CHE 107 Spring 2017 Exam 2

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

_____

Question #: 1

The decomposition of $PH_3(g)$ can be described by
    $4\ PH_3(g) \rightarrow P_4(g) + 6\ H_2(g)$.
The average rate of disappearance of $PH_3(g)$ was 0.36 M/s over a given time interval. What is the average rate of appearance of $H_2(g)$ over the same time interval?
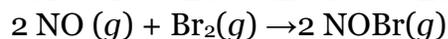   __1__ M/s
Report your answer with **two** significant figures. Do **NOT** include units in your answer.

1. _____

_____

Question #: 2

The table below shows the data collected for the reaction:
    $2\ NO\ (g) + Br_2(g) \rightarrow 2\ NOBr(g)$
where rate = $k[NO]^x[Br_2]^y$

[NO] (M)	[Br₂] (M)	Initial Rate [NOBr] (M/s)
0.10	0.20	24
0.25	0.20	150
0.10	0.50	60
0.35	0.50	735

What is the order of the reaction, x, with respect to NO? $x =$ __1__
What is the order of the reaction, y, with respect to Br₂? $y =$ __2__
What is the overall order of the reaction? __3__
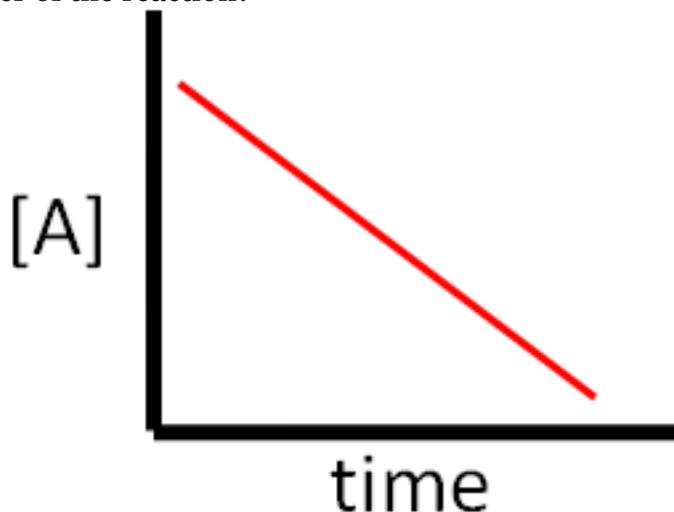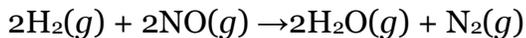
1. _____
2. _____
3. _____

_____

Question #: 3

Based on the graph of concentration vs. time below for the reaction A → products, what is the order of the reaction?

A. Zero order
B. First order
C. Second order
D. There is not enough information to answer the question.

_____

Question #: 4

The rate law for the reaction below was experimentally determined to be rate = $k[H_2][NO]^2$.
$2H_2(g) + 2NO(g) \rightarrow 2H_2O(g) + N_2(g)$
If the rate is measured to be 0.014 M/s, what is the rate if $[H_2]$ is halved and $[NO]$ is doubled?

A. 0.028 M/s
B. 0.056 M/s
C. 0.0070 M/s
D. 0.112 M/s

_____

In an experiment for a reaction with the general form of $2A \rightarrow B$, a plot of $\ln[A]$ versus time resulted in a straight line with a slope of -3.58×10^{-2} min^{-1}.
If initially $[A]= 1.00$ M, how much time, in **minutes**, is required for $[A]$ to decrease to 0.150 M?
__1__ min
Report your answer with **three** significant figures. Do **NOT** include units in your answer.

1. _____

For a second order reaction, the slope of the straight-line graph below is _____ and the y-intercept is _____.

Time

A. k, $1/[A]_o$
B. k, $1/[A]_t$
C. $1/k$, $[A]_t$
D. $1/k$, $[A]_o$

Question #: 7

The zero-order decomposition of ammonia on a hot tungsten surface proceeds according to
   $2\ NH_3(g) \rightarrow N_2(g) + 3\ H_2(g)$.
The reaction has a half-life of 2.40×10^3 seconds when the initial ammonia concentration is 2.00 M. How long does it take for the concentration of ammonia to decrease from 2.00 M to 1.16 M?
$t =$ __1__ seconds
Report your answer with **two** significant figures.   Do **NOT** include units in your answer. Use the format 2.2E2 or 2.2E-2 for numbers in scientific notation.

1. _____

Question #: 8

The rate of a first order reaction at 30°C is 0.0035 M/s. If the temperature of the reaction is raised to 45°C, what will happen to the rate of the reaction?

A. The rate will increase.
B. The rate will decrease.
C. The rate will stay the same.

Fill in the blank with the term that corresponds to the appropriate number on the diagram below.   Choose from **transition state**, **activation energy**, or **reaction enthalpy**.

Reaction progress

<u>1</u>   <u>2</u>   <u>3</u>

1. _____
2. _____
3. _____

If a temperature increase from 10.0°C to 20.0°C doubles the rate constant for a reaction, what is the **activation energy** for the reaction?

