

Name \_\_\_\_\_ Date \_\_\_\_\_

In this section, you are only going to start the problem by identifying the type of problem and writing the chemical equation for the following substances dissolved in water:



2. Perchloric acid



3. Ammonia



4. Sodium hydroxide



5.  $\text{N}_2\text{H}_4$



6. Ammonium chloride  $\text{NH}_4\text{Cl} \rightarrow \text{NH}_4^+ + \text{Cl}^-$



7. Lithium fluoride  $\text{LiF} \rightarrow \text{Li}^+ + \text{F}^-$



8. Potassium nitrite  $\text{KNO}_2 \rightarrow \text{K}^+ + \text{NO}_2^-$



9. Sodium acetate  $\text{NaC}_2\text{H}_3\text{O}_2 \rightarrow \text{Na}^+ + \text{C}_2\text{H}_3\text{O}_2^-$

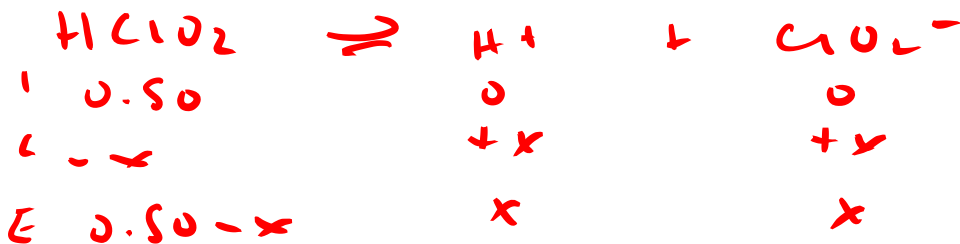
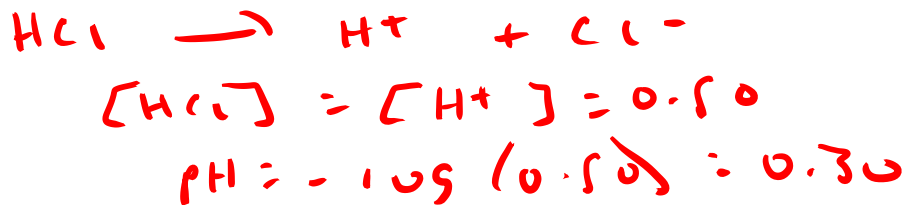


10. Phosphoric acid



Calculate the pH of the following 0.50 M solutions:

1. Hydrochloric acid
2. Chlorous acid
3. Ammonia
4. Sodium hydroxide
5. Sodium fluoride
6. Ammonium nitrate
7. Formic acid (HCOOH) and Hypobromous acid (HOBr)
8. Phosphoric acid

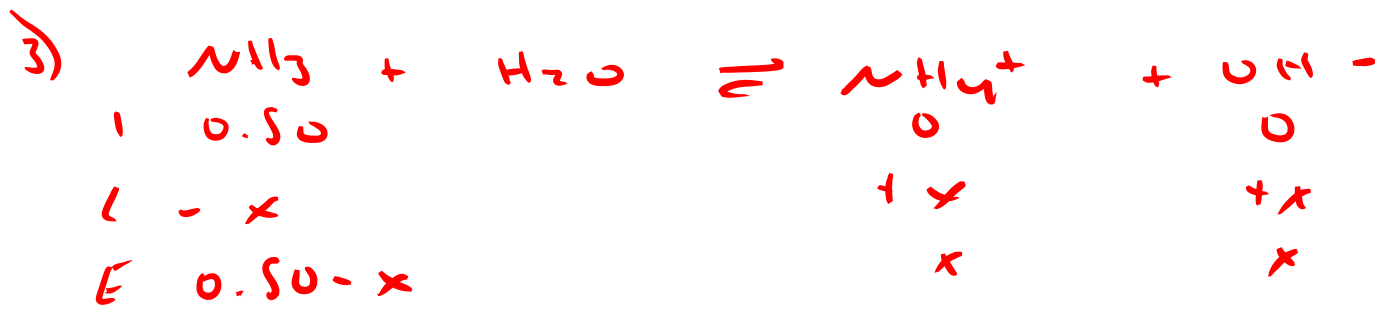


$$K_a = \frac{[\text{H}^+][\text{ClO}_2^-]}{[\text{HClO}_2]}$$

$$1.2 \times 10^{-2} = \frac{x^2}{0.50 - x}$$

$$x = 0.077 \text{ M} = [\text{H}^+]$$

$$\text{pH} = \frac{0.077}{0.50} \times 100 = 15.4 \quad !! \quad \text{quadratic}$$



