

Acid-Base – Equilibrium Practice

Name: Key

1) Classify the following as acidic, basic or neutral salts:

a) LiCl

neutral

b) KNO₃

neutral

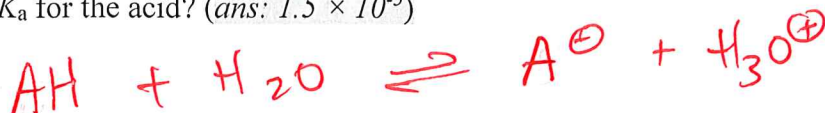
c) NH₄Cl

acidic

d) Na₃PO₄

basic

2) Butyric acid is responsible for the odor in rancid butter. A solution of 0.25 M butyric acid has a pH of 2.71. What is the K_a for the acid? (ans: 1.5×10^{-5})



I 0.25 M

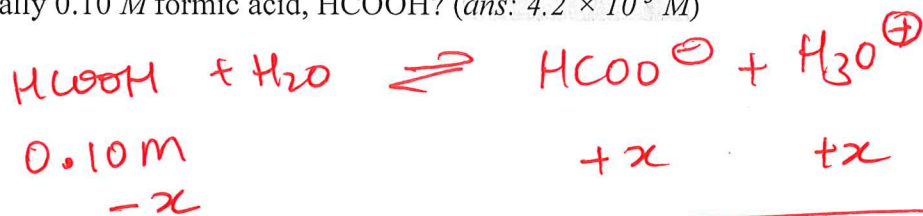
C

1.95×10^{-3} 1.95×10^{-3} $\text{antilog } 2.71$

E $0.25 - 1.95 \times 10^{-3}$

$$K_a = \frac{(1.95 \times 10^{-3})^2}{0.2481} = \frac{3.803 \times 10^{-6}}{0.2481} = \boxed{1.53 \times 10^{-5}}$$

3) Formic acid, which is a component of insect venom, has a $K_a = 1.8 \times 10^{-4}$. What is the $[H_3O^+]$ in a solution that is initially 0.10 M formic acid, HCOOH? (ans: $4.2 \times 10^{-3} M$)

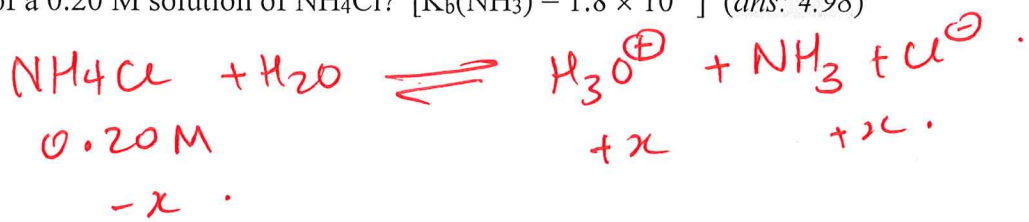


$$K_a = 1.8 \times 10^{-4} = \frac{x^2}{0.10 - x}$$

↑
ignore

$$= \sqrt{(1.8 \times 10^{-4})(0.1)} = \boxed{4.2 \times 10^{-3} M}$$

4) What is the pH of a 0.20 M solution of NH₄Cl? [$K_b(NH_3) = 1.8 \times 10^{-5}$] (ans: 4.98)