A. 47.8 kJ/mol
B. 1.14 kJ/mol
C. −0.576 kJ/mol
D. 129 kJ/mol

The mechanism below has been proposed for a certain gas phase reaction.
Step 1: NO + O_3 → NO_2 + O_2
Step 2: O + NO_2 → NO + O_2
In this mechanism:
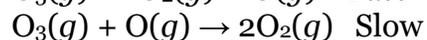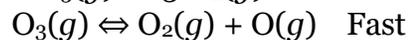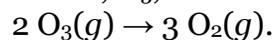 __1__ is a catalyst.
  __2__ is a reaction intermediate.
Enter your answer without formatting the subscripts, e.g., enter H_2O as H2O.   If the answer is none, type none; do not leave it blank.
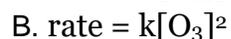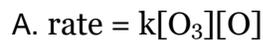

1. _____

2. _____

Ozone, O_3, naturally decomposes to oxygen, O_2, by the mechanism below for the overall reaction $2 O_3(g)$ → $3 O_2(g)$.
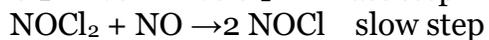$O_3(g)$ ⇔ $O_2(g)$ + $O(g)$ Fast
$O_3(g)$ + $O(g)$ → $2O_2(g)$ Slow
What is the rate law for this reaction?

A. rate = $k[O_3][O]$
B. rate = $k[O_3]^2$
C. rate = $k[O_3]^2[O_2]^{-1}$
D. rate = $k[O_3]^2[O_2]^3$

Which **graph** best describes the gas-phase reaction below?

$Cl_2 + NO \Leftrightarrow NOCl_2$ fast step

$NOCl_2 + NO \rightarrow 2\ NOCl$ slow step

_____

$Cl_2 + 2\ NO \rightarrow 2\ NOCl$ overall reaction

A.

B.
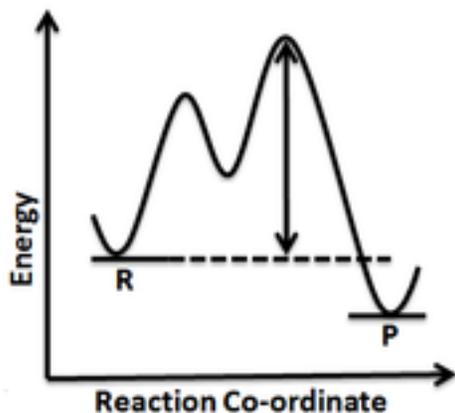
C.

Reaction Co-ordinate

D.

Reaction Co-ordinate

Question #: 14

Choose the answer that **best describes** how a catalyst affects the reaction rate.

A. A catalyst increases the rate of a reaction by increasing the temperature.
B. A catalyst decreases the rate of a reaction by decreasing the rate constant, k.
C. A catalyst increases the rate of a reaction by decreasing the activation energy, E_a.
D. A catalyst decreases the rate of a reaction by increasing the activation energy, E_a.
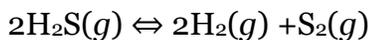

Select the **<u>two true</u>** statements regarding chemical equilibrium.

    A. At equilibrium, the rates of the forward and reverse reactions are equal.
    B. At constant temperature, the equilibrium concentrations will not change if the initial concentrations change.
    C. At constant temperature, the calculated equilibrium constant will not change if the initial concentrations change.
    D. At equilibrium, both the forward and reverse reactions cease to occur.

Consider the reaction for the decomposition of hydrogen sulfide.
$2H_2S(g) \Leftrightarrow 2H_2(g) + S_2(g)$
At 800°C, K_c for this reaction is 1.67 x 10^{-7}.
At equilibrium:

    A. the forward reaction is favored.
    B. the reverse reaction is favored.
    C. neither direction is favored.
    D. the reaction will stop.

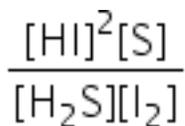Which of the following is the correct equilibrium constant expression, K_c, for the reaction below?
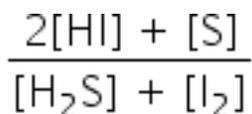$H_2S(g) + I_2(s) \Leftrightarrow 2\,HI(g) + S(s)$

A.
$$\frac{[2HI]}{[H_2S]}$$

B.
$$\frac{[HI]^2}{[H_2S]}$$

C.

$$\frac{[HI]^2[S]}{[H_2S][I_2]}$$

D.

$$\frac{2[HI] + [S]}{[H_2S] + [I_2]}$$

Question #: 18

Calculate the equilibrium constant for
$N_2(g) + O_2(g) + Br_2(g) \Leftrightarrow 2\ NOBr(g)$
given
$2\ NOBr(g) \Leftrightarrow 2\ NO(g) + Br_2(g)$ $K = 0.50$
$2\ NO(g) \Leftrightarrow N_2(g) + O_2(g)$ $K = 2.1 \times 10^{30}$.
$K =$ __1__
Report your answer with **two** significant figures in scientific notation with the format 2.2E2 or 2.2E-2. Do **NOT** include units in your answer.

