

Review Quiz Units A, B, C, D, E, F

Name _____ Per _____

You may write on your Quiz pages.

Mark all of your answers carefully on this grade cam sheet.

No calculator. You will have 21 min to work on the Quiz

You may use only your AP Periodic Table and Formula Sheets.

Please bubble in your 6 digit student ID number.



GradeCam ID

--	--	--	--	--	--

1. (A) (B) (C) (D) (X)	8. (A) (B) (C) (D) (X)	0	0	0	0	0	0
2. (A) (B) (C) (D) (X)	9. (A) (B) (C) (D) (X)	1	1	1	1	1	1
3. (A) (B) (C) (D) (X)	10. (A) (B) (C) (D) (X)	2	2	2	2	2	2
4. (A) (B) (C) (D) (X)	11. (A) (B) (C) (D) (X)	3	3	3	3	3	3
5. (A) (B) (C) (D) (X)	12. (A) (B) (C) (D) (X)	4	4	4	4	4	4
6. (A) (B) (C) (D) (X)	13. (A) (B) (C) (D) (X)	5	5	5	5	5	5
7. (A) (B) (C) (D) (X)	14. (A) (B) (C) (D) (X)	6	6	6	6	6	6
		7	7	7	7	7	7
		8	8	8	8	8	8
		9	9	9	9	9	9

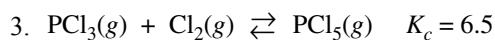
Review Quiz Units A, B, C, D, E, F

Use the information below to answer questions 1-3.

M^+ is an unknown metal cation with a +1 charge. A student dissolves the chloride of the unknown metal, MCl , in enough water to make 100.0 mL of solution. The student then mixes the solution with excess $AgNO_3$ solution, causing $AgCl$ to precipitate. The student collects the precipitate by filtration, dries it, and records the data shown below. (The molar mass of $AgCl$ is 143 g/mol.)

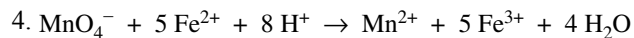
Mass of unknown chloride, MCl	0.74 g
Mass of filter paper	0.80 g
Mass of filter paper plus $AgCl$ precipitate	2.23 g

- What is the identity of the metal chloride?
 - $NaCl$
 - KCl
 - $CuCl$
 - $LiCl$
- During the course of the experiment, which of the following happens to the NO_3^- ions?
 - They are oxidized by Cl^- ions.
 - They are reduced to NO_2^- ions.
 - They are decomposed by reacting with M^+ ions.
 - They remain dissolved in the filtrate solution.



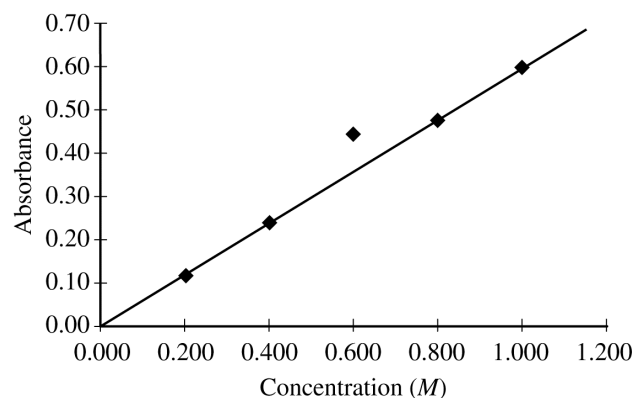
At a certain point in time, a 1.00 L rigid reaction vessel contains 1.5 mol of $PCl_3(g)$, 1.0 mol of $Cl_2(g)$, and 2.5 mol of $PCl_5(g)$. Which of the following describes how the measured pressure in the reaction vessel will change and why it will change that way as the reaction system approaches equilibrium at constant temperature?

- The pressure will increase because $Q < K_c$.
- The pressure will increase because $Q > K_c$.
- The pressure will decrease because $Q < K_c$.
- The pressure will decrease because $Q > K_c$.



In the reaction represented above, the number of MnO_4^- ions that react must be equal to which of the following?

