

Calculating Concentration from pH and pOH

1. What is the concentration of ^{H₃O⁺} hydronium ions in the following solutions given their pH values?

- 2 sig digs (a) pH = 2.34 $10^{-\text{pH}}$ $10^{-2.34}$ 0.0046 mol/L or 4.6×10^{-3} mol/L
- 1 sig dig (b) pH = 15.6 ~~2.5~~ 3×10^{-16} mol/L
- 1 sig dig (c) pH = 4.4 4×10^{-5} mol/L
- 3 sig digs (d) pH = 1.892 0.0128 mol/L or 1.28×10^{-2} mol/L
- 2 sig digs (e) pH = 5.63 2.3×10^{-6} mol/L

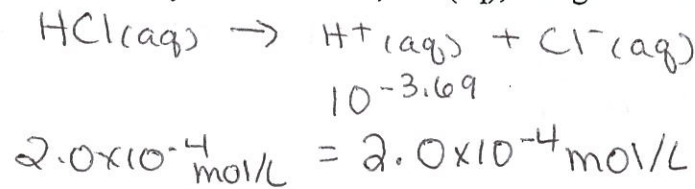
2. What is the concentration of ^{OH⁻} hydroxide ions in the following solutions given the following information?

- (a) pOH = 1.45 $10^{-\text{pOH}}$ 0.035 mol/L or 3.5×10^{-2} mol/L
- (b) pOH = 10.672 2.13×10^{-11} mol/L
- (c) pOH = 7.3 5×10^{-8} mol/L

- pH + pOH = 14
- (d) pH = 2.982 $14 - 2.982 = 11.018$ 9.59×10^{-12} mol/L
- (e) pH = 4.932 $14 - 4.932 = 9.068$ 8.55×10^{-10} mol/L
- (f) pH = 10.2 $14 - 10.2 = 3.8$ 2×10^{-4} mol/L

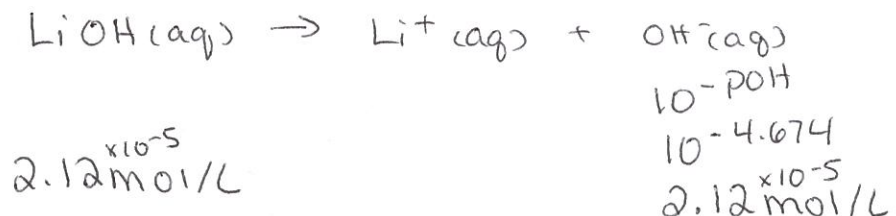
3. What is the concentration of hydrochloric acid, HCl(aq), that gives a solution with a pH of 3.69?

