#2 How would you prepare an 800 mL phosphate buffer solution at 0.5M using 1M $H_2PO_4^-$ and 0.6M HPO_4^{2-} at pH 6.0 ? (pKa 6.86)

($H_2PO_4^-$ → [HA]; HPO_4^{2-} → [A⁻])

1st calculate the total mols of phosphate you need:

$$800\,mL \times \frac{0.5\,mol}{1000\,mL} = 0.4\,mols\ total\ phosphate$$

Now, using the H-H equation, calculate the amt.s of conjugate base and weak acid:

$$pH = pka + \log\left(\frac{[A]}{[HA]}\right)$$

$$6.0 = 6.86 + \log\frac{A}{HA}$$

$$-0.86 = \log\left(\frac{[A]}{[HA]}\right)$$

$$\frac{0.14}{1} = \frac{[A]}{[HA]}$$

remembering that [A] + [HA] = 0.4 mols, and solving for [A] = 0.4 − [HA], plug this back into the ratio equation

$$\frac{0.14}{1} = \frac{0.4-[HA]}{[HA]}$$

$$0.14[HA] = 0.4-[HA]$$

$$[HA] = \frac{0.35\,mols}{}$$

now solve for [A⁻]

calculate vol. of HA in soln

$$\frac{0.35\,mols}{x} = \frac{1\,mol\ H_2PO_4^-}{1000\,mL}$$

$x = 350\,mL$ of 1M $H_2PO_4^-$

$$[A] + 0.35\,mols = 0.4\,mols$$

$$[A^-] = \underline{0.05\ mols}$$

calculate vol. of [A] in soln

$$\frac{0.05\,mols}{x} = \frac{0.6\,mols\ HPO_4^{2-}}{1000\,mL}$$

$x = 83.3\,mL$ of 0.6M HPO_4^{2-}

SO,

350 mL 1M $H_2PO_4^-$
+ 83.3 mL 0.6M HPO_4^{2-}

433.3 mL
+ 366.7 mL H_2O

800 mL total phosphate solution