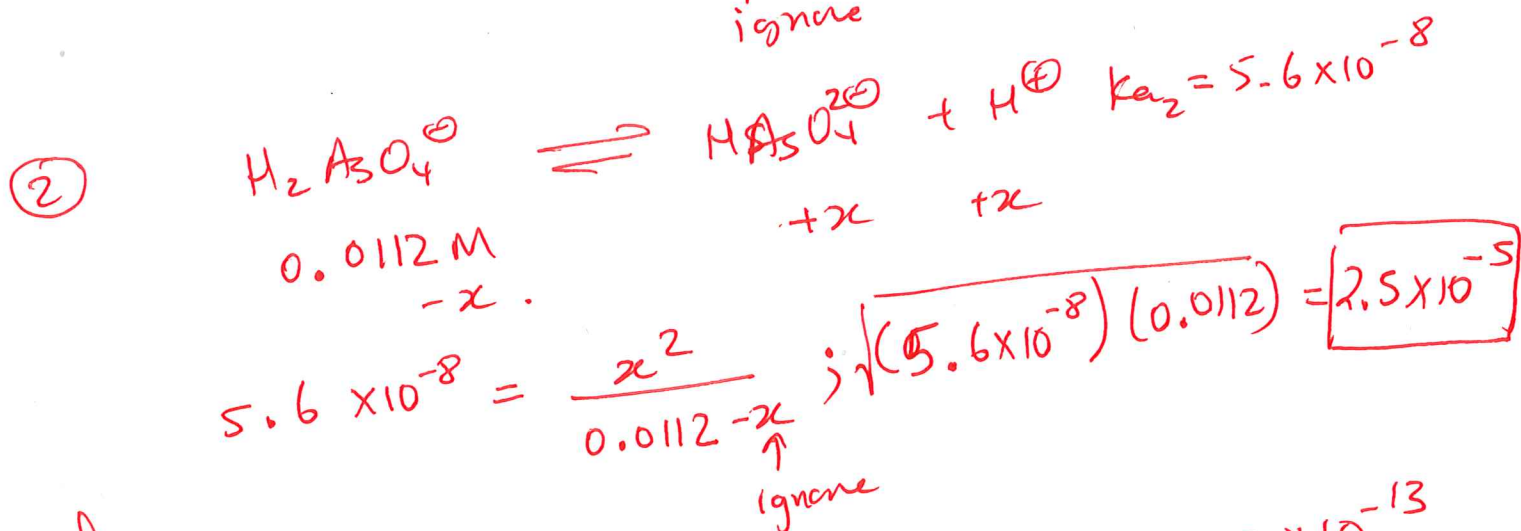
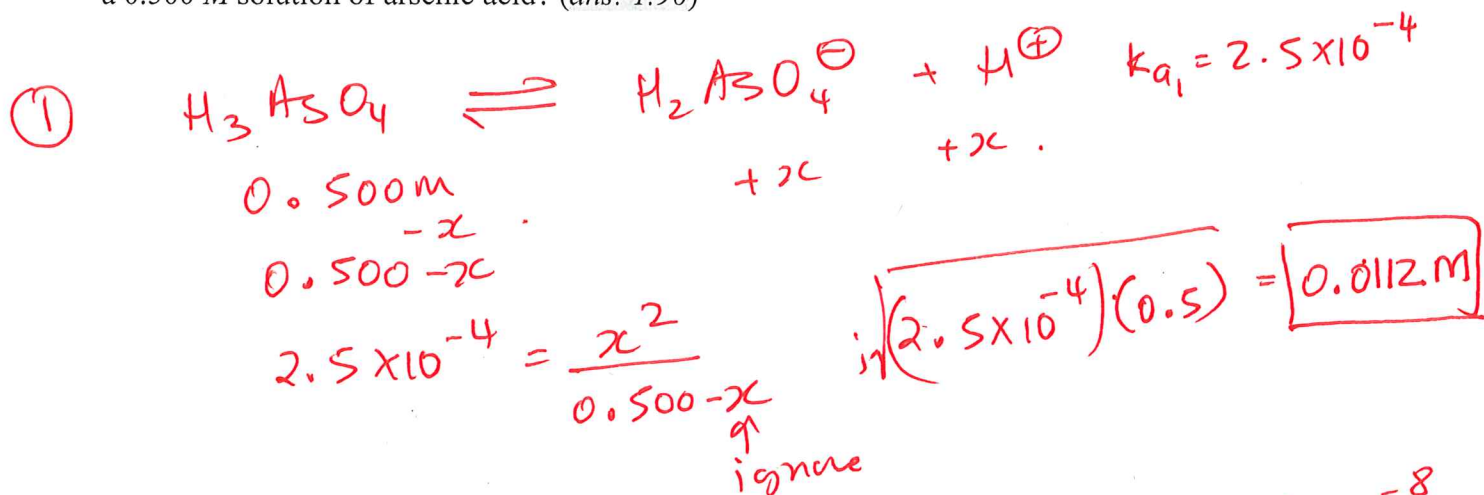
$$K_a = \frac{1 \times 10^{-14}}{1.8 \times 10^{-5}} = 5.56 \times 10^{-10} = \frac{x^2}{(0.20 - x)}$$

↑
ignore

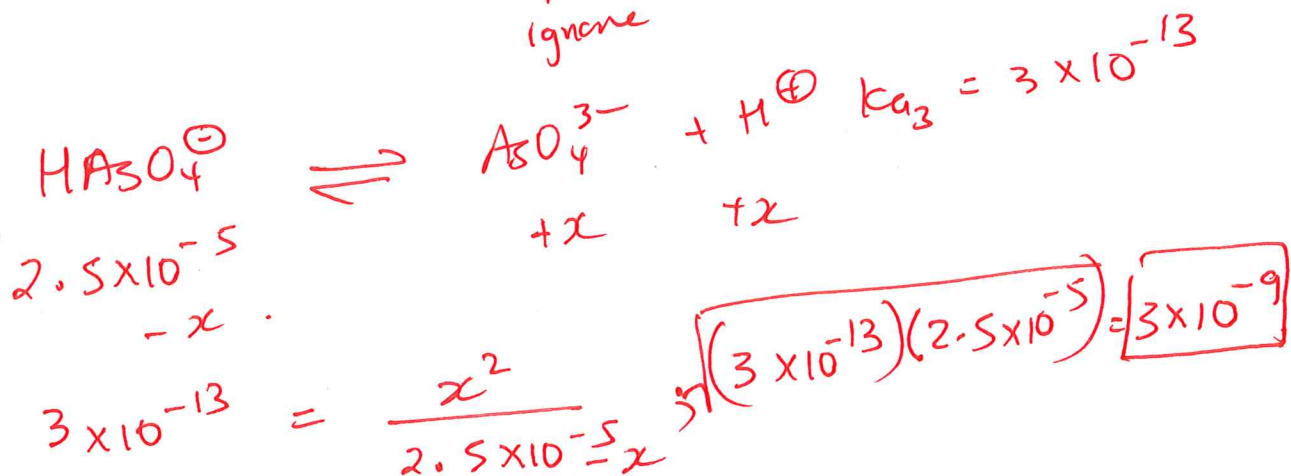
$$\sqrt{(5.56 \times 10^{-10})(0.20)} = 1.054 \times 10^{-5} M$$

$$pH = -\log 1.054 \times 10^{-5} = \boxed{4.98}$$

5) Farmers who raise cotton once used arsenic acid, H_3AsO_4 , as a defoliant at harvest time. Arsenic acid is a polyprotic acid with $K_1 = 2.5 \times 10^{-4}$, $K_2 = 5.6 \times 10^{-8}$, and $K_3 = 3 \times 10^{-13}$. What is the pH of a 0.500 M solution of arsenic acid? (ans: 1.96)



optional



total $[\text{H}_3\text{O}^+] = 0.0112 + 2.5 \times 10^{-5} + 3 \times 10^{-9}$
 $= 0.011225$

$\text{pH} = -\log 0.011225$
 $= \boxed{1.95}$

Just FYI
 $\text{pH} = -\log 0.0112$
 $= 1.95$ also!!
 the 2nd & 3rd ionization are minimal.