

Name: _____ Student ID: _____
CHEM 161 PAL Fall 2026

Worksheet # 3: Henderson-Hasselbalch Calculations

1. You are preparing 200.0 mL of a 0.05M phosphate buffer at pH = 7.00 from solid Na_2HPO_4 and a 0.10 M solution of NaH_2PO_4 . The pK_a 's for H_3PO_4 are listed below. Calculate the amounts needed of each. Show your work.

$$\text{pK}_{a1} = 2.1$$

$$\text{pK}_{a2} = 7.2$$

$$\text{pK}_{a3} = 12.3$$

$$\text{Na}_2\text{HPO}_4 \text{ MW} = 141.96 \text{ g/mol}$$

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2. You are preparing 200.0 mL of a 0.05M phosphate buffer at pH = 7.00 from solid Na_2HPO_4 and a 0.10 M solution of NaOH. The pK_a 's for H_3PO_4 are listed below. Calculate the amounts needed of each. Show your work.

$$\text{pK}_{a1} = 2.1$$

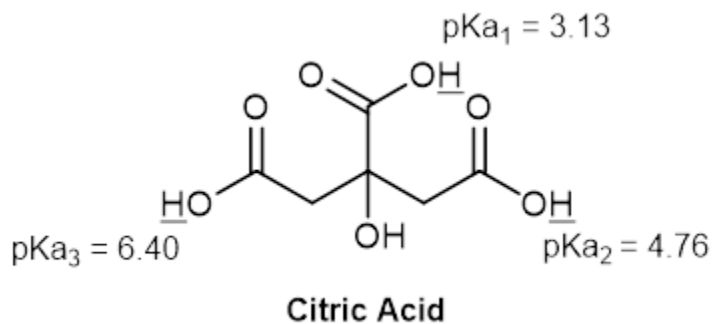
$$\text{pK}_{a2} = 7.2$$

$$\text{pK}_{a3} = 12.3$$

$$\text{Na}_2\text{HPO}_4 \text{ MW} = 141.96 \text{ g/mol}$$

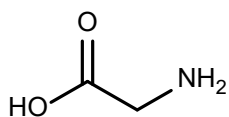
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3. Calculate the grams of acid and conjugate base needed to prepare 250 mL of a 30 mM citrate buffer at pH=3.00. Below is the structure of citric acid. Ionizable protons are underlined in the structure and the pKa of each proton is listed next to it. The MW of citric acid ($\text{C}_6\text{H}_8\text{O}_7$) is 192.123 g/mol and the MW of $\text{NaC}_6\text{H}_7\text{O}_7 = 214.105$ g/mol.

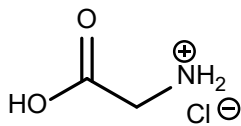


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4. You are preparing 55.00 mL of a 0.0175 M glycine buffer at pH 9.75. Calculate the number of grams of glycine and glycine hydrochloride needed. Show all calculations in the space provided below. (20 points)



Glycine
MW = 75.05 g/mol



Glycine hydrochloride
MW = 111.53 g/mol

pKa₁ = 2.34

pKa₂ = 9.60