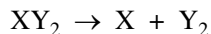
- One-fifth the number of Fe^{2+} ions that are consumed
- Eight times the number of H^+ ions that are consumed
- Five times the number of Fe^{3+} ions that are produced
- One-half the number of H_2O molecules that are produced



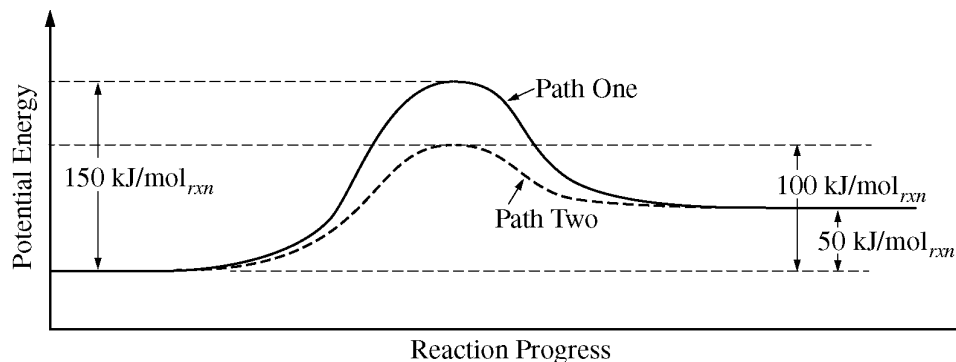
- A student prepared five solutions of $CuSO_4$ with different concentrations, and then filled five cuvettes, each containing one of the solutions. The cuvettes were placed in a spectrophotometer set to the appropriate wavelength for maximum absorbance. The absorbance of each solution was measured and recorded. The student plotted absorbance versus concentration, as shown in the figure above. Which of the following is the most likely explanation for the variance of the data point for the 0.600 M $CuSO_4$ solution?
 - The cuvette into which the 0.600 M solution was placed had some water droplets inside.
 - The cuvette into which the 0.600 M solution was placed was filled slightly more than the other cuvettes.
 - The wavelength setting was accidentally moved away from that of maximum absorbance.
 - The cuvette used for the 0.600 M solution had not been wiped clean before being put in the spectrophotometer.

Review Quiz Units A, B, C, D, E, F

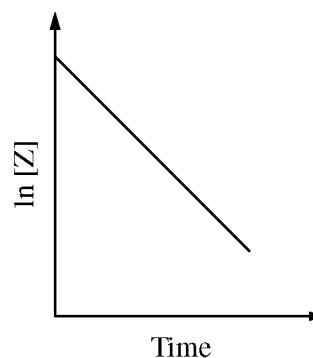
Use the following information and energy profile to answer questions 6-8.



The equation above represents the decomposition of a compound XY_2 . The diagram below shows two reaction profiles (path one and path two) for the decomposition of XY_2 .



6. Which of the following most likely accounts for the difference between reaction path one and reaction path two?
- (A) A higher temperature in path one
(B) A higher temperature in path two
(C) The presence of a catalyst in path one
(D) The presence of a catalyst in path two
7. Which of the following best describes the flow of heat when 1.0 mol of XY_2 decomposes?
- (A) 50 kJ of heat is transferred to the surroundings.
(B) 50 kJ of heat is transferred from the surroundings.
(C) 100 kJ of heat is transferred to the surroundings.
(D) 100 kJ of heat is transferred from the surroundings.
8. The reaction is thermodynamically favorable under standard conditions at 298 K. Therefore, the value of ΔS° for the reaction must be
- (A) equal to zero
(B) equal to $\Delta H^\circ/298 \text{ K}$
(C) greater than $\Delta H^\circ/298 \text{ K}$
(D) less than $\Delta H^\circ/298 \text{ K}$



9. Consider the reaction represented by the equation $2 \text{X} + 2 \text{Z} \rightarrow \text{X}_2\text{Z}_2$. During a reaction in which a large excess of reactant X was present, the concentration of reactant Z was monitored over time. A plot of the natural logarithm of the concentration of Z versus time is shown in the figure above. The order of the reaction with respect to reactant Z is
- (A) zero order
(B) first order
(C) second order
(D) third order

Review Quiz Units A, B, C, D, E, F

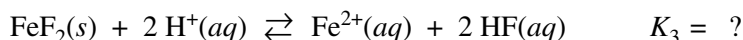
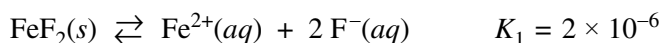
Use the following information to answer questions 10-12

The table below contains information about samples of four different gases at 273 K. The samples are in four identical rigid containers numbered 1 through 4.

