Chap 16

What is the pH of 0.10M Na_2HPO_4 / 0.15M KH_2PO_4?

ICE chart method

$HPO_4^{2-} + H_2O \rightarrow H_2PO_4^- + OH^-$

I	0.10M	0.15M	
C	−x	+x	+x
E	(0.10 − x)	(0.15 + x)	x

K_{a2} is $H_2PO_4^- \rightleftharpoons HPO_4^{2-} + H^+$

conjugated base → $K_w = K_{a2} K_b$

$1e-14 = (6.2e-8)(K_b)$

$1.6e-7 = K_b$ for HPO_4^{2-}

$$1.6e-7 = \frac{[x][0.15]}{[0.10]}$$

$1.1e-7 = [x] = [OH^-]$

$pOH = -\log[1.1e-7]$

$= 6.97$

$14 = 6.97 + pH$

$\boxed{pH = 7.03}$

Known

H_3PO_4 $K_{a1} = 7.5e-3$

$K_{a2} = 6.2e-8$

$K_{a3} = 4.8e-13$

H-H method

$$pH = pK_a + \log\frac{[\text{conjbase}]}{[\text{acid}]}$$

$H_2PO_4^-$ is acid

HPO_4^{2-} is conj base

$pK_{a2} = -\log[6.2e-8]$

$= 7.21$

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

$= 7.03$