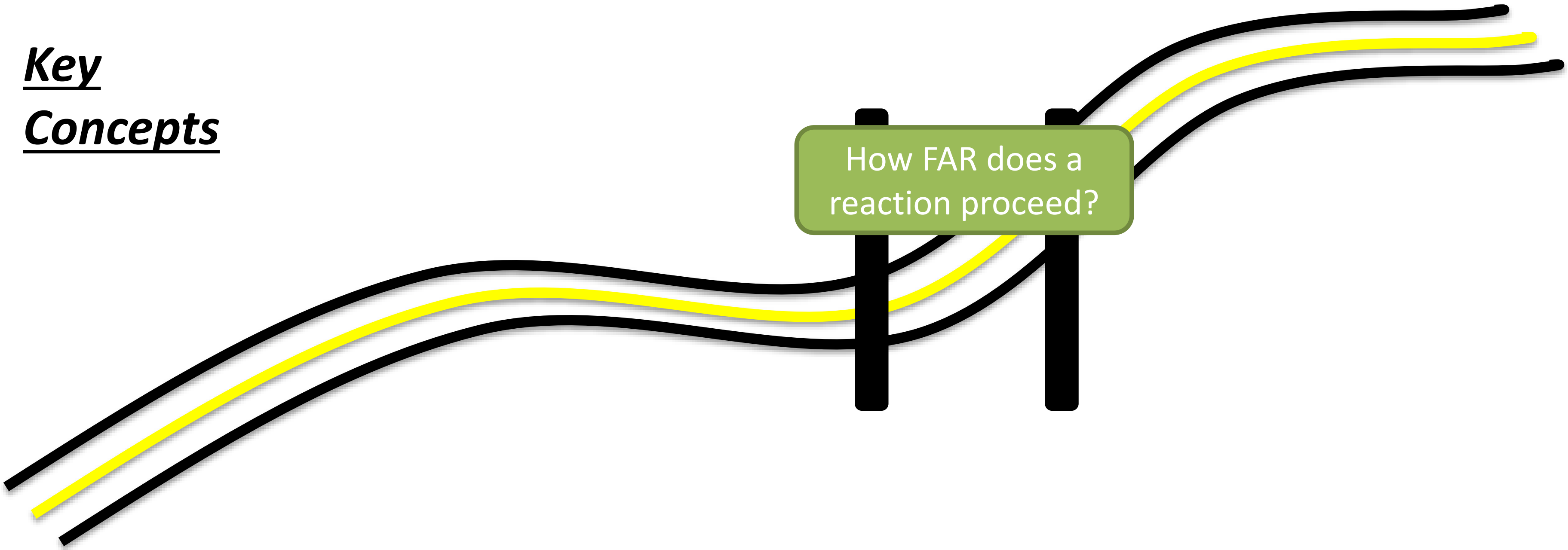
Key Concepts



e.g. $HCl(aq) + H_2O(l) \rightleftarrows Cl^{-}(aq) + H_3O^{+}(aq)$

$K = \infty$

Acid and base solutions are equilibrium systems.

e.g. $CH_3COOH(aq) + H_2O(l) \rightleftarrows CH_3COO^{-}(aq) + H_3O^{+}(aq)$ $\quad K = \dfrac{[CH_3COO^{-}]_E\,[H^{+}]_E}{[CH_3COOH]_E}$

$$pH = pK_a + \ln\frac{[CH_3COO^{-}]_E}{[CH_3COOH]_E}$$

The key concepts of equilibria explain how buffers control the acidity (pH) of solutions.

The following pages are titled with respect to the learning objectives that their content relates to.

Learning Objectives

Identify and *describe* solutions of acids and bases using K_a, pH, and pOH. (review material)
Describe (quantitatively and qualitatively) the relationship between the K_a of an acid, the K_b of its conjugate base, and K_w for the auto-ionization of water.
Relate K_a and pH to the equilibrium concentrations of all species in a monoprotic acid or base solution.
Compare the relative strengths of acids and bases using pH, pK_a, pK_b and % dissociation.
Predict the relative pH of a salt solution
Identify buffers and *describe* how to prepare buffers using a weak acid or base and its conjugate.
Calculate the pH of a buffer using the Henderson-Hasselbalch equation.
Calculate the pH of a buffer after the addition of strong acid or base.
Interpret titration curves and *calculate* the pH of a titration at any point along the curve. (Laboratory only)

Identify and *describe* solutions of acids and bases using K_a, pH, and pOH. (review material)