1. _____

Question #: 19

Consider the following reaction and the corresponding value of K_c:
$2\ A\ (g) + B\ (g) \Leftrightarrow 2\ C\ (g)$ $K_c = 6.2 \times 10^2$ at 25 °C
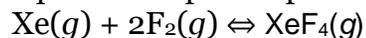What is the value of K_p at this temperature?
$K_p =$ __1__
Report your answer with **two** significant figures. Use the format 2.2E2 or 2.2E-2 for numbers in scientific notation. Do **NOT** include units in your answer.
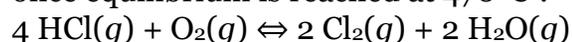
1. _____

A reaction mixture intially contains 2.24 atm of Xe and 4.27 atm of F_2 gases at 298 K. If the equilibrium partial pressure of Xe is 0.34 atm, what is K_P for the reaction below at 298 K?
$Xe(g) + 2F_2(g) \Leftrightarrow XeF_4(g)$

    A. 25
    B. 1.2×10^{-5}
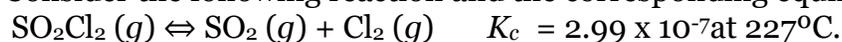   C. 8.3
    D. 242

K_p at 470°C for the reaction below is 27.3. Initially 1.00 atm of $HCl(g)$, 2.00 atm of $O_2(g)$, 2.00 atm of $Cl_2(g)$ and 1.00 atm of $H_2O(g)$ were injected into an empty rigid reaction vessel and then heated to 470°C and allowed to reach equilibrium. Which of the following statements is **true** once equilibrium is reached at 470°C ?
$4\ HCl(g) + O_2(g) \Leftrightarrow 2\ Cl_2(g) + 2\ H_2O(g)$

    A. The total pressure will be 6.00 atm.
    B. The total pressure will be less than 6.00 atm
    C. The total pressure will be greater than 6.00 atm.
    D. The total pressure will be 27.3 atm.

Consider the following reaction and the corresponding equilibrium constant:
$SO_2Cl_2\ (g) \Leftrightarrow SO_2\ (g) + Cl_2\ (g)$ K_c = 2.99 x 10^{-7} at 227°C.
If a reaction vessel initially contains 0.00175 M SO_2Cl_2 at 227 °C, find the equilibrium concentration of Cl_2 at this temperature.
Report your answer to **three** significant figures. Do **NOT** include units in your answer. Use the format 2.22E2 or 2.22E-2 for numbers in scientific notation
$[Cl_2]$ = __1__ M

    1. _____

Which change will cause the reaction below to shift to **products**?
$H_2(g) + S(s) \Leftrightarrow H_2S(g)$ $\Delta H_{rxn} = -20.2$ kJ

    A. Adding 1.0 g of $S(s)$
    B. Adding 1.0 g of $Xe(g)$ at constant volume
    C. Reducing the volume of the container
    D. Increasing the volume of the container
    E. Heating the reaction
    F. Cooling the reaction

Plants produce energy by photosynthesis according to the following reaction:
$6CO_2(g) + 6H_2O(l) \Leftrightarrow C_6H_{12}O_6(aq) + 6O_2(g)$ $\Delta H^o_{rxn} = 2801$ kJ
If the temperature is **increased**, the reaction with shift __1__ **[right, left]** and the value of K will be __2__ **[larger, smaller, constant]**.

    1. _____
    2. _____

Select the **two true** options for a solution at 25°C when $[OH^-] = 1.3 \times 10^{-10}$ M.

    A. The solution is acidic.
    B. The solution is basic.
    C. $[OH^-] < [H_3O^+]$
    D. $[OH^-] = [H_3O^+]$

Select the **two true** statements regarding strong and weak acids.

    A. Weak acids completely ionize in aqueous solutions.
    B. Nitric acid is a strong acid.
    C. For a strong acid solution, $[H_3O^+]$ depends only on the initial acid concentration.
    D. A weak acid will have a weak conjugate base.

Which acid is **strongest**?

    A. hydrofluoric acid, HF, $K_a = 3.5 \times 10^{-4}$
    B. chlorous acid, $HClO_2$, $K_a = 1.1 \times 10^{-2}$
    C. benzoic acid, $HC_7H_5O_2$, $K_a = 6.5 \times 10^{-5}$
    D. hydrocyanic acid, HCN, $K_a = 4.9 \times 10^{-10}$

Calculate $[OH^-]$ in a solution containing $[H_3O^+] = 7.5 \times 10^{-5}$ M at **40 ⁰C.**

Temperature (⁰C)	K_w
0	1.14×10^{-15}
10	2.93×10^{-15}
20	6.81×10^{-15}
25	1.00×10^{-14}
30	1.47×10^{-14}
40	2.92×10^{-14}
50	5.48×10^{-14}

Report your answer with **two** significant figures. Do **NOT** include units in your answer. Use the format 2.2E2 or 2.2E-2 for numbers in scientific notation
$[OH^-]$ = ___1___ M

    1. _____

What is the pH of a solution that has an $OH^-(aq)$ concentration of 7.8×10^{-6} M at 25.0°C?
pH = ___1___
Report your answer with **three** significant figures. Do **NOT** include units in your answer.

1. _____

_____

Select the **two** choices that list a conjugate acid-base pair.

