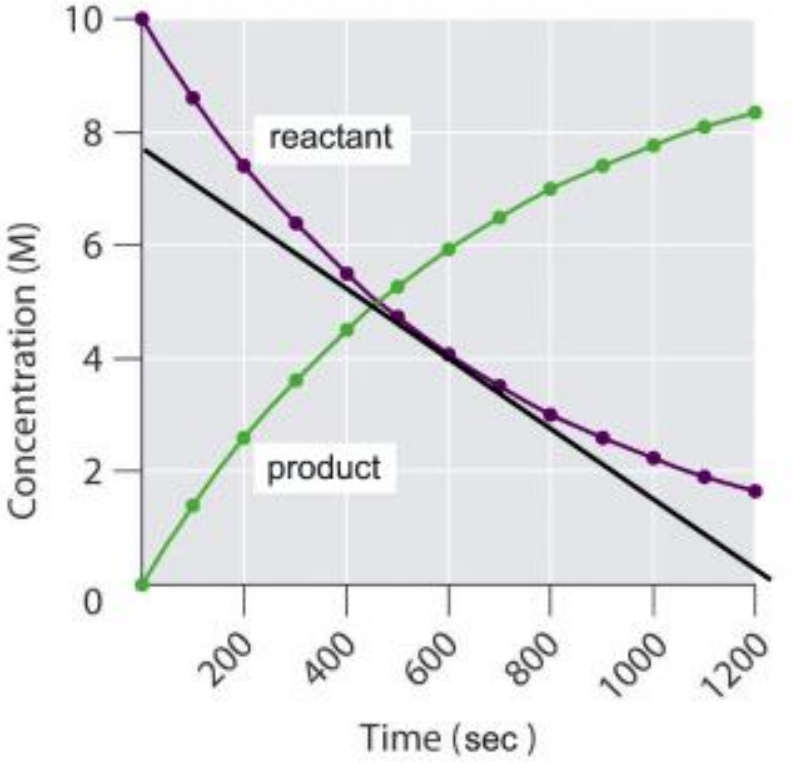
Question #: 2

Estimate the instantaneous rate of this reaction at time = 600 seconds.

rate = __1__ M/s

Report your answer with **one** significant digit, without units, using the form 2E-2 for scientific notation.

1. 6E-3|7E-3|7 E-3|6 E-3|0.006|0.007|6x10^-3|7x10^-3|6 x 10^-3|7 x 10^-3|



Question #: 3

The rate constant for the gas-phase decomposition of N_2O_5 according to the reaction equation below is 7.0×10^{-3} s^{-1} at 335 K. What is the overall order of this reaction?

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

A. zero
✓B. first
C. second
D. third

Question #: 4

The table below shows the data collected for the reaction:

$$2\ NO_2(g) + Cl_2(g) \rightarrow 2\ NO_2Cl(g)$$

where rate = $k[NO_2]^x[Cl_2]^y$.

$[NO_2]$ (M)	$[Cl_2]$ (M)	Initial Rate $[NO_2Cl]$ (M/s)
0.100	0.100	0.026
0.200	0.100	0.051
0.200	0.200	0.103
0.400	0.400	0.411

What is the order of the reaction, x, with respect to NO_2? $x =$ 1
What is the order of the reaction, y, with respect to Cl_2? $y =$ 2
What is the overall order of the reaction, z? $z =$ 3

1. 1|one|first|
2. 1|one|first|
3. 2|two|second|

Question #: 5

The reaction below is first-order in SO_2Cl_2 and has a rate constant of 1.9×10^{-4} s^{-1} at 25 °C. If the initial concentration of SO_2Cl_2 is 0.084 M, what would the SO_2Cl_2 concentration be after 700 s?

