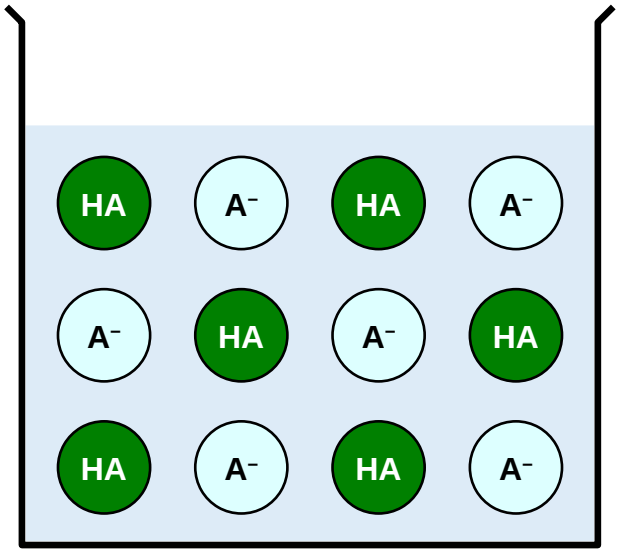
Essential Question

How does a buffer resist pH change?

What Is a Buffer?

- Lots of a weak acid, HA
- Lots of its conjugate base, A^-
- Resists changes in pH