1:1 ratio

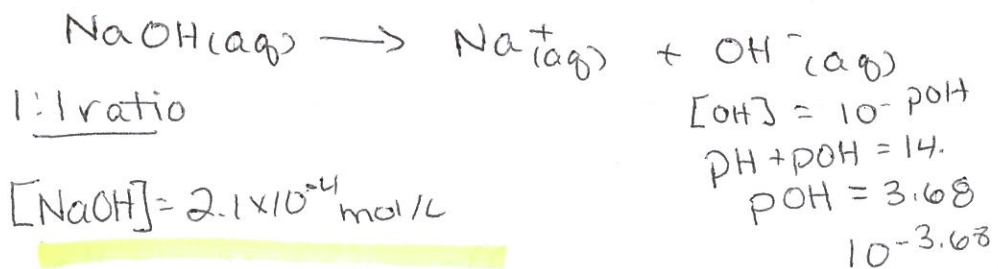


4. What is the concentration of lithium hydroxide, LiOH(aq), that gives a solution with a pOH of 4.674?

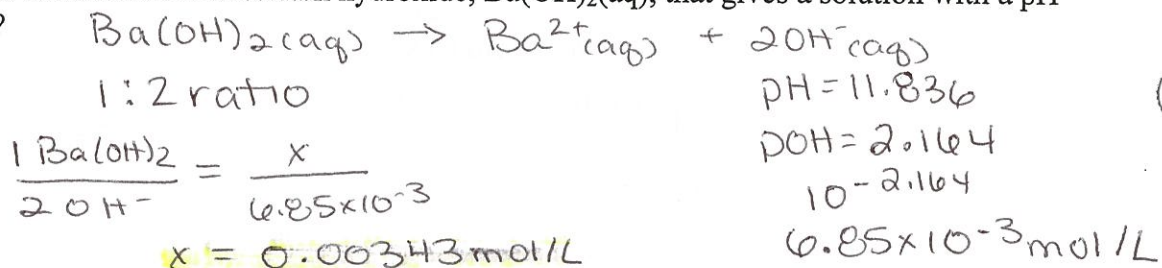
1:1 ratio



5. What is the concentration of sodium hydroxide, NaOH(aq), that gives a solution with a pH of 10.32?



6. What is the concentration of barium hydroxide, $\text{Ba}(\text{OH})_2(\text{aq})$, that gives a solution with a pH of 11.836?



7. Is it possible to make an aqueous solution with strontium hydroxide, $\text{Sr}(\text{OH})_2(\text{aq})$, that gives a pOH of 10.54? If so calculate it. If not, explain why not.

8. What mass of hydrogen chloride gas, $\text{HCl}(\text{g})$, needs to be dissolved in 2.00 L of water to create a solution with a pH of 3.298?

Molar Mass = 36.46 g/mol

$$[\text{H}_3\text{O}^{+}] = 10^{-3.298}$$

$$= 5.035 \times 10^{-4} \text{ mol/L}$$

$$\frac{36.46 \text{ g}}{1 \text{ mol}} = \frac{0.0367 \text{ g}}{1.007 \times 10^{-3} \text{ mol}}$$

1:1 ratio

$$\frac{5.035 \times 10^{-4} \text{ mol}}{1 \text{ L}} = \frac{1.007 \times 10^{-3} \text{ mol}}{2.00 \text{ L}}$$

9. What mass of rubidium hydroxide, $\text{RbOH}(\text{s})$, needs to be dissolved in 1.50 L of water to create a solution with a pH of 9.35?

$$\frac{2.24 \times 10^{-5} \text{ mol}}{1 \text{ L}} = \frac{3.35 \times 10^{-5} \text{ mol}}{1.50 \text{ L}}$$

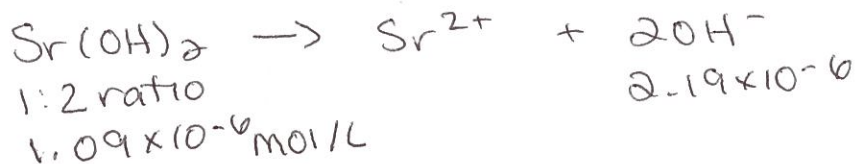
pOH = 4.65
 $10^{-4.65}$
 $[\text{OH}^{-}] = 2.24 \times 10^{-5} \text{ mol/L}$
1:1 ratio $\therefore [\text{RbOH}] = 2.24 \times 10^{-5} \text{ mol/L}$

$$\frac{102.475 \text{ g}}{1 \text{ mol}} = \frac{0.034 \text{ g}}{3.35 \times 10^{-5} \text{ mol}}$$

10. What mass of strontium hydroxide, $\text{Sr}(\text{OH})_2(\text{s})$, needs to be dissolved in 3.0 L of water to create a solution with a pH of 8.34?

pOH = 5.66
 $10^{-5.66}$

$$[\text{OH}^{-}] = 2.19 \times 10^{-6} \text{ mol/L}$$



Molar mass = 121.63 g/mol

$$\frac{121.63 \text{ g}}{1 \text{ mol}} = \frac{4.0 \times 10^{-4} \text{ g}}{3.28 \times 10^{-6} \text{ mol}}$$

$$\frac{1.09 \times 10^{-6} \text{ mol}}{1 \text{ L}} = \frac{3.28 \times 10^{-6} \text{ mol}}{3.0 \text{ L}}$$

$$m_{\text{Sr}(\text{OH})_2} = 4.0 \times 10^{-4} \text{ g}$$