

****Honor System: You are to Work Alone on this Quiz.

1. (3 Pts) What volume of 12.0 M HNO₃ is required to prepare 900 mL of 2.0 M HNO₃ solution?

Dilution Problem

$$M_1 V_1 = M_2 V_2$$

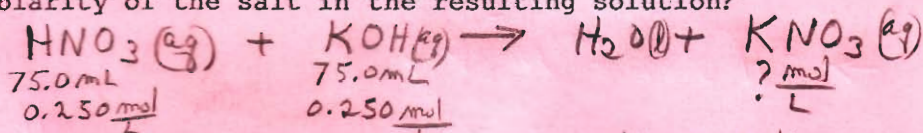
$$(12.0M)(V_1) = (2.0M)(900\text{mL})$$

$$V_1 = 150\text{ mL}$$

2. (3 Pts) What is the molarity of 1600 mL of a solution that contains 3.25 g of H₃PO₄?

$$\frac{3.25\text{ g H}_3\text{PO}_4}{97.994\text{ g}} \times \frac{1\text{ mol}}{1600 \times 10^{-3}\text{ L}} = 0.0207 \frac{\text{mol H}_3\text{PO}_4}{\text{L}}$$

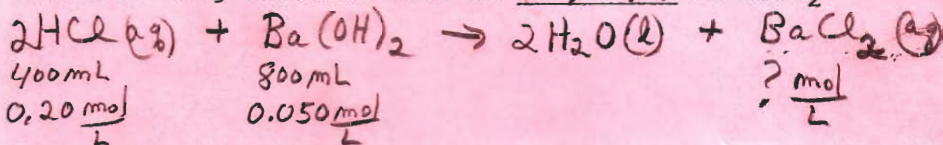
3. (3 Pts) If 75.0 mL of 0.250 M HNO₃ and 75.0 mL of 0.250 M KOH are mixed, what is the molarity of the salt in the resulting solution?



Since the reaction has a 1:1 ratio and there are stoichiometric amounts (same volumes & concentrations), we can work with either reactant.

$$\frac{75.0\text{ mL HNO}_3}{1000\text{ mL HNO}_3} \times \frac{0.250\text{ mol HNO}_3}{1\text{ mol HNO}_3} \times \frac{1\text{ mol KNO}_3}{1\text{ mol HNO}_3} \times \frac{1}{0.150\text{ L solution}} = 0.125 \frac{\text{mol KNO}_3}{\text{L solution}}$$

4. (3 Pts) If 400 mL of 0.20 M HCl solution is added to 800 mL of 0.050 M Ba(OH)₂ solution, the resulting solution will be 0.033 M in BaCl₂.

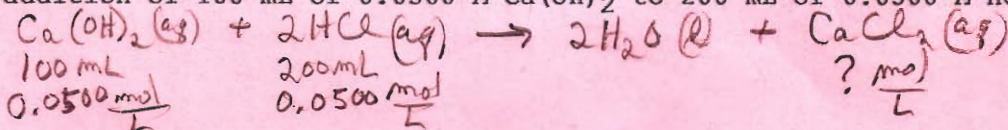


either one

Based on HCl: $\frac{400\text{ mL HCl}}{1000\text{ mL HCl}} \times \frac{0.20\text{ mol HCl}}{2\text{ mol HCl}} \times \frac{1\text{ mol BaCl}_2}{1\text{ mol BaCl}_2} \times \frac{1}{1.2\text{ L solution}} = 0.033 \frac{\text{mol BaCl}_2}{\text{L solution}}$

Based on Ba(OH)₂: $\frac{800\text{ mL Ba}(\text{OH})_2}{1000\text{ mL Ba}(\text{OH})_2} \times \frac{0.050\text{ mol Ba}(\text{OH})_2}{1\text{ mol Ba}(\text{OH})_2} \times \frac{1\text{ mol BaCl}_2}{1\text{ mol Ba}(\text{OH})_2} \times \frac{1}{1.2\text{ L solution}} = 0.033 \frac{\text{mol BaCl}_2}{\text{L solution}}$

5. (3 pts) What is the molarity of the calcium chloride in the solution resulting from the addition of 100 mL of 0.0500 M Ca(OH)₂ to 200 mL of 0.0500 M HCl?



either one

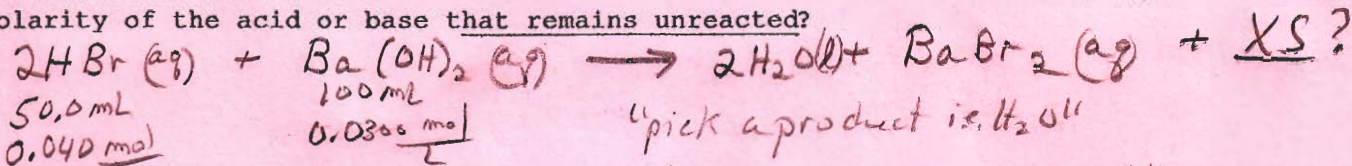
Based on Ca(OH)₂: $\frac{100\text{ mL Ca}(\text{OH})_2}{1000\text{ mL Ca}(\text{OH})_2} \times \frac{0.0500\text{ mol Ca}(\text{OH})_2}{1\text{ mol Ca}(\text{OH})_2} \times \frac{1\text{ mol CaCl}_2}{1\text{ mol Ca}(\text{OH})_2} \times \frac{1}{0.300\text{ L solution}} = 0.017 \frac{\text{mol CaCl}_2}{\text{L solution}}$

Based on HCl: $\frac{200\text{ mL HCl}}{1000\text{ mL HCl}} \times \frac{0.0500\text{ mol HCl}}{2\text{ mol HCl}} \times \frac{1\text{ mol CaCl}_2}{1\text{ mol HCl}} \times \frac{1}{0.300\text{ L solution}} = 0.017 \frac{\text{mol CaCl}_2}{\text{L solution}}$

Quiz 6

Key

6. (3 Pts) If 50.0 mL of 0.0400 M HBr is added to 100 mL of 0.0300 M Ba(OH)₂, what is the molarity of the acid or base that remains unreacted?



Based on HBr:

$$\frac{50.0 \text{ mL HBr} \times 0.0400 \frac{\text{mol}}{\text{L}}}{1000 \text{ mL HBr}} \times \frac{2 \text{ mol H}_2\text{O}}{2 \text{ mol HBr}} = 0.00200 \text{ mol H}_2\text{O}$$

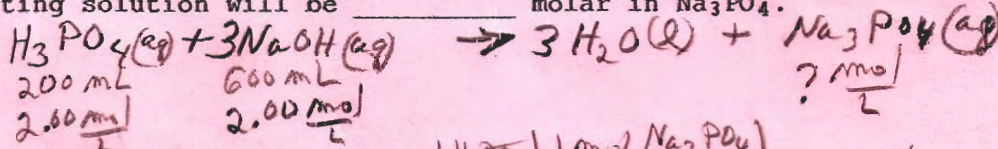
Based on Ba(OH)₂:

$$\frac{100 \text{ mL Ba(OH)}_2 \times 0.0300