Container	Gas	Pressure (atm)	Mass of Sample (g)
1	He	2.00	?
2	Ne	2.00	?
3	?	2.00	16.0
4	SO ₂	1.96	64.1

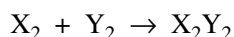
10. On the basis of the data provided above, the gas in container 3 could be

- (A) CH₄
- (B) O₂
- (C) Ar
- (D) CO₂



13. On the basis of the information above, the dissolution of FeF₂(s) in acidic solution is

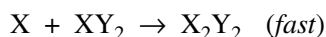
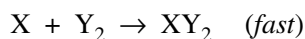
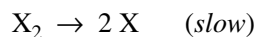
- (A) thermodynamically favorable, because $K_2 > 1$
- (B) thermodynamically favorable, because $K_3 > 1$
- (C) not thermodynamically favorable, because $K_1 < 1$
- (D) not thermodynamically favorable, because $K_3 < 1$



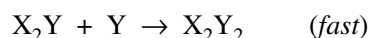
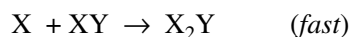
$$\text{rate} = k[\text{X}_2]$$

A reaction and its experimentally determined rate law are represented above. A chemist proposes two different possible mechanisms for the reaction, which are given below.

Mechanism 1



Mechanism 2



14. Based on the information above, which of the following is true?

- (A) Only mechanism 1 is consistent with the rate law.
- (B) Only mechanism 2 is consistent with the rate law.
- (C) Both mechanism 1 and mechanism 2 are consistent with the rate law.
- (D) Neither mechanism 1 nor mechanism 2 is consistent with the rate law.

11. Under the conditions given, consider containers 1, 2, and 4 only. The average speed of the gas particles is

- (A) greatest in container 1
- (B) greatest in container 2
- (C) greatest in container 4
- (D) the same in containers 1, 2, and 4

12. The best explanation for the lower pressure in container 4 is that SO₂ molecules

- (A) have a larger average speed than the other three gases
- (B) occupy a larger portion of the container volume than the other three gases
- (C) have stronger intermolecular attractions than the other three gases
- (D) contain π bonds, while the other gases contain only σ bonds

Review Quiz Units A, B, C, D, E, F

ANSWERS

Use the information below to answer questions 1-3.

M^+ is an unknown metal cation with a +1 charge. A student dissolves the chloride of the unknown metal, MCl , in enough water to make 100.0 mL of solution. The student then mixes the solution with excess $AgNO_3$ solution, causing $AgCl$ to precipitate. The student collects the precipitate by filtration, dries it, and records the data shown below. (The molar mass of $AgCl$ is 143 g/mol.)

Mass of unknown chloride, MCl	0.74 g
Mass of filter paper	0.80 g
Mass of filter paper plus $AgCl$ precipitate	2.23 g

1. What is the identity of the metal chloride?

- (A) $NaCl$
- (B) KCl
- (C) $CuCl$
- (D) $LiCl$

2. During the course of the experiment, which of the following happens to the NO_3^- ions?

- (A) They are oxidized by Cl^- ions.
- (B) They are reduced to NO_2^- ions.
- (C) They are decomposed by reacting with M^+ ions.
- (D) They remain dissolved in the filtrate solution.

