

# Chap 16

What is the pH of 0.10M  $\text{Na}_2\text{HPO}_4$  / 0.15M  $\text{KH}_2\text{PO}_4$ ?

## ICE chart method



I 0.10M

0.15M

C -x

+x

+x

E (0.10-x)

(0.15+x)

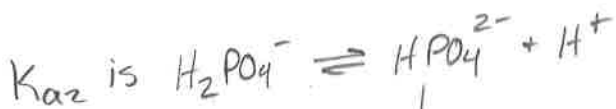
x

Known

$$\text{H}_3\text{PO}_4 \quad K_{a1} = 7.5 \times 10^{-3}$$

$$K_{a2} = 6.2 \times 10^{-8}$$

$$K_{a3} = 4.8 \times 10^{-13}$$



conjugate base  $\rightarrow K_w = K_{a2} K_b$

$$1 \times 10^{-14} = (6.2 \times 10^{-8}) K_b$$

$$1.6 \times 10^{-7} = K_b \text{ for } \text{HPO}_4^{2-}$$

$$1.6 \times 10^{-7} = \frac{[x][0.15]}{[0.10]}$$

$$1.1 \times 10^{-7} = [x] = [\text{OH}^-]$$

$$\text{pOH} = -\log[1.1 \times 10^{-7}] = 6.97$$

$$14 = 6.97 + \text{pH}$$

$$\boxed{\text{pH} = 7.03}$$

## H-H method

$$\text{pH} = \text{p}K_a + \log \frac{[\text{conj base}]}{[\text{acid}]}$$

$\text{H}_2\text{PO}_4^-$  is acid

$\text{HPO}_4^{2-}$  is conj base

$$\text{p}K_{a2} = -\log[6.2 \times 10^{-8}] = 7.21$$

$$\text{pH} = 7.21 + \log \frac{[0.10]}{[0.15]}$$

$$\boxed{= 7.03}$$