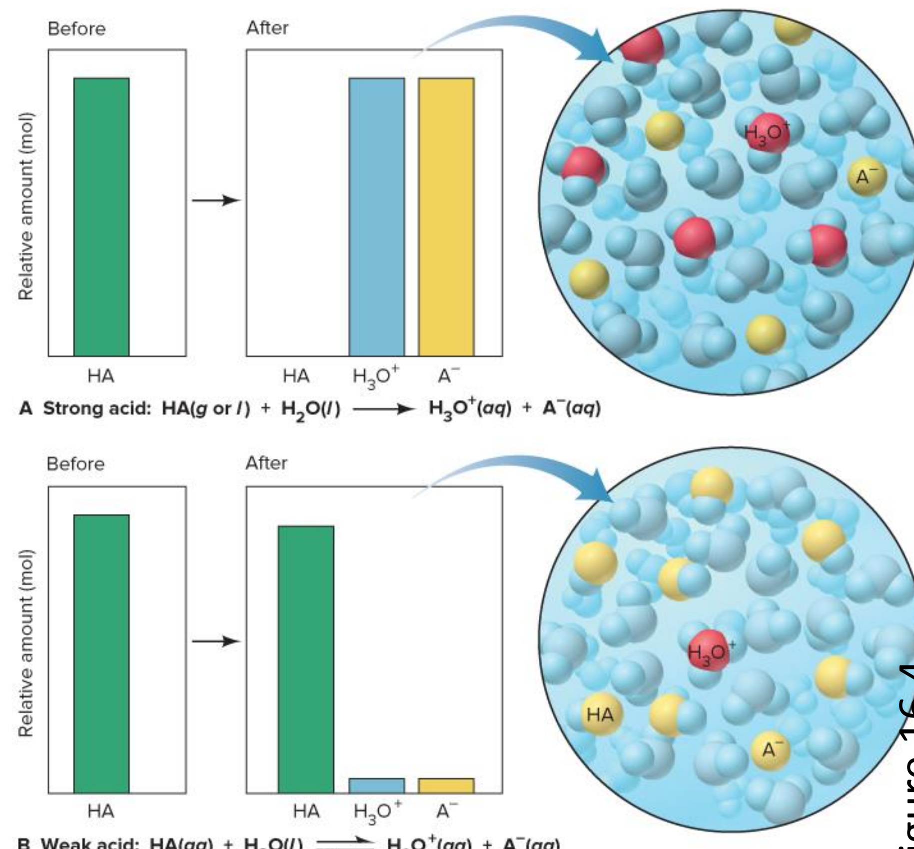
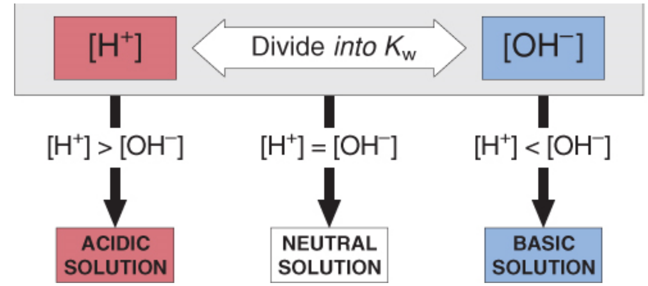


Figure 16.4

Identify and *describe* solutions of acids and bases using K_a, pH, and pOH. (review material)



		$[H_3O^+]$	pH	$[OH^-]$	pOH
MORE BASIC		1.0×10^{-15}	15.00	1.0×10^{1}	–1.00
		1.0×10^{-14}	14.00	1.0×10^{0}	0.00
		1.0×10^{-13}	13.00	1.0×10^{-1}	1.00
	BASIC	1.0×10^{-12}	12.00	1.0×10^{-2}	2.00
		1.0×10^{-11}	11.00	1.0×10^{-3}	3.00
		1.0×10^{-10}	10.00	1.0×10^{-4}	4.00
		1.0×10^{-9}	9.00	1.0×10^{-5}	5.00
		1.0×10^{-8}	8.00	1.0×10^{-6}	6.00
	NEUTRAL	1.0×10^{-7}	7.00	1.0×10^{-7}	7.00
MORE ACIDIC		1.0×10^{-6}	6.00	1.0×10^{-8}	8.00
		1.0×10^{-5}	5.00	1.0×10^{-9}	9.00
		1.0×10^{-4}	4.00	1.0×10^{-10}	10.00
	ACIDIC	1.0×10^{-3}	3.00	1.0×10^{-11}	11.00
		1.0×10^{-2}	2.00	1.0×10^{-12}	12.00
		1.0×10^{-1}	1.00	1.0×10^{-13}	13.00
		1.0×10^{0}	0.00	1.0×10^{-14}	14.00

Figure 16.6 and 16.8

Identify and *describe* solutions of acids and bases using K_a, pH, and pOH. (review material)

