AP Chemistry Daily Videos

8.10 Buffer Capacity

Video #1

1. **Does diluting a buffer solution change the pH? Why or why not?**

2. **What is buffer capacity and what determines its capacity?**

3. **According to the Henderson-Hasselbalch Equation, what would you need to change in order to change the pH of the buffer solution?**

4. **Evaluate your work.**

$HC_2H_3O_2(aq) + H_2O(l) \rightleftarrows H_3O^+(aq) + C_2H_3O_2^-(aq)$ $pK_a = 4.756$ at 25°C

The acid ionization equilibrium for the weak acid $HC_2H_3O_2$ is represented by the equation above. To prepare a buffer with a pH = 5.70, a student needs to mix 250 mL of 0.100 *M* $HC_2H_3O_2$ and 500 mL of 0.440 *M* $NaC_2H_3O_2$. If the student mistakenly mixes 250 mL of 0.0500 *M* $HC_2H_3O_2$ and 250 mL of 0.440 *M* $NaC_2H_3O_2$, which of the following is the result of this error?

(A) The buffer will have a lower capacity because of the smaller numbers of moles of $HC_2H_3O_2$ and $C_2H_3O_2^-$ available to react if an acid or a base is added.

(B) The buffer will have a lower capacity, because the smaller amounts of $HC_2H_3O_2$ and $C_2H_3O_2^-$ will lower the pH of the buffer.

(C) The buffer will have a higher capacity, because a larger proportion of $HC_2H_3O_2$ and $C_2H_3O_2^-$ will ionize at lower concentrations.

(D) The buffer will have the same capacity, because the large volume dilutes the components.

5. **To begin this problem, identify your weak base and its conjugate acid in the reaction.**

$$NH_3(aq) + H_2O(l) \leftrightarrows NH_4^+(aq) + OH^-(aq)$$

The equation above represents the base ionization equilibrium for ammonia, NH_3. To prepare a buffer with pH ≈ 8.20, 3.50 g of $NH_4Cl(s)$ should be added to 500 mL of 0.01 *M* $NH_3(aq)$. The buffer is accidentally prepared using 85% pure $NH_4Cl(s)$ instead of 99% pure. Assuming impurities in this solid are unreactive, explain how this error affects the pH and capacity of the buffer.

6. **Write down the three key points from this video in your own words.**