

March 4, 2002

✓ ***No Labs This Week!***

✓ **Exam #2**

Conflict? Email me *this week* to schedule alternate time

✓ **Problem Session**

Put problems/question in box or email me or just show up today with questions!

✓ **Chapter 16 Problems**

Part 1 of solutions are ***now online*** (questions 1-31)

1

Water Logged

➤ We can define other log functions:

$$\text{pOH} = -\text{Log}[\text{OH}^-]$$

$$\text{pK}_w = -\text{LogK}_w = \mathbf{14.00}$$

➤ We can quantify the *autoionization* of water entirely in logs:

$$\text{pK}_w = \text{pH} + \text{pOH}$$

So, at 25 °C:

$$\text{pH} + \text{pOH} = \mathbf{14.00}$$

2

Example

- What is the pH of an aqueous solution in which $[\text{OH}^-] = 1.0 \times 10^{-10} \text{ M}$?

$$K_w = [\text{H}^+][\text{OH}^-] \Rightarrow [\text{H}^+] = \frac{K_w}{[\text{OH}^-]} = \frac{1.0 \times 10^{-14}}{1.0 \times 10^{-10}} = 1.0 \times 10^{-4} \text{ M}$$

So: $\text{pH} = -\text{Log}(1.0 \times 10^{-4}) = \underline{\underline{4.00}}$

It's easier with logs!

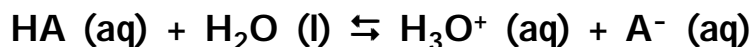
$$\text{pOH} = -\text{Log}(1.0 \times 10^{-10}) = 10.00$$

So: $\text{pH} = 14.00 - \text{pOH} = 14.00 - 10.00 = \underline{\underline{4.00}}$

3

K_a and K_b

For acid dissociation:



We define an acid dissociation constant:

$$K_a = \frac{[\text{H}_3\text{O}^+][\text{A}^-]}{[\text{HA}]}$$

Similarly, for a base:



Where:

$$K_b = \frac{[\text{OH}^-][\text{BH}^+]}{[\text{B}]}$$

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Acid (Base) Strength

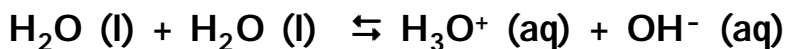
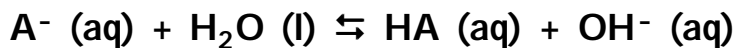
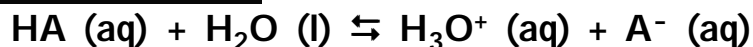
- Magnitude of K_a (or K_b) indicates *degree of dissociation*
 - As K_a increases, the degree of dissociation increases
 - Increased dissociation = more H^+
 - SO: as K_a increases, acid strength increases

Example:

Acetic Acid - CH_3COOH ($K_a \approx 10^{-5}$)
is stronger than
Hydrocyanic Acid - HCN ($K_a \approx 10^{-9}$)

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Conjugate Acid/Base Pairs



$$K_a = \frac{[H_3O^+][A^-]}{[HA]}$$

$$K_b = \frac{[OH^-][HA]}{[A^-]}$$

$$\boxed{K_a K_b = K_w} \text{ OR } \boxed{pK_w = pK_a + pK_b}$$

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