Buffer: HA + A^-

Common Buffer Pairs

- Weak acid + conjugate base
- The pair differs by one H^+

Blood stays near pH 7.4

CH_3COOH / CH_3COO^-
acetic acid / acetate

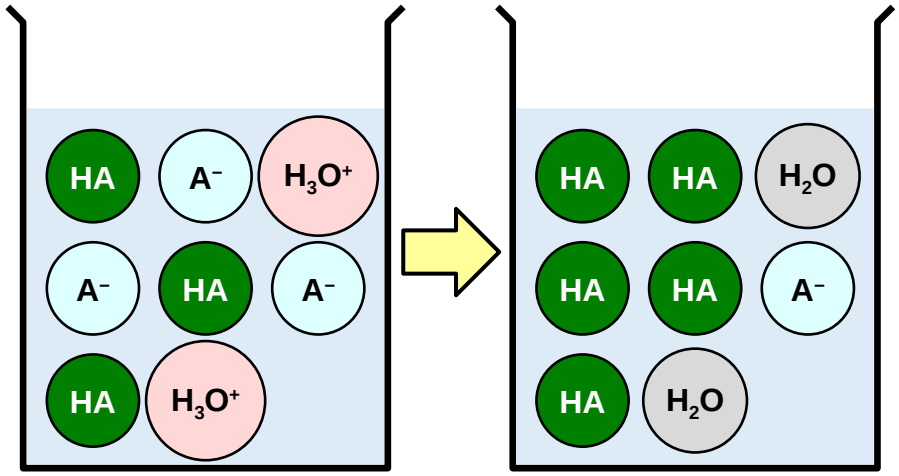
NH_4^+ / NH_3
ammonium / ammonia

H_2CO_3 / HCO_3^-
the buffer in your blood

Adding Strong Acid

- A^- reacts with added H_3O^+
- Strong acid → weak acid

$$A^- + H_3O^+ \longrightarrow HA + H_2O$$



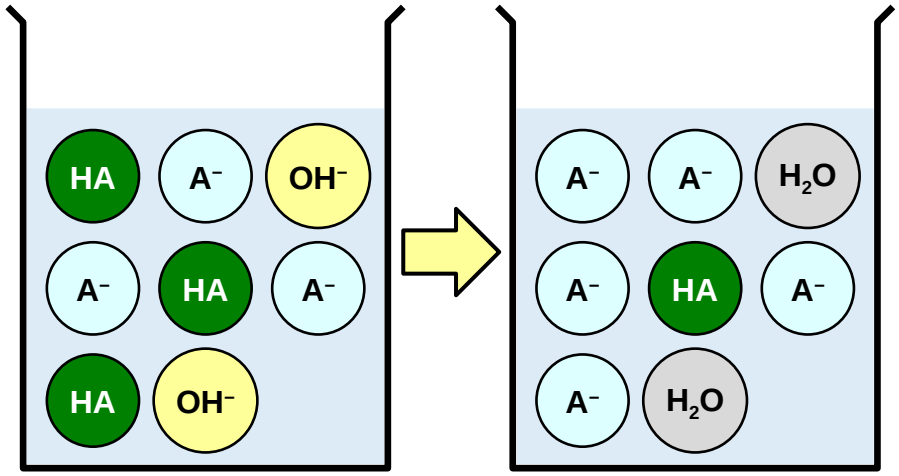
Just added H_3O^+

After the reaction

Adding Strong Base

- HA reacts with added OH^-
- Strong base → weak base

$$HA + OH^- \longrightarrow A^- + H_2O$$



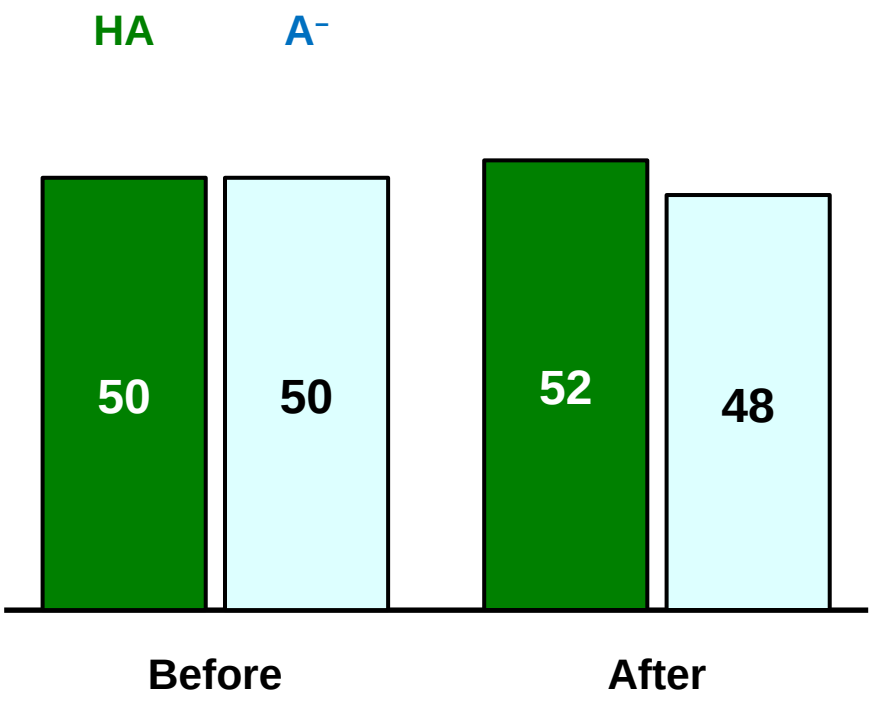
Just added OH^-

After the reaction

Why pH Barely Changes

- Huge amounts of HA and A^-
- Small addition: tiny shift

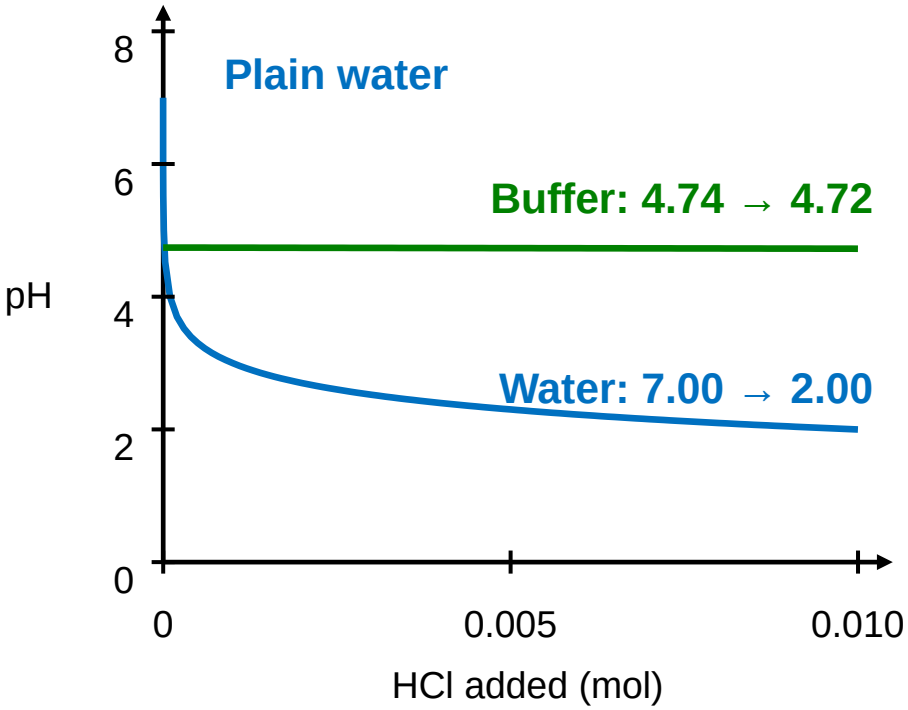
Add 2 H_3O^+ to
50 HA + 50 A^-



Buffer vs. Plain Water

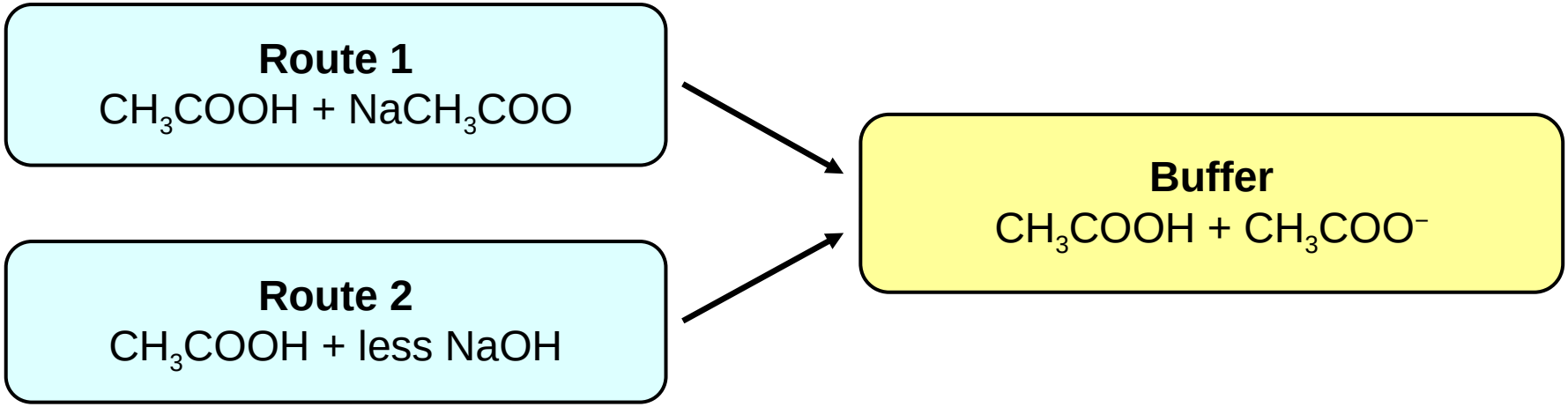
- Same HCl added to each
- Water: pH drops a lot