A. NH_4^+ and NH_3
B. H_2SO_4 and SO_4^{2-}
C. $HC_2H_3O_2$ and $C_2H_3O_2^-$
D. H_3O^+ and OH^-

CHE 107 Spring 2017 Exam 2 - Confidential

Your Name: _____   **Your ID:** _____
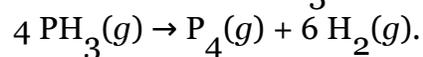
Periodic Table of the Elements

Molar volume of ideal gas at STP = 22.4 L	Ideal gas constant:	Speed of light, $c = 3.00 \times 10^8$ m•s^{-1}
Faraday constant, $F = 9.6485 \times 10^4$ C/mol e	$R = 8.314$ J•K^{-1}•mol^{-1}	Rydberg constant, $R_H = 2.18 \times 10^{-18}$ J
Avogadro's number, $N = 6.022 \times 10^{23}$ mol^{-1}	$R = 1.987$ cal•K^{-1}•mol^{-1}	Electron charge, $e = 1.602 \times 10^{-19}$ C
Planck's constant, $h = 6.626 \times 10^{-34}$ J•s	$R = 8.206 \times 10^{-2}$ L•atm•K^{-1}•mol^{-1}	Atomic mass unit, $u = 1.6605 \times 10^{-24}$ g

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Question #: 1

The decomposition of $PH_3(g)$ can be described by
$$4\ PH_3(g) \rightarrow P_4(g) + 6\ H_2(g).$$
The average rate of disappearance of $PH_3(g)$ was 0.36 M/s over a given time interval. What is the average rate of appearance of $H_2(g)$ over the same time interval?
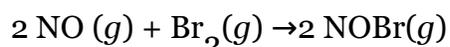
_____1_____ M/s

Report your answer with **two** significant figures. Do **NOT** include units in your answer.

1. 0.54

Question #: 2

The table below shows the data collected for the reaction:

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

where rate $= k[NO]^x[Br_2]^y$

[NO] (M)	[Br$_2$] (M)	Initial Rate [NOBr] (M/s)
0.10	0.20	24
0.25	0.20	150
0.10	0.50	60
0.35	0.50	735

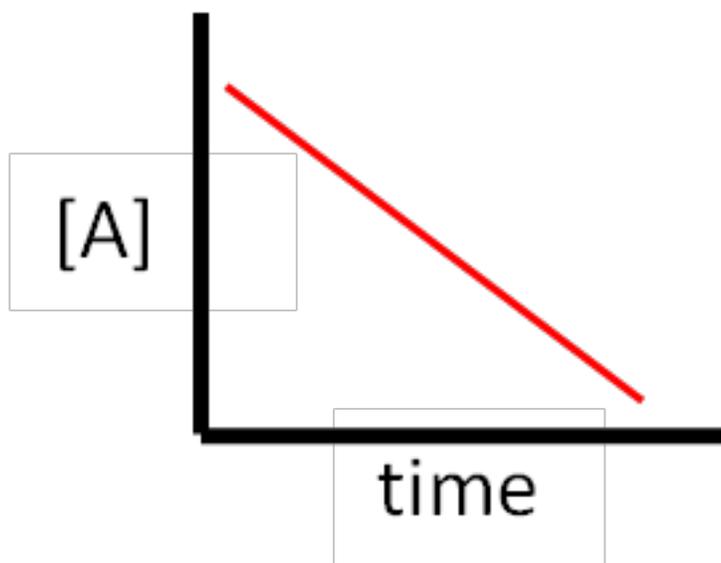What is the order of the reaction, x, with respect to NO? x = ___1___

What is the order of the reaction, y, with respect to Br$_2$? y = ___2___

What is the overall order of the reaction? ___3___

1. 2|two|second|2nd|
2. 1|one|first|1st|
3. 3|three|third|3rd|

Question #: 3

Based on the graph of concentration vs. time below for the reaction A → products, what is the order of the reaction?
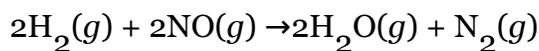

✓A. Zero order

B. First order

C. Second order

D. There is not enough information to answer the question.

Question #: 4

The rate law for the reaction below was experimentally determined to be rate = $k[H_2][NO]^2$.

$2H_2(g) + 2NO(g) \rightarrow 2H_2O(g) + N_2(g)$

If the rate is measured to be 0.014 M/s, what is the rate if $[H_2]$ is halved and [NO] is doubled?

✓A. 0.028 M/s

B. 0.056 M/s

C. 0.0070 M/s

D. 0.112 M/s

Question #: 5

In an experiment for a reaction with the general form of $2A \rightarrow B$, a plot of ln[A] versus time resulted in a straight line with a slope of -3.58×10^{-2} min^{-1}.

If initially [A]= 1.00 M, how much time, in **minutes**, is required for [A] to decrease to 0.150 M?
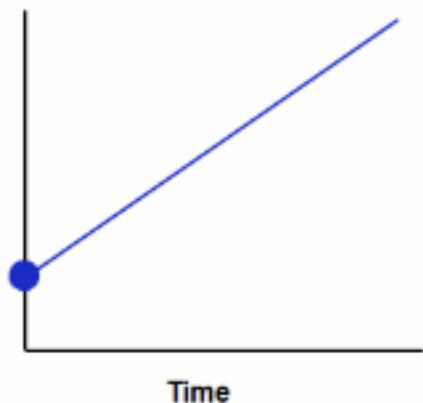
___1___ min

Report your answer with **three** significant figures. Do **NOT** include units in your answer.
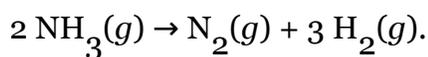
1. 53.0

Question #: 6

For a second order reaction, the slope of the straight-line graph below is _____ and the y-intercept is _____.