$$SO_2Cl_2(g) \rightarrow SO_2(g) + Cl_2(g)$$

✓A. 0.074 M
B. 0.036 M
C. 0.11 M
D. 0.056 M

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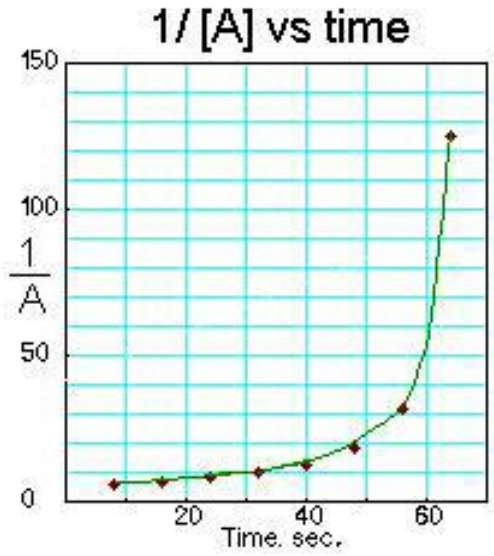
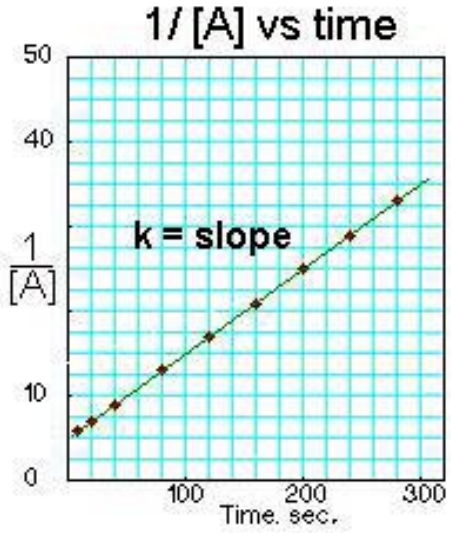
Which plot shows 1/[A] vs. time for the **second-order** conversion of reactant A to products

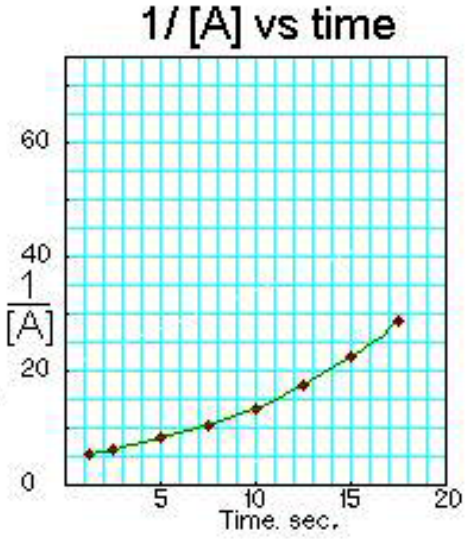
A.



✓C.



B.



Question #: 7

The decomposition of $COCl_2$ is first order in $COCl_2$ and has a rate constant of $8.90 \times 10^{-3}\ s^{-1}$ at a certain temperature. What is the half-life for the reaction?

$$COCl_2(g) \rightarrow CO(g) + Cl_2(g)$$

A. 111 s

✓B. 77.9 s

C. 224 s

D. 40.1 s

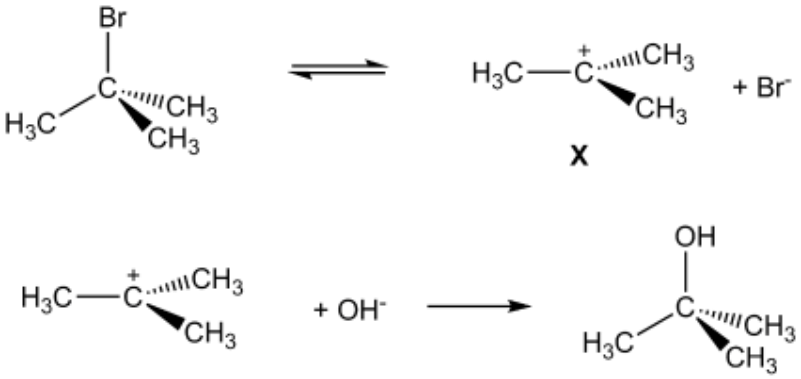
Question #: 8
According to the collision model, reaction rates increase with increasing temperature mainly because

A. the frequency factor (*A* in the Arrhenius equation) increases strongly with increasing temperature.
B. a larger fraction of intermolecular collisions occurs with the proper orientation to form products.
✓C. a larger fraction of intermolecular collisions occurs with sufficient energy to overcome the activation energy barrier, leading to products.
D. the activation energy (E_a in the Arrhenius equation) decreases with increasing temperature.

