0.479M

$H_2SO_3 \rightleftharpoons H^+ + HSO_3^-$ | 1st dissoc

	H_2SO_3	H^+	HSO_3^-
I	0.479M	~0	0
C	−x	+x	+x
E	0.479−x	x	x
E	0.397M	.082M	0.082M

$$K_{a_1} = \frac{[H^+][HSO_3^-]}{[H_2SO_3]}$$

$$1.7\times10^{-2} = \frac{(x)(x)}{.479-x}$$

$\frac{.479}{1.7\times10^{-2}} = 28$ not ≥ 400

$$1.7\times10^{-2}(.479-x) = x^2$$

$$8.14\times10^{-3} - 1.7\times10^{-2}x = x^2$$

$$\frac{1}{a}x^2 + 1.7\times10^{-2} - 8.14\times10^{-3} = 0$$

$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a} = \frac{-1.7\times10^{-2} \pm \sqrt{(1.7\times10^{-2})^2 - (4)(1)(-8.14\times10^{-3})}}{2}$$

$$\approx \frac{-1.7\times10^{-2} \pm \sqrt{3.28\times10^{-2}}}{2}$$

$[HSO_3^-] = [H^+] = x = \frac{-1.7\times10^{-2} \pm 0.181}{2} = \frac{.164}{2} = 0.082M$

$HSO_3^- \rightleftharpoons H^+ + SO_3^{2-}$ 2nd dissociation

	HSO_3^-	H^+	SO_3^{2-}
I	0.082	0.082	0
C	−x	+x	+x
E	0.082−x	0.082+x	x
E	0.082	0.082	6.4×10^{-8}

$$Ka_2 = 6.4\times10^{-8} = \frac{[H^+][SO_3^{2-}]}{[HSO_3^-]}$$

$$6.4\times10^{-8} = \frac{(0.082+x)(x)}{0.082-x}$$

$\frac{0.082}{6.4\times10^{-8}} = 1.28\times10^{7}$ (>400)

$x << 0.082$

$$6.4\times10^{-8} \approx \frac{(0.082)(x)}{0.082}$$

$$6.4\times10^{-8} \approx x$$

$$pH = -\log[H^+]$$

$$pH \approx -\log(0.082)$$

$$pH \approx 1.09$$

.578 M $NaHSO_4$

$NaHSO_4 \rightarrow Na^+ + HSO_4^-$

$HSO_4^- + H_2O \rightleftharpoons H_2SO_4 + OH^-$

$\longrightarrow HSO_4^- + H_2O \rightleftharpoons H_3O^+ + SO_4^{2-}$

$K_b = \frac{K_w}{K_{a_1}} = \frac{1 \times 10^{-14}}{\text{very large}} = \frac{1 \times 10^{-14}}{1 \times 10^{8}} = 1 \times 10^{-22}$

$K_{a_2} = 1.2 \times 10^{-2}$

Calc the pH of 0.627M $NaHCO_3$.

$NaHCO_3 \longrightarrow Na^+ + HCO_3^-$

HCO_3^- can act as an acid or a base!!

As an acid

$HCO_3^- + H_2O \rightleftharpoons CO_3^{2-} + H^+$

or

as a base

$HCO_3^- + H_2O \rightleftharpoons H_2CO_3 + OH^-$

which one does HCO_3^- act as?

acid $\longrightarrow K_{a_2} = 5.6 \times 10^{-11}$

or

base $\longrightarrow K_b = \frac{K_w}{K_{a_1}} = \frac{1 \times 10^{-14}}{4.3 \times 10^{-7}} = 2.32 \times 10^{-8}$

K_b is larger than K_{a_2}
so HCO_3^- acts as a base

$$HCO_3^- + H_2O \rightleftharpoons H_2CO_3 + OH^-$$

	HCO_3^-		H_2CO_3	OH^-
I	0.627M	−	0	~0
C	−x	−	+x	+x
E	0.627−x	−	+x	+x

$$K_b = 2.32 \times 10^{-8} = \frac{[H_2CO_3][OH^-]}{[HCO_3^-]}$$

$$2.32 \times 10^{-8} = \frac{(x)(x)}{0.627 - x} \qquad x \ll 0.627$$

$$1.46 \times 10^{-8} = x^2$$

$$1.24 \times 10^{-4} M = x = [OH^-]$$

$$pOH = -\log(1.21 \times 10^{-4})$$

$$= 3.92$$

$$pH = 14 - 3.92 = 10.08$$