Time
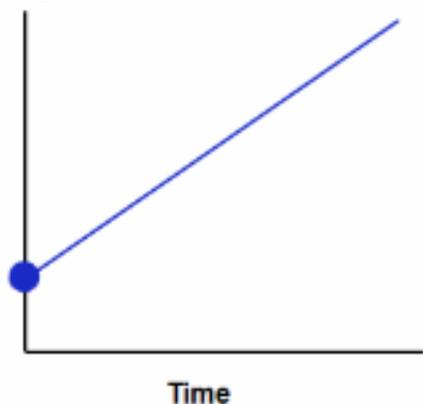
✓A. k, $1/[A]_0$
B. k, $1/[A]_t$
C. $1/k$, $[A]_t$
D. $1/k$, $[A]_0$

Question #: 7

The zero-order decomposition of ammonia on a hot tungsten surface proceeds according to
$2\, NH_3(g) \rightarrow N_2(g) + 3\, H_2(g)$.
The reaction has a half-life of 2.40×10^3 seconds when the initial ammonia concentration is 2.00 M. How long does it take for the concentration of ammonia to decrease from 2.00 M to 1.16 M?

$t =$ __1__ seconds

Report your answer with **two** significant figures. Do **NOT** include units in your answer. Use the format 2.2E2 or 2.2E-2 for numbers in scientific notation.

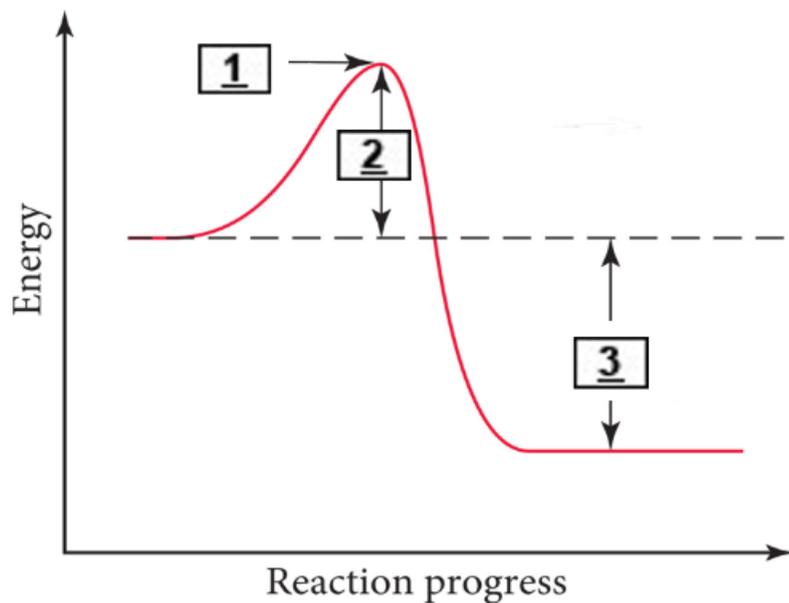1. 2.0E3

Question #: 8

The rate of a first order reaction at 30°C is 0.0035 M/s. If the temperature of the reaction is raised to 45°C, what will happen to the rate of the reaction?

✓A. The rate will increase.

B. The rate will decrease.
C. The rate will stay the same.

Question #: 9

Fill in the blank with the term that corresponds to the appropriate number on the diagram below. Choose from **transition state**, **activation energy**, or **reaction enthalpy**.

Reaction progress

1 ___   2 ___   3 ___

1. transition state
2. activation energy
3. reaction enthalpy
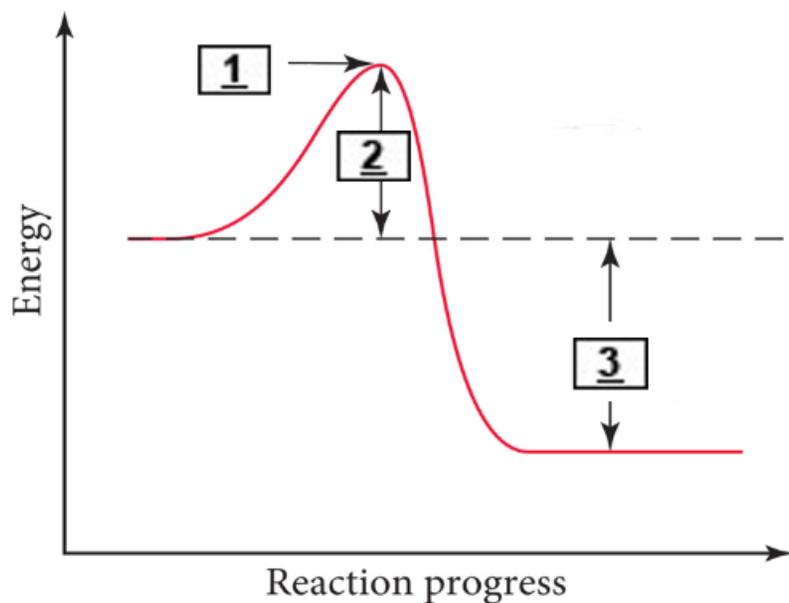
Question #: 10