$$K_b = \frac{[\text{NH}_4^+][\text{OH}^-]}{[\text{NH}_3]}$$

$$1.8 \times 10^{-5} = \frac{x^2}{0.50 - x}$$

$$x = 3.0 \times 10^{-3} = [\text{OH}^-]$$

$$\text{pOH} = \frac{3.0 \times 10^{-3}}{0.50} \times 100 = 0.60 \checkmark$$

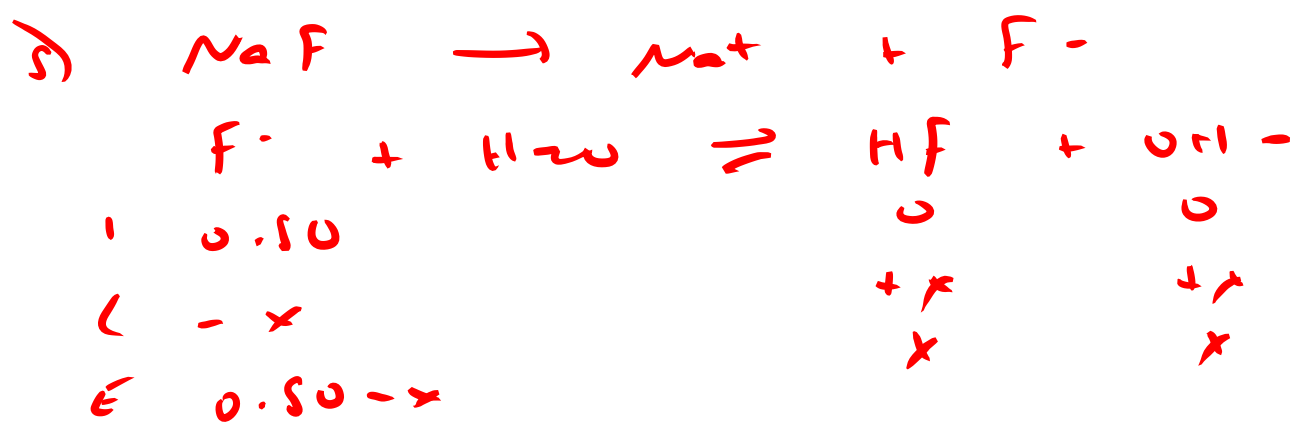
$$\text{pOH} = -\log(3.0 \times 10^{-3}) = 2.52$$

$$\text{pH} = 14 - 2.52 = 11.48$$



$$\text{pOH} = -\log(0.50) = 0.30$$

$$\text{pH} = 14 - 0.30 = 13.70$$



$$K_b = \frac{[\text{HF}][\text{OH}^-]}{[\text{F}^-]}$$

$$1.38 \times 10^{-4} = \frac{x^2}{0.50-x}$$

$$x = 2.64 \times 10^{-6} \text{ M} = [\text{OH}^-]$$

$$\text{pOH} = \frac{2.64 \times 10^{-6}}{0.50} \times 1000 = 5.27 \times 10^{-4} \text{ pOH} \checkmark$$

$$\text{pOH} = -\log(2.64 \times 10^{-6}) = 5.58$$

$$\text{pH} = 8.42$$



I	$0.50$	$\rightleftharpoons$	$0$	+	$0$
C	$-x$		$+x$		$+x$
E	$0.50 - x$		$x$		$x$

$$K_a = \frac{[\text{NH}_3][\text{H}^+]}{[\text{NH}_4^+]}$$

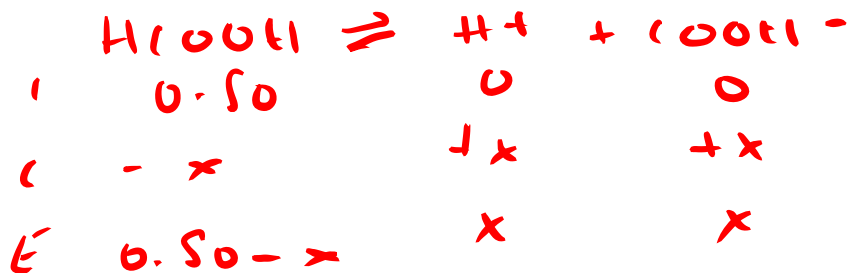
$$K_a = \frac{K_w}{K_b} = \frac{1.0 \times 10^{-14}}{1.8 \times 10^{-5}} = 5.56 \times 10^{-10}$$

