

What is the pH of a solution made by mixing 100 mL of 0.1M HF with 50 mL of 0.1M NaF? **BUFFER**

$$[\text{HF}] = \frac{(0.1\text{M})(100\text{mL})}{150\text{mL}} = 0.067\text{M}$$

$$[\text{F}^-] = \frac{(0.1\text{M})(50\text{mL})}{150\text{mL}} = 0.033\text{M}$$

$$\text{p}K_a = -\log K_a = -\log(3.5 \times 10^{-4}) = 3.46$$

$$\text{pH} = \text{p}K_a + \log \frac{[\text{F}^-]}{[\text{HF}]} = 3.46 + \log \left( \frac{0.033}{0.067} \right) = 3.15$$

What would be the pH of this buffer after adding 0.001 moles of  $\text{OH}^-$ ? (assume constant volumes)



$$\text{HF: } (0.1\text{M})(0.1\text{L}) = 0.01 \text{ moles} - 0.001 \text{ moles} = 0.009 \text{ moles HF leftover}$$

$$\text{F}^-: (0.1\text{M})(0.05\text{L}) = 0.005 \text{ moles} + 0.001 \text{ moles} = 0.006 \text{ moles F}^- \text{ leftover}$$

$$[\text{F}^-] = \frac{0.006 \text{ moles}}{0.15\text{L}} = 0.040\text{M}$$

$$[\text{HF}] = \frac{0.009 \text{ moles}}{0.15\text{L}} = 0.060\text{M}$$

$$\text{pH} = 3.46 + \log \left( \frac{0.040}{0.060} \right) = 3.28$$

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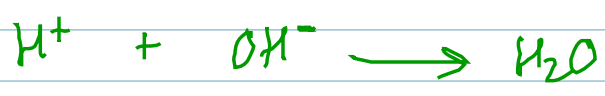
# ACID BASE REACTIONS

ANY ACID + ANY BASE  $\longrightarrow$  REACT UNTIL ALL OF ONE (OR BOTH) REACTANTS ARE GONE

- strong acid (SA)
- " base (SB)
- weak acid (WA)
- " base (WB)

LR

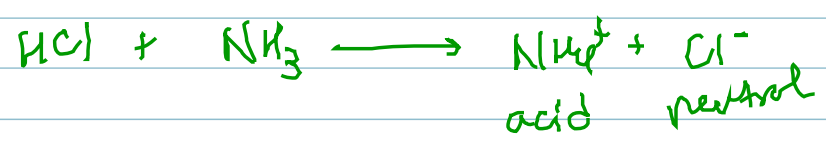
SA + SB



pH = 7 at the "EQUIVALENCE POINT"

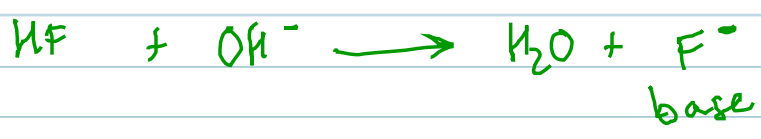
(NO LR) PRODUCTS

SA + WB



pH < 7  
@ EQ POINT

WA + SB



pH > 7  
@ EQ POINT

## How to find the pH of your dish contents

- ① strong acid  $pH = -\log[H^+]$
- ② strong base  $pOH = -\log[OH^-]$   
 $pH = 14 - pOH$
- ③ weak acid  $K_a$
- ④ weak base  $K_b$
- ⑤ weak acid + conj. base = buffer
- ⑥ strong acid + weak acid
- ⑦ strong base + weak base