Question #: 9
The activation energy of a reaction is 56.8 kJ•mol^{-1} and the frequency factor is 1.5 ×10^{11} s^{-1}. What is the rate constant of the reaction at 25 °C? k = __1__ s^{-1}
Report your answer with two significant digits. Use the form 2.2E-2 for scientific notation.

1. 17|1.7E1|1.7 E1|1.7E+1|1.7 E+1|16.6|1.66E1|1.66 E1|1.66E+1|1.66 E+1|

Question #: 10
The hydrolysis of *tert*-butyl bromide follows the following reaction mechanism. The species labeled **X** is a(n) __1__ in this mechanism.



1. intermediate|innermediate|intermedia|reaction intermediate|

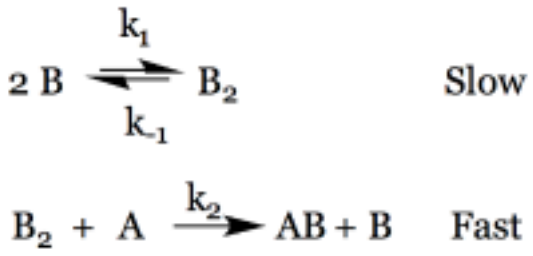
Question #: 11

The overall reaction below is second order in A and first order in B:

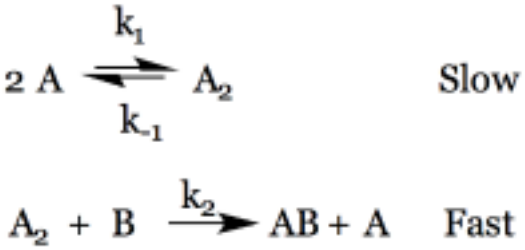
$$A + B \rightarrow AB$$

Which of the following mechanisms is consistent with this observation?

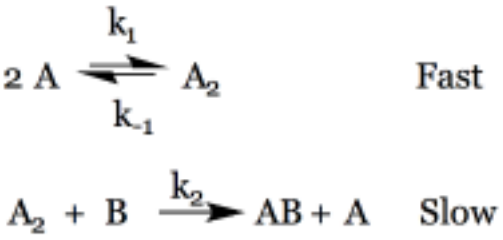
A.



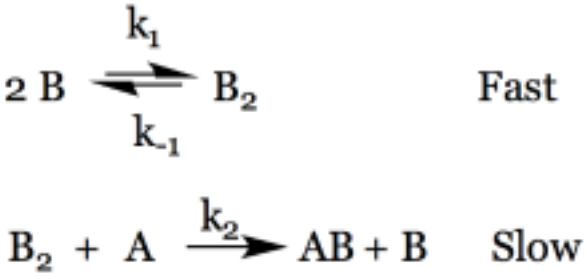
B.



✓C.

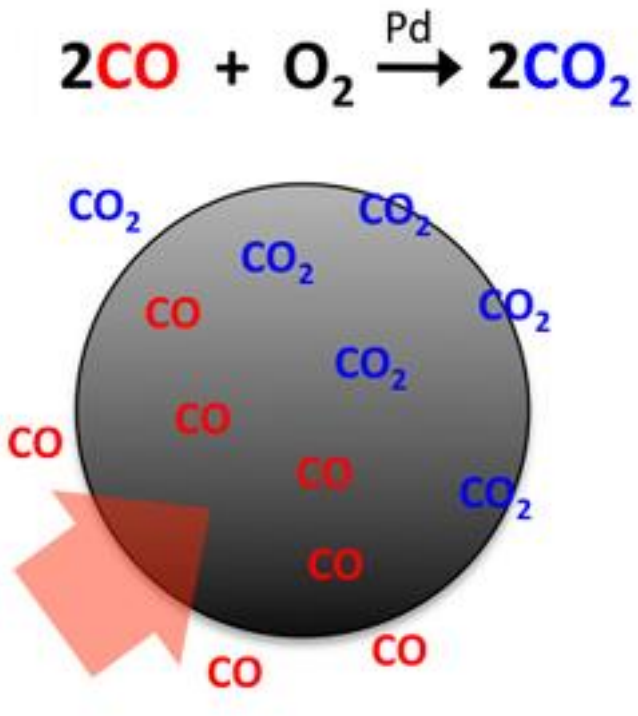


D.