$$5.56 \times 10^{-10} = \frac{x^2}{0.50 - x}$$

$$x = 1.7 \times 10^{-5} \text{ M} = [\text{H}^+]$$

$$\text{pH} = -\log \left( \frac{1.7 \times 10^{-5}}{0.50} \right) = 4.77$$

$$\text{pH} = -\log (1.7 \times 10^{-5}) = 4.77$$



$$K_a = \frac{[\text{H}^+][\text{COOH}^-]}{[\text{HCOOH}]}$$

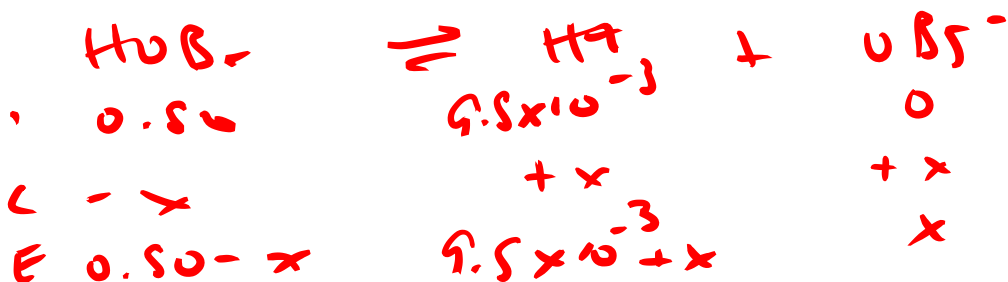
$$1.8 \times 10^{-4} = \frac{x^2}{0.50 - x}$$

$$x = 9.5 \times 10^{-3} \text{ M} = [\text{H}^+]$$

$$= [\text{COOH}^-]$$

$$\text{pH} = -\log(9.5 \times 10^{-3})$$

$$= 2.98$$



$$K_a = \frac{[\text{H}^+][\text{OBz}^-]}{[\text{HOBz}]}$$

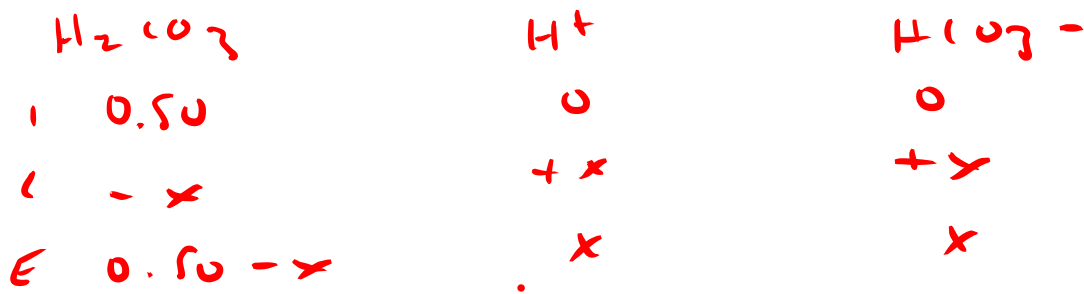
$$2 \times 10^{-9} = \frac{(9.5 \times 10^{-3} + x)(x)}{0.50 - x}$$

$$x = 1.05 \times 10^{-7} \text{ M}$$

$$[\text{OBz}^-]$$

$$\text{pH} = -\log(1.05 \times 10^{-7})$$

$$= 6.98$$



$$K_a = \frac{[\text{H}^+][\text{H}_2\text{PO}_4^-]}{[\text{H}_3\text{PO}_4]}$$

$$4.3 \times 10^{-7} = \frac{x^2}{0.50 - x}$$

$$x = 4.6 \times 10^{-4} \text{ M} = [\text{H}^+]$$

$$\% \text{H}^+ = \frac{4.6 \times 10^{-4}}{0.50} \cdot 100 = 0.092\% \checkmark$$