- Buffer: pH barely moves

Each is 1.0 L. Buffer: 0.50 M CH_3COOH and 0.50 M CH_3COO^-



Making a Buffer

- Mix a weak acid with its salt
- Or partly neutralize a weak acid



Example: Can It Buffer?

Which mixture can act as a buffer: HCl and NaCl, or HF and NaF? Justify your answer.

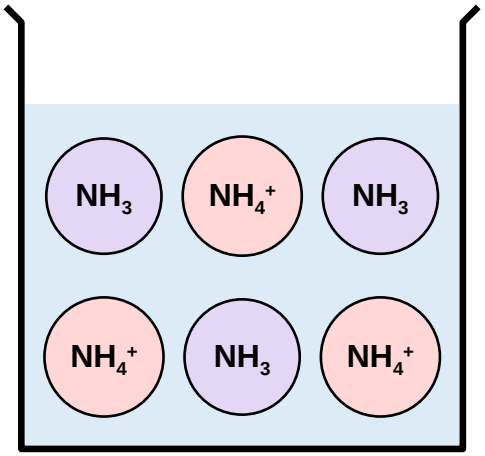
HCl + NaCl

HF + NaF

Example: Net Ionic Equation

A buffer contains NH_3 and NH_4Cl. Write the net ionic equation for the reaction that occurs when a small amount of HCl is added.

+ HCl

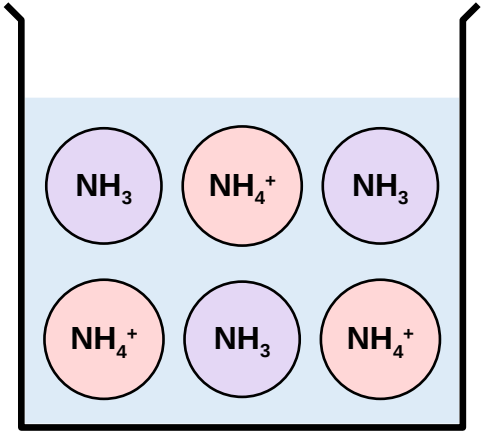


NH_3 / NH_4^+ buffer

Example: Explain the Buffer

A small amount of NaOH is added to a buffer made of NH_3 and NH_4Cl. Explain why the pH barely changes.

+ NaOH



NH_3 / NH_4^+ buffer

Properties of Buffers

Big Ideas

- Buffer: lots of HA and A^-
- A^- neutralizes added acid
- HA neutralizes added base

$$A^- + H_3O^+ \longrightarrow HA + H_2O$$

$$HA + OH^- \longrightarrow A^- + H_2O$$