Quiz: Ch 14 & 15 **Name:**
Version M (32 pts) **I have not received or given, nor will give any aid on this exam.**
AP Chemistry **February 10, 2006** **Period: 1 2 3 4**

Show your work for all problems and be sure to box your final answer and include sensible units. No work (i.e., no reasonable justification) = no credit.

1. (18 pts) Consider the following balanced reaction:

$$BrO_3^{1-}(aq) + 5\ Br^{1-}(aq) + 6\ H^+(aq) \rightarrow 3\ Br_2(l) + 3\ H_2O(l)$$

The following data were collected at 35.0°C:

Initial $[BrO_3^{1-}(aq)]$ (mol/L)	Initial $[Br^{1-}]$ (mol/L)	Initial $[H^+]$ (mol/L)	Measured initial rate ($mol \cdot L^{-1} \cdot s^{-1}$)
0.10	0.10	0.10	8.00×10^{-3}
0.20	0.10	0.10	1.60×10^{-2}
0.20	0.20	0.20	1.28×10^{-1}

a. (8 pts) Determine the rate law for this reaction (include the value of k and units).

Rate =

b. (2 pts) What is the overall order of the above reaction?

c. (3 pts) Considering the order of reaction you have determined for bromide, a graph of

_____ vs. time would yield a useful straight-line relationship.

d. (5 pts) What is the activation energy of this reaction if the rate constant at 50.0ºC is 150?

E_A =

2. (14 pts) At 200.0 K, $K_C = 9.27 \times 10^{-4}$ for this balanced, endothermic reaction:

$$2\ NaHCO_3\ (s) \leftrightarrow Na_2CO_3\ (s) + CO_2\ (g) + H_2O\ (g)$$

a. (2 pts) Write the equilibrium constant expression, K_C, for this reaction:

$K_C =$

b. (4 pts) 10.0 g of sodium bicarbonate is added to a 2.0-L container, which is then evacuated and heated to 200.0 K. Calculate the equilibrium partial pressure of CO_2 (g) after equilibrium is established.

$P_{CO2} =$

c. (4 pts) Explain how the value of K_C will change (*increase, decrease*, or *no change*) if the following stresses are applied; <u>then</u> briefly explain why:

i. The temperature is decreased.

ii. The volume of the container is changed to 1.0-L.

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3. (18 pts) Consider the following balanced reaction:

$$BrO_3^{1-}(aq) + 5\ Br^{1-}(aq) + 6\ H^+(aq) \rightarrow 3\ Br_2(l) + 3\ H_2O(l)$$

The following data were collected at 15.0°C:

Initial $[BrO_3^{1-}(aq)]$ (mol/L)	Initial $[Br^{1-}]$ (mol/L)	Initial $[H^+]$ (mol/L)	Measured initial rate ($mol \cdot L^{-1} \cdot s^{-1}$)
0.050	0.050	0.050	6.00×10^{-4}
0.050	0.050	0.10	1.20×10^{-3}
0.10	0.10	0.10	1.92×10^{-2}

e. (8 pts) Determine the rate law for this reaction (include the value of k and units).

Rate =

f. (2 pts) What is the overall order of the above reaction?

g. (3 pts) Considering the order of reaction you have determined for bromide, a graph of

_____ vs. time would yield a useful straight-line relationship.

h. (5 pts) What is the activation energy of this reaction if the rate constant at 40.0ºC is 2.5×10^3?

E_A =

4. (14 pts) At 300.0 K, $K_C = 1.08 \times 10^3$ for this balanced, exothermic reaction:

$$Na_2CO_3\ (s) + CO_2\ (g) + H_2O\ (g) \leftrightarrow 2\ NaHCO_3\ (s)$$

a. (2 pts) Write the equilibrium constant expression, K_C, for this reaction:

$K_C =$

b. (4 pts) 10.0 g of sodium bicarbonate is added to a 2.0-L container, which is then evacuated and heated to 300.0 K. Calculate the equilibrium partial pressure of $H_2O\ (g)$ after equilibrium is established.

$P_{H2O} =$

c. (4 pts) Explain how the value of K_C will change (*increase, decrease*, or *no change*) if the following stresses are applied; <u>then</u> briefly explain why:

i. The temperature is increased.

ii. Sodium carbonate is added to the container.