

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:



The following data were collected at 35.0°C:

Initial $[\text{BrO}_3^{1-}(\text{aq})]$ (mol/L)	Initial $[\text{Br}^{1-}]$ (mol/L)	Initial $[\text{H}^+]$ (mol/L)	Measured initial rate ($\text{mol}\cdot\text{L}^{-1}\cdot\text{s}^{-1}$)
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}

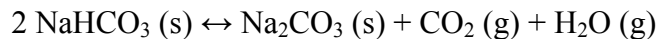
- a. (8 pts) Determine the rate law for this reaction (include the value of k and units).

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 50.0°C is 150?

$E_A =$

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



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 $\text{CO}_2 (\text{g})$ after equilibrium is established.

$P_{\text{CO}_2} =$

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



The following data were collected at 15.0°C:

Initial $[\text{BrO}_3^{1-}(\text{aq})]$ (mol/L)	Initial $[\text{Br}^{1-}]$ (mol/L)	Initial $[\text{H}^+]$ (mol/L)	Measured initial rate ($\text{mol}\cdot\text{L}^{-1}\cdot\text{s}^{-1}$)
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}

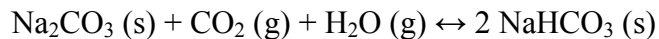
- e. (8 pts) Determine the rate law for this reaction (include the value of k and units).

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 40.0°C 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:



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 $\text{H}_2\text{O} (\text{g})$ after equilibrium is established.

$P_{\text{H}_2\text{O}} =$

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

i. The temperature is increased.

ii. Sodium carbonate is added to the container.