3. $PCl_3(g) + Cl_2(g) \rightleftharpoons PCl_5(g) \quad K_c = 6.5$

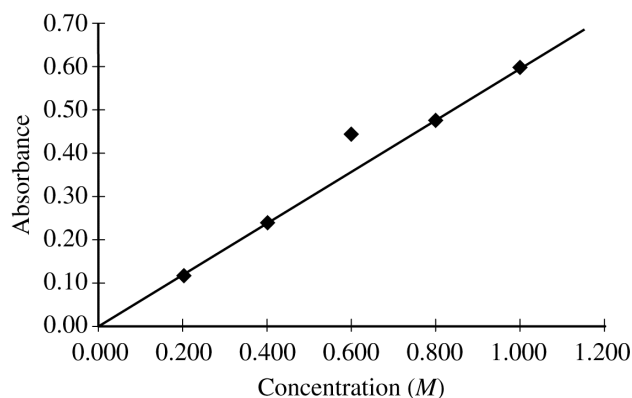
At a certain point in time, a 1.00 L rigid reaction vessel contains 1.5 mol of $PCl_3(g)$, 1.0 mol of $Cl_2(g)$, and 2.5 mol of $PCl_5(g)$. Which of the following describes how the measured pressure in the reaction vessel will change and why it will change that way as the reaction system approaches equilibrium at constant temperature?

- (A) The pressure will increase because $Q < K_c$.
- (B) The pressure will increase because $Q > K_c$.
- (C) The pressure will decrease because $Q < K_c$.
- (D) The pressure will decrease because $Q > K_c$.

4. $MnO_4^- + 5 Fe^{2+} + 8 H^+ \rightarrow Mn^{2+} + 5 Fe^{3+} + 4 H_2O$

In the reaction represented above, the number of MnO_4^- ions that react must be equal to which of the following?

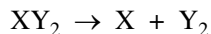
- (A) One-fifth the number of Fe^{2+} ions that are consumed
- (B) Eight times the number of H^+ ions that are consumed
- (C) Five times the number of Fe^{3+} ions that are produced
- (D) One-half the number of H_2O molecules that are produced



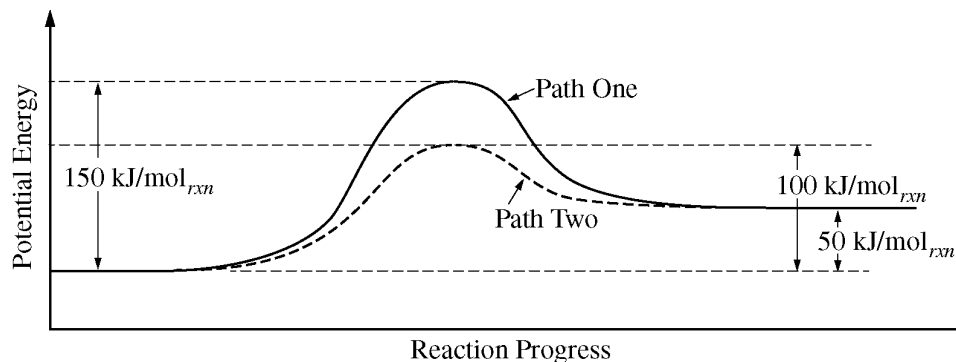
5. A student prepared five solutions of $CuSO_4$ with different concentrations, and then filled five cuvettes, each containing one of the solutions. The cuvettes were placed in a spectrophotometer set to the appropriate wavelength for maximum absorbance. The absorbance of each solution was measured and recorded. The student plotted absorbance versus concentration, as shown in the figure above. Which of the following is the most likely explanation for the variance of the data point for the 0.600 M $CuSO_4$ solution?

- (A) The cuvette into which the 0.600 M solution was placed had some water droplets inside.
- (B) The cuvette into which the 0.600 M solution was placed was filled slightly more than the other cuvettes.
- (C) The wavelength setting was accidentally moved away from that of maximum absorbance.
- (D) The cuvette used for the 0.600 M solution had not been wiped clean before being put in the spectrophotometer.

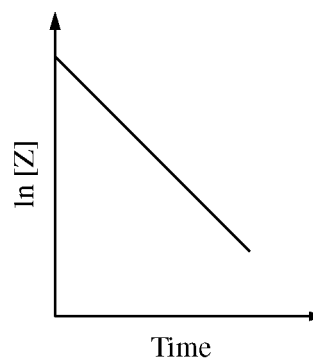
Use the following information and energy profile to answer questions 6-8.



