

## Chemistry 101

### Sample exam 3 (Chapters 7, 8 and 9)

*Closed book, open homework, open notes, calculators allowed; 50 minutes, no collaboration.* Partial credit for problems can be awarded only with a clear setup of the problem.

Answer all questions.

1. How many grams of pure sodium chloride solid are required to prepare 700.0 mL of 1.2 M NaCl solution?

49. g NaCl (two sig figs)

2. What is the **percent by mass** of a solution made by adding 35 g of KOH to 944 mL of water (density: 1.00g/mL)?

3.6% (w/w) (or (m/m)) KOH (two sig figs)

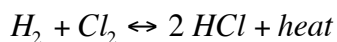
3. 14.0 mL of a 1.0 M NaC<sub>2</sub>H<sub>3</sub>O<sub>2</sub> solution is **diluted** to a final volume of 100.0 mL. What is the diluted solution's molarity?

0.14 M NaC<sub>2</sub>H<sub>3</sub>O<sub>2</sub> (two sig figs)

4. Using an **energy diagram**, demonstrate how the addition of a **catalyst** speeds up a reaction.

Basically, a standard energy diagram except showing that the activation energy is lower. Thus the number of reactant molecules that have the necessary energy to cross the activation energy barrier is greater than without the catalyst, and so the reaction will proceed more quickly.

5. According to Le Chatelier's principle, what would be the result of adding heat to the system at equilibrium:



Since heat is a product of this equation, adding heat (raising the temperature, for instance) will cause the equilibrium to shift to the left and generate more reactants.

6. Calculate the pH of the following solutions:

a. 0.00300 M HCl

2.523

b.  $4.2 \times 10^{-5}$  M Ca(OH)<sub>2</sub>

9.92

7. a. What is  $[H^+]$  when the pH of a solution is 6.4?

$$4 \times 10^{-7} \text{ M}$$

b. Calculate the concentration of  $OH^-$  when the pH is 3.7.

$$5 \times 10^{-11} \text{ M}$$

8. Hydrocyanic acid, HCN, has a  $K_a = 6.2 \times 10^{-10}$ .

a. Calculate the  $K_b$  of  $CN^-$

$$1.6 \times 10^{-5}$$

b. Use the Henderson-Hasselbalch to determine the pH of a buffer that was made up to be 1.00 M in HCN and 0.100 M in  $CN^-$

8.21