Question #: 12

In the figure below, palladium metal functions as a __1__ [homogeneous, heterogeneous] catalyst, which speeds up the reaction rate by __2__ [increasing, decreasing] the activation energy, E_a, for the reaction of oxygen gas with carbon monoxide gas to form carbon dioxide gas.



1. heterogeneous|Heterogeneous|heterogenous|hetero|
2. decreasing|decrease|decreases|

Question #: 13

Which of the following statements is/are **false** for a chemical reaction at dynamic equilibrium? Choose **all** that apply.

✓A. Only product(s) can be formed.

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C. Rate of forward reaction = rate of reverse reaction.

✓D. Rates of forward and reverse reactions equal zero.

Question #: 14

Initially, 0.50 atm each of $PCl_3(g)$ and $Cl_2(g)$ is added to a reaction vessel. Given the balanced chemical equation and K_P, what is true about the **equilibrium** concentrations of reactants and products?

$$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g) \quad K_P = 1.21 \times 10^{-2}$$

The equilibrium lies to the _____, so the concentrations of PCl_3 and Cl_2 will be significantly _____ than the concentration of PCl_5.

A. right; higher

B. right; lower

✓C. left; lower

D. left; higher

Question #: 15

Given the reactions below and their equilibrium constants:

$NO(g) + 1/2\ Br_2(g) \rightleftharpoons NOBr(g) \quad K_p = 5.3$

$2\ NO(g) \rightleftharpoons N_2(g) + O_2(g) \quad K_p = 2.1 \times 10^{30}$

Predict the equilibrium constant for the following reaction:

$N_2(g) + O_2(g) + Br_2(g) \rightleftharpoons 2\ NOBr(g) \quad K_p =$ 1

Report your answer with **two** significant digits. Enter scientific notation in the form 2.2E-2.

1. 1.3E-29|1.3 E-29|1.3x10-29|1.3 x 10-29|1.3x10^-29|1.3 x 10^-29|

Question #: 16

What is the value of K_c for the reaction below?

$4\ NH_3(g) + 7\ O_2(g) \rightleftharpoons 4\ NO_2(g) + 6\ H_2O(g) \quad K_P = 52$ at 300. K

A. 5.0

B. 320

✓C. 1.3×10^3

D. 8.2×10^4

Question #: 17

At a certain temperature, phosphorus reacts with chlorine gas according to the equation

$P_4(s) + 6\ Cl_2(g) \rightleftharpoons 4\ PCl_3(l)$

What is the K_p expression for this reaction?

A.

$$K_p = (P_{Cl_2})^6$$

B.

$$K_p = \frac{(P_{P_4})(P_{Cl_2})^6}{(P_{PCl_3})^4}$$

C.

$$K_p = \frac{(P_{PCl_3})^4}{(P_{P_4})(P_{Cl_2})^6}$$

✓D.

$$K_p = \frac{1}{(P_{Cl_2})^6}$$

Question #: 18

Initially, 4.0 moles of NOCl gas are added to a 2.0 L reaction vessel. Once the reaction reached equilibrium, the concentration of NO was found to be 0.66 M. What is K_c for the reaction?

$$2\ NOCl(g) \rightleftharpoons 2\ NO(g) + Cl_2(g) \quad K_c = \underline{\quad 1 \quad}$$

Report your answer with two significant figures using the form 2.0E4 for scientific notation.

1. 0.080|8.0E-2|.080|8.0 E-2|8.0x10^-2|8.0 x 10^-2|

Question #: 19

The reaction

$$2\ H_2S(g) \rightleftharpoons 2\ H_2(g) + S_2(g)$$

has an equilibrium constant, $K_p = 2.4 \times 10^{-4}$ at 1073 K. If the reaction quotient, $Q_p = 2.23 \times 10^{-5}$ at the same temperature,

A. the reaction will proceed towards the reactants (to the left) to reach equilibrium.
✓B. the reaction will proceed towards the products (to the right) to reach equilibrium.
C. the reaction has reached equilibrium and no changes in concentrations occur.

Question #: 20

When a reaction vessel contains 0.200 atm each of N_2O_4 and NO_2, is the mixture at equilibrium?

$$N_2O_4(g) \rightleftharpoons 2\ NO_2(g) \quad K_P = 0.133$$

A. The mixture **is** at equilibrium because $Q_P = 0.200$.
✓B. The mixture **is not** at equilibrium because $Q_P = 0.200$.
C. The mixture **is** at equilibrium because $Q_P = 0.133$.
D. The mixture **is not** at equilibrium because $Q_P = 0.133$.