If a temperature increase from 10.0°C to 20.0°C doubles the rate constant for a reaction, what is the **activation energy** for the reaction?
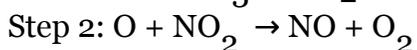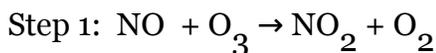
✓A. 47.8 kJ/mol
B. 1.14 kJ/mol

C. −0.576 kJ/mol

D. 129 kJ/mol

Question #: 11

The mechanism below has been proposed for a certain gas phase reaction.
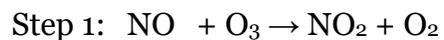
Step 1: $NO + O_3 \rightarrow NO_2 + O_2$

Step 2: $O + NO_2 \rightarrow NO + O_2$

In this mechanism:

___1___ is a catalyst.

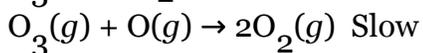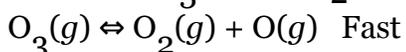___2___ is a reaction intermediate.

Enter your answer without formatting the subscripts, e.g., enter H_2O as H2O. If the answer is none, type none; do not leave it blank.

1. <u>NO</u>
2. <u>NO2</u>

Question #: 12

Ozone, O_3, naturally decomposes to oxygen, O_2, by the mechanism below for the overall reaction $2\,O_3(g) \rightarrow 3\,O_2(g)$.

$O_3(g) \leftrightarrow O_2(g) + O(g)$ Fast

$O_3(g) + O(g) \rightarrow 2O_2(g)$ Slow

What is the rate law for this reaction?

A. rate = $k[O_3][O]$

B. rate = $k[O_3]^2$

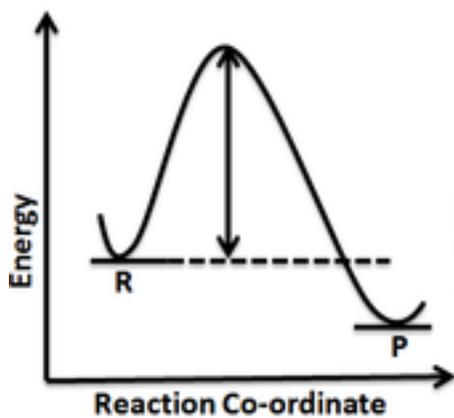✓C. rate = $k[O_3]^2[O_2]^{-1}$

D. rate = $k[O_3]^2[O_2]^3$

Question #: 13

Which **graph** best describes the gas-phase reaction below?
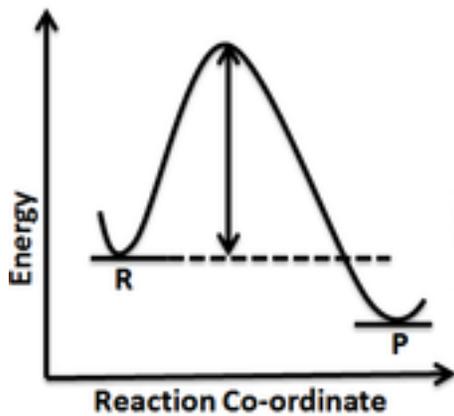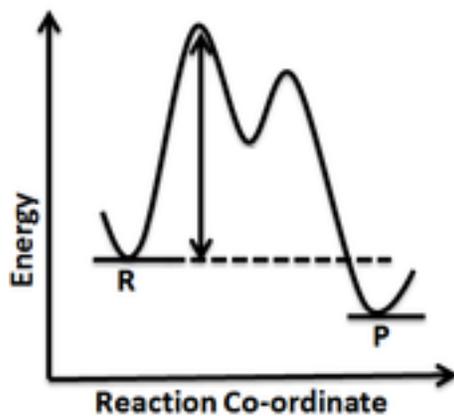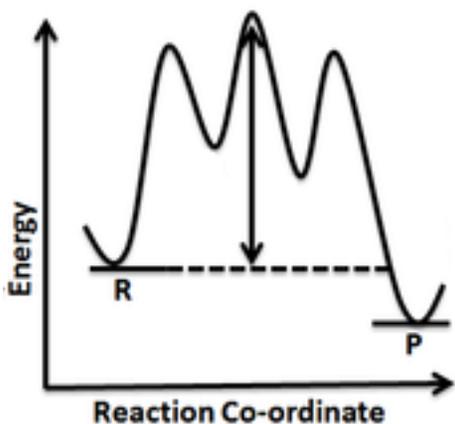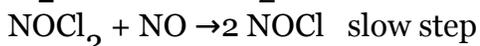
$Cl_2 + NO \leftrightarrow NOCl_2$ fast step

$NOCl_2 + NO \rightarrow 2\,NOCl$ slow step

_____

$Cl_2 + 2\,NO \rightarrow 2\,NOCl$ overall reaction
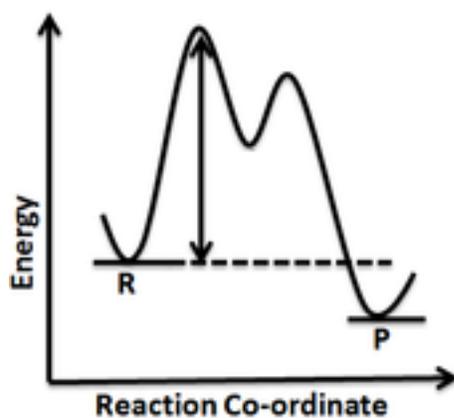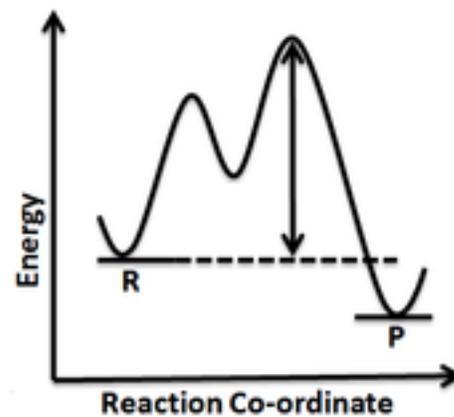
A.

