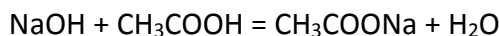


## Answer on Question #59773, Chemistry / General Chemistry

1. What volume of 1.00 M solutions of NaOH and acetic acid must be mixed to give 1.00 l of solution having a pH of 4.00?

### Solution:



If  $\text{pH} < 7$ , we must neutralize not all acid.

$\text{CH}_3\text{COOH} + \text{CH}_3\text{COONa}$  – acetic buffer system

For calculation pH of buffer system (acid type):

$$\text{pH} = \text{pKa} + \log \frac{[\text{salt}] \times V(\text{salt})}{[\text{acid}] \times V(\text{acid})}$$

$$\text{pKa} = -\log K_a$$

$$\text{pKa} = -\log 1.8 \times 10^{-5} = 4.75 \text{ (acetic acid)}$$

$$4 = 4.75 + \log \frac{[1 \text{ mol/L}] \times V(\text{salt})}{[1 \text{ mol/L}] \times V(\text{acid})}$$

$$4 = 4.75 + \log \frac{V(\text{salt})}{V(\text{acid})}$$

$$\log \frac{V(\text{salt})}{V(\text{acid})} = 4 - 4.75 = -0.75$$

$$\frac{V(\text{salt})}{V(\text{acid})} = 10^{-0.75} = 0.177$$

$$\frac{V(\text{salt})}{V(\text{acid})} = \frac{0.177}{1}$$

For 1L of solution we need 1 portion of acid and 0.177 portion of salt.

$$1.177 - 1000 \text{ ml}$$

$$0.177 - X \text{ ml}$$

$$X = \frac{0.177 \times 1000}{1.177} = 150 \text{ ml} - \text{volume of salt}$$

$$1000 \text{ ml} - 150 \text{ ml} = 850 \text{ ml} - \text{volume of acid}$$

For 150ml of salt (1M) we need 75ml 1M NaOH and 75ml 1M  $\text{CH}_3\text{COOH}$ .

Total volume  $\text{CH}_3\text{COOH}$ : 850ml + 75ml (for salt) = 925ml

Total volume NaOH – 75ml (for salt).

**Answer:** must be mixed 75ml NaOH and 925ml  $\text{CH}_3\text{COOH}$ .