Question: What's in the pot?

Identifying what **region** of the titration curve of an acid we are working in.

1. Weak acid **only**
2. Weak acid, **partially consumed** by some base
3. Weak acid, **exactly consumed** by base
4. Weak acid, consumed by **excess base**

Weak acid only (region 1)

1. "A 0.1 mol sample of weak acid HA ($K_a = 3 \times 10^{-6}$) is dissolved in 1L of water at 25°C. What is the pH?"

2. "A 0.1 mol sample of weak base, B- ($K_b = 4 \times 10^{-5}$) is dissolved in 1L of water at 25°C. What is the pH?"

Weak acid partially consumed (region 2)

1. "A 0.1 mol sample of weak acid HA (K_a = 3 x 10^{-6}) is dissolved in 1.0 L of a dilute solution of NaOH (0.05 M). What is the pH of the solution?"

2. "A 0.1 mol sample of weak acid HA (K_a = 3 x 10^{-6}) and 0.10 mol of conjugate base (A^-) are dissolved in 1.0 L of water. What is the pH of the solution?"

Weak acid exactly consumed (region 3)

1. "A 1.0 L sample of 0.10 M weak acid HA (K_a = 3 x 10^{-6}) is **titrated** with 0.15 M NaOH. What is the pH at the equivalence point?"

2. "A 1.0 L sample of 0.10 M weak acid HA (K_a = 3 x 10^{-6}) is **titrated** with 0.20 M NaOH. What is the pH at the equivalence point?"

Weak acid and excess base (region 4)

1. "A 0.10 mol sample of weak acid HA (K_a = 3 x 10^{-6}) is dissolved in 1.0 L of 0.15 M NaOH. What is the pH of the solution?"

2. "A 0.10 mol sample of weak acid HA (K_a = 3 x 10^{-6}) is dissolved in 1.5 L of 0.15 M NaOH. What is the pH of the solution?"

Challenge 3: Acid-base regions

A solution is prepared by mixing 400. mL of 0.2 M formic acid (HCO_2H, $K_a = 1.8 \times 10^{-4}$), 400. mL of 0.1 M hydrochloric acid (HCl, $Ka = 1x10^{7}$).

(a) What is the pH of the solution before anything additional is added? Answer: pH = 1.3

(b) What would be the pH after 200. mL of 0.3 M NaOH were added to the original solution? Answer: pH = 3.3

(c) What would be the pH after 200. mL of 0.6 M NaOH were added to the original solution? Answer: pH = 8.3

BOSTON UNIVERSITY