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**POST-LAB REPORT #5**

**GIBBS FREE ENERGY OF A DISSOLUTION REACTION**

*1. Using your mass of and the theoretical concentration of HCl (0.3500 M) calculate the theoretical volume of HCl needed to reach the end point of the titration.*

Mass of = **0.2120 g**

Theoretical volume of HCl = = = =

= 0.0114296 L = **11.43 mL**

*2. Using the data for one of your trials, calculate the molarity of the HCl solution.*

Trial 1: Mass of = **0.2120 g**

= **20.00 mL**

= **32.32 mL**

Volume HCl used = – = 32.32 mL – 20.00 mL = **12.32 mL**

Molarity of HCl = 0.2120 g x x x = **0.3247 M**

*3. Using the average molarity for HCl from Part A and the average volume of HCl at the endpoint, show how you calculated the molarity of the tetraborate anion, [] for your assigned Sample; remember that 5.00 mL of the tetraborate solution was titrated.*

Trial 2: Mass of = **0.2090 g**

= **20.00 mL**

= **32.10 mL**

Volume HCl used = – = 32.10 mL – 20.00 mL = **12.10 mL**

Molarity of HCl = 0.2090 g x x x = **0.3259 M**

Average molarity of HCl = = **0.3253 M**

At 40.0 : Average volume of HCl = **9.25 mL**

[] = 0.3253 x 9.25 mL x x x = **0.301 M**

*4. Based on your calculated value for , is the dissolution reaction (equation 1) an exo- or endothermic reaction in the forward reaction? Explain.*

Equation of straight line: **y = – 13426.3x + 40.9335**

Trendline slope = – = 8.314 x 13426.3 K = 111626 = 111.626 = **112**

Since is positive, the reaction is endothermic in the forward reaction.

*5. If the temperature of a saturated solution of borax is increased, in which direction will the equilibrium shift? Explain using La Chatelier’s Principle.*

From Question 4, we know that the reaction is endothermic. The increase in temperature will shift the reaction to the right because La Chatelier’s Principle says increasing temperature is the same as adding more reactant to the system. Therefore, the equilibrium needs to shift to the right.

*6. Is the dissolution reaction (equation 1) a spontaneous or a non-spontaneous process at 25? Explain using your calculated value for .*

Trendline intercept = = 8.314 x 40.9335 = **340.321**

= – T = 111626 – (25 + 273.15K) x 340.321 = 10159 x

= 10.159 = **1.0 x**

With a positive value at 25, this is a non-spontaneous process.