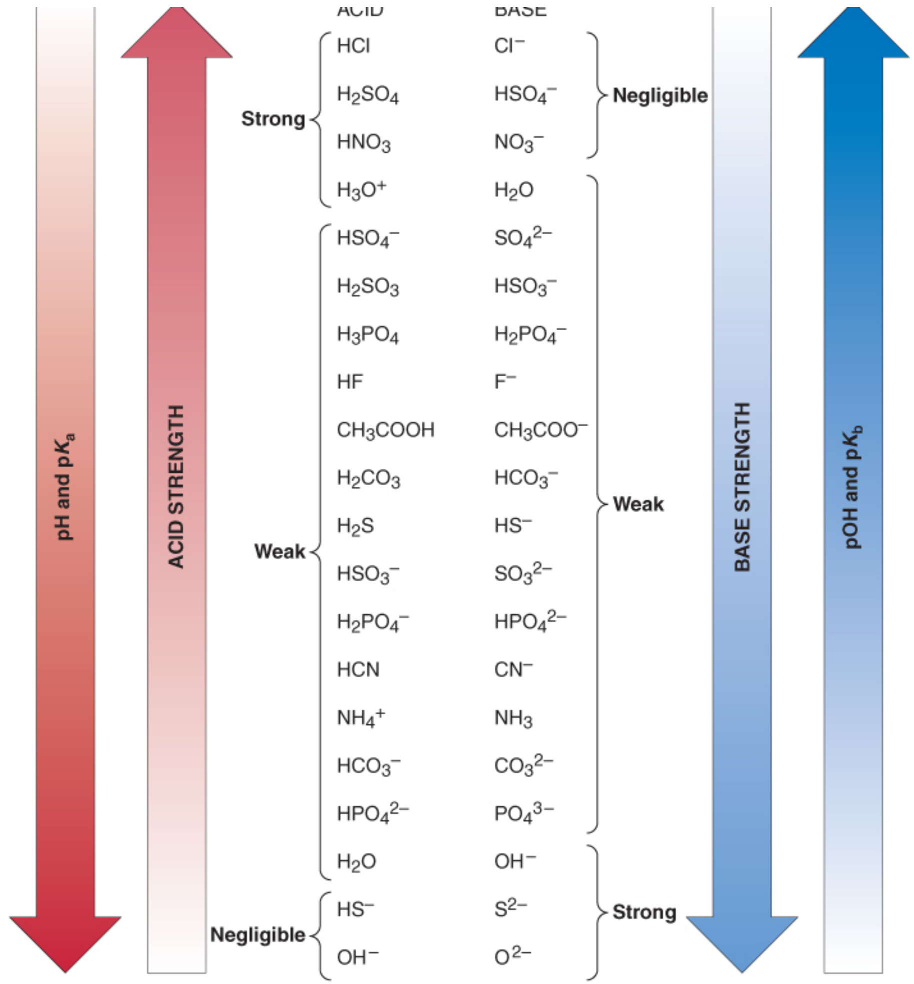


Figure 16.3

Describe (quantitatively and qualitatively) the relationship between the K_a of an acid, the K_b of its conjugate base, and K_w for the auto-ionization of water.

Relate K_a and pH to the equilibrium concentrations of all species in a monoprotic acid or base solution.

Compare the relative strengths of acids and bases using pH, pK_a, pK_b and % dissociation.

Predict the relative pH of a salt solution

Identify buffers and *describe* how to prepare buffers using a weak acid or base and its conjugate.

Calculate the pH of a buffer using the Henderson-Hasselbalch equation.

Calculate the pH of a buffer after the addition of strong acid or base.

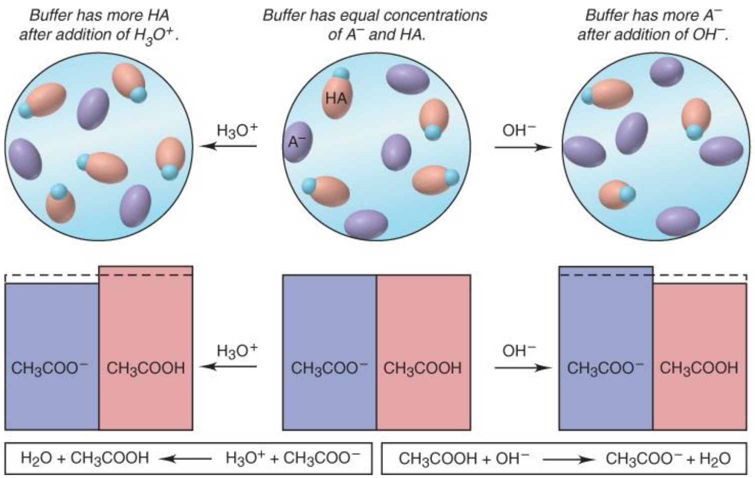


Figure 17.3

Interpret titration curves and *calculate* the pH of a titration at any point along the curve. (Laboratory only)