B.

✓C.

D.

Reaction Co-ordinate

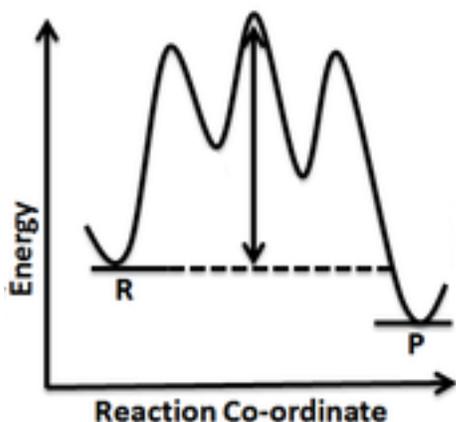**Question #:** 14

Choose the answer that **best describes** how a catalyst affects the reaction rate.

    A. A catalyst increases the rate of a reaction by increasing the temperature.
    B. A catalyst decreases the rate of a reaction by decreasing the rate constant, k.
    ✓C. A catalyst increases the rate of a reaction by decreasing the activation energy, E_a.
    D. A catalyst decreases the rate of a reaction by increasing the activation energy, E_a.

Question #: 15

Select the **two true** statements regarding chemical equilibrium.

    ✓A. At equilibrium, the rates of the forward and reverse reactions are equal.
    B. At constant temperature, the equilibrium concentrations will not change if the initial concentrations change.
    ✓C. At constant temperature, the calculated equilibrium constant will not change if the initial concentrations change.
    D. At equilibrium, both the forward and reverse reactions cease to occur.

Question #: 16

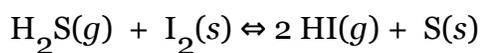Consider the reaction for the decomposition of hydrogen sulfide.
$$2H_2S(g) \leftrightarrow 2H_2(g) + S_2(g)$$
At 800°C, K_c for this reaction is 1.67×10^{-7}.

At equilibrium:

   A. the forward reaction is favored.
  ✓B. the reverse reaction is favored.
   C. neither direction is favored.
   D. the reaction will stop.

Question #: 17

Which of the following is the correct equilibrium constant expression, K_c, for the reaction below?

$$H_2S(g) \;+\; I_2(s) \rightleftharpoons 2\,HI(g) \;+\; S(s)$$

A.
$$\frac{[2HI]}{[H_2S]}$$

✓B.
$$\frac{[HI]^2}{[H_2S]}$$

C.
$$\frac{[HI]^2[S]}{[H_2S][I_2]}$$

D.
$$\frac{2[HI] + [S]}{[H_2S] + [I_2]}$$

Question #: 18

Calculate the equilibrium constant for

$$N_2(g) + O_2(g) + Br_2(g) \rightleftharpoons 2\,NOBr(g)$$

given

$2\ NOBr(g) \Leftrightarrow 2\ NO(g) + Br_2(g)$ $K = 0.50$

$2\ NO(g) \Leftrightarrow N_2(g) + O_2(g)$ $K = 2.1 \times 10^{30}$.

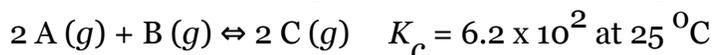$K =$ __1__
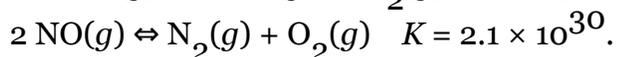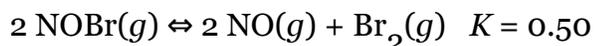
Report your answer with **two** significant figures in scientific notation with the format 2.2E2 or 2.2E-2. Do **NOT** include units in your answer.

1. 9.5E-31

Question #: 19

Consider the following reaction and the corresponding value of K_c:

$2\ A\ (g) + B\ (g) \Leftrightarrow 2\ C\ (g)$ $K_c = 6.2 \times 10^2$ at $25\ ^{\circ}C$

What is the value of K_p at this temperature?

$K_p =$ __1__

Report your answer with **two** significant figures. Use the format 2.2E2 or 2.2E-2 for numbers in scientific notation. Do **NOT** include units in your answer.

1. 25|2.5E1|

Question #: 20

A reaction mixture intially contains 2.24 atm of Xe and 4.27 atm of F_2 gases at 298 K. If the equilibrium partial pressure of Xe is 0.34 atm, what is K_P for the reaction below at 298 K?