Question #: 21

Given

$$N_2(g) + 3\ H_2(g) \rightleftharpoons 2\ NH_3(g) \quad K_c = 3.70 \times 10^{-3}$$

If $[N_2] = 0.350$ M and $[H_2] = 0.900$ M at equilibrium, what is the equilibrium concentration of NH_3?

✓A. 0.0307 M
B. 0.0789 M
C. 1.13 M
D. 2.11 M

Question #: 22
What is the equilibrium pressure of PCl_5 if 1140 torr of PCl_3 and 190 torr of Cl_2 are added to a reaction vessel at 298 K and allowed to reach equilibrium?

$$PCl_3(g) + Cl_2(g) \rightleftharpoons PCl_5(g) \quad K_P = 6.4 \times 10^{-3} \text{ at } 298 \text{ K}$$

A. 1600 torr
B. 170 torr
C. 22 torr
✓D. 1.8 torr

Question #: 23
For the reaction

$$PCl_3(g) + Cl_2(g) \rightleftharpoons PCl_5(g)$$

at equilibrium at a fixed temperature, which of the following is **true**?

✓A. Increasing the volume of the reaction vessel causes the reaction to shift to the left (reactants).
B. Decreasing the volume of the reaction vessel causes the reaction to shift to the left (reactants).
C. Increasing the pressure of Cl_2 causes the pressure of PCl_3 to increase.
D. Increasing the pressure by addition of an inert gas causes the reaction to shift to the left (reactants).

Question #: 24
Given the reaction

$$H_2(g) + I_2(g) \rightleftharpoons 2\ HI(g) \quad \Delta H = -51 \text{ kJ/mol}$$

which statement is correct?

✓A. Heating the reaction mixture causes a shift to more reactants because K decreases.
B. Heating the reaction mixture causes a shift to more products because K increases.
C. Cooling the reaction mixture causes a shift to more products because K decreases.
D. Cooling the reaction mixture causes a shift to more reactants because K decreases.

Question #: 25
The reaction below is best described by the ____ theory; ___ is the base and ___ is the acid.

$NH_3(g) + HBr(g) \rightarrow NH_4Br(s)$

✓A. Brønsted-Lowry; NH_3; HBr
B. Brønsted-Lowry; HBr; NH_3
C. Arrhenius; NH_3; HBr
D. Arrhenius; HBr; NH_3

Question #: 26

Which pair identifies a Brønsted-Lowry conjugate acid-base pair and the function of each substance in the reaction below?

$$CH_3COOH(aq) + H_2O(l) \rightleftharpoons CH3COO^-(aq) + H3O^+(aq)$$

A. H_2O, acid; H_3O^+conjugate base
B. H_3O^+, base; CH_3COO^-, conjugate acid
✓C. CH_3COOH, acid; CH_3COO^-, conjugate base
D. CH_3COO^-, base; H_2O, conjugate acid

Question #: 27

Which of the following is(are) **strong** acid(s)? Select all that apply.

✓A. HI
B. HClO
C. $HC_2H_3O_2$
✓D. HNO_3
E. HCN

Question #: 28

Considering the general acid equilibrium reaction with the equilibrium constant K_a,

$$HA(aq) + H_2O(l) \rightleftharpoons A^-(aq) + H_3O^+(aq)$$

A. if HA is a weak acid, A^- is pH-neutral.
✓B. if HA is a weak acid, A^- is a strong conjugate base.
C. if HA is a strong acid, A^- is a strong conjugate base.
D. a large value of K_a indicates that HA is a weak acid.

Question #: 29

What is the pH of an aqueous solution at 25 °C with $[OH^-] = 1.1 \times 10^{-9}$ M?

A. 8.95

✓B. 5.04

C. 6.21

D. 11.10

Question #: 30

Given the data below, how would you describe the enthalpy of the autoionization of water?

°C	K_w
0	0.114×10^{-14}
50	5.48×10^{-14}
100	51.3×10^{-14}

✓A. The autoionization of water is endothermic.

B. The autoionization of water is exothermic.

C. There is not enough information to describe the enthalpy of the autoionization of water.

D. The autoionization of water is not influenced by temperature.