The equation above represents the decomposition of a compound XY_2 . The diagram below shows two reaction profiles (path one and path two) for the decomposition of XY_2 .



6. Which of the following most likely accounts for the difference between reaction path one and reaction path two?
- (A) A higher temperature in path one
 (B) A higher temperature in path two
 (C) The presence of a catalyst in path one
 (D) The presence of a catalyst in path two
7. Which of the following best describes the flow of heat when 1.0 mol of XY_2 decomposes?
- (A) 50 kJ of heat is transferred to the surroundings.
 (B) 50 kJ of heat is transferred from the surroundings.
 (C) 100 kJ of heat is transferred to the surroundings.
 (D) 100 kJ of heat is transferred from the surroundings.
8. The reaction is thermodynamically favorable under standard conditions at 298 K. Therefore, the value of ΔS° for the reaction must be
- (A) equal to zero
 (B) equal to $\Delta H^\circ/298 \text{ K}$
 (C) greater than $\Delta H^\circ/298 \text{ K}$
 (D) less than $\Delta H^\circ/298 \text{ K}$



9. Consider the reaction represented by the equation $2 \text{X} + 2 \text{Z} \rightarrow \text{X}_2\text{Z}_2$. During a reaction in which a large excess of reactant X was present, the concentration of reactant Z was monitored over time. A plot of the natural logarithm of the concentration of Z versus time is shown in the figure above. The order of the reaction with respect to reactant Z is
- (A) zero order
 (B) first order
 (C) second order
 (D) third order

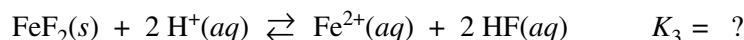
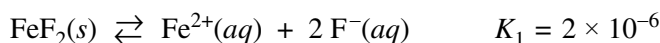
Use the following information to answer questions 10-12

The table below contains information about samples of four different gases at 273 K. The samples are in four identical rigid containers numbered 1 through 4.

Container	Gas	Pressure (atm)	Mass of Sample (g)
1	He	2.00	?
2	Ne	2.00	?
3	?	2.00	16.0
4	SO ₂	1.96	64.1

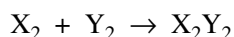
10. On the basis of the data provided above, the gas in container 3 could be

- (A) CH₄
 (B) O₂
 (C) Ar
 (D) CO₂



13. On the basis of the information above, the dissolution of FeF₂(s) in acidic solution is

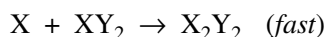
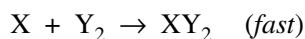
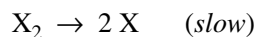
- (A) thermodynamically favorable, because $K_2 > 1$
 (B) thermodynamically favorable, because $K_3 > 1$
 (C) not thermodynamically favorable, because $K_1 < 1$
 (D) not thermodynamically favorable, because $K_3 < 1$



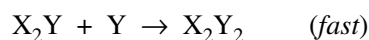
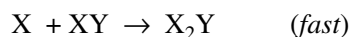
$$\text{rate} = k[\text{X}_2]$$

A reaction and its experimentally determined rate law are represented above. A chemist proposes two different possible mechanisms for the reaction, which are given below.

Mechanism 1



Mechanism 2



14. Based on the information above, which of the following is true?

- (A) Only mechanism 1 is consistent with the rate law.
 (B) Only mechanism 2 is consistent with the rate law.
 (C) Both mechanism 1 and mechanism 2 are consistent with the rate law.
 (D) Neither mechanism 1 nor mechanism 2 is consistent with the rate law.

11. Under the conditions given, consider containers 1, 2, and 4 only. The average speed of the gas particles is

- (A) greatest in container 1
 (B) greatest in container 2
 (C) greatest in container 4
 (D) the same in containers 1, 2, and 4

12. The best explanation for the lower pressure in container 4 is that SO₂ molecules

- (A) have a larger average speed than the other three gases
 (B) occupy a larger portion of the container volume than the other three gases
 (C) have stronger intermolecular attractions than the other three gases
 (D) contain π bonds, while the other gases contain only σ bonds