$Xe(g) + 2F_2(g) \Leftrightarrow XeF_4(g)$
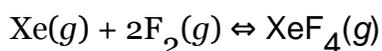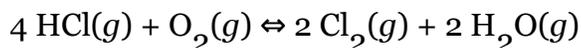
✓A. 25

B. 1.2×10^{-5}

C. 8.3

D. 242

Question #: 21

K_p at 470°C for the reaction below is 27.3. Initially 1.00 atm of HCl(g), 2.00 atm of $O_2(g)$, 2.00 atm of $Cl_2(g)$ and 1.00 atm of $H_2O(g)$ were injected into an empty rigid reaction vessel and then heated to 470°C and allowed to reach equilibrium. Which of the following statements is **true**
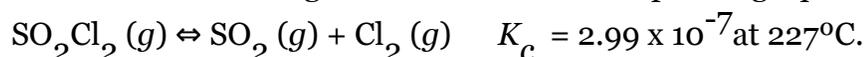
once equilibrium is reached at 470°C ?

$4\ HCl(g) + O_2(g) \leftrightarrow 2\ Cl_2(g) + 2\ H_2O(g)$

    A. The total pressure will be 6.00 atm.
   ✓B. The total pressure will be less than 6.00 atm
    C. The total pressure will be greater than 6.00 atm.
    D. The total pressure will be 27.3 atm.

Question #: 22

Consider the following reaction and the corresponding equilibrium constant:

$SO_2Cl_2\ (g) \leftrightarrow SO_2\ (g) + Cl_2\ (g)$ $K_c = 2.99$ x 10^{-7} at 227°C.

If a reaction vessel initially contains 0.00175 M SO_2Cl_2 at 227 °C, find the equilibrium concentration of Cl_2 at this temperature.
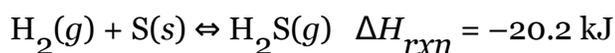
Report your answer to **three** significant figures. Do **NOT** include units in your answer. Use the format 2.22E2 or 2.22E-2 for numbers in scientific notation

$[Cl_2] =$ __1__ M

    1. 2.29E-5|0.0000229|

Question #: 23

Which change will cause the reaction below to shift to **products**?

$H_2(g) + S(s) \leftrightarrow H_2S(g)$ $\Delta H_{rxn} = -20.2$ kJ

    A. Adding 1.0 g of S(s)
    B. Adding 1.0 g of Xe(g) at constant volume
    C. Reducing the volume of the container
    D. Increasing the volume of the container
    E. Heating the reaction
   ✓F. Cooling the reaction

Question #: 24

Plants produce energy by photosynthesis according to the following reaction:
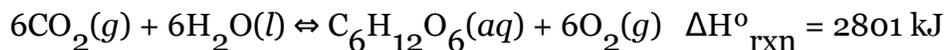
$6CO_2(g) + 6H_2O(l) \leftrightharpoons C_6H_{12}O_6(aq) + 6O_2(g) \quad \Delta H°_{rxn} = 2801 \text{ kJ}$

If the temperature is **increased**, the reaction with shift __1__ **[right, left]** and the value of K will be __2__ **[larger, smaller, constant]**.

1. right
2. larger

Question #: 25

Select the **two true** options for a solution at 25°C when $[OH^-] = 1.3 \times 10^{-10}$ M.

✓A. The solution is acidic.
  B. The solution is basic.
✓C. $[OH^-] < [H_3O^+]$
  D. $[OH^-] = [H_3O^+]$

Question #: 26

Select the **two true** statements regarding strong and weak acids.

  A. Weak acids completely ionize in aqueous solutions.
✓B. Nitric acid is a strong acid.
✓C. For a strong acid solution, $[H_3O^+]$ depends only on the initial acid concentration.
  D. A weak acid will have a weak conjugate base.

Question #: 27

Which acid is **strongest**?

  A. hydrofluoric acid, HF, $K_a = 3.5 \times 10^{-4}$
✓B. chlorous acid, $HClO_2$, $K_a = 1.1 \times 10^{-2}$
  C. benzoic acid, $HC_7H_5O_2$, $K_a = 6.5 \times 10^{-5}$
  D. hydrocyanic acid, HCN, $K_a = 4.9 \times 10^{-10}$

Calculate [OH⁻] in a solution containing $[H_3O^+]$ = 7.5 x 10⁻⁵ M at **40 °C.**

Temperature (°C)	K_w
0	1.14 x 10⁻¹⁵
10	2.93 x 10⁻¹⁵
20	6.81 x 10⁻¹⁵
25	1.00 x 10⁻¹⁴
30	1.47 x 10⁻¹⁴
40	2.92 x 10⁻¹⁴
50	5.48 x 10⁻¹⁴

Report your answer with **two** significant figures. Do **NOT** include units in your answer. Use the format 2.2E2 or 2.2E-2 for numbers in scientific notation

[OH⁻] = __1__ M

   1. 3.9E-10|0.00000000039|

What is the pH of a solution that has an OH⁻(aq) concentration of 7.8 ×10⁻⁶ M at 25.0°C?

pH = __1__

Report your answer with **three** significant figures. Do **NOT** include units in your answer.

   1. 8.89

Select the **two** choices that list a conjugate acid-base pair.

   ✓A. NH_4^+ and NH_3
    B. H_2SO_4 and SO_4^{2-}
   ✓C. $HC_2H_3O_2$ and $C_2H_3O_2^-$
    D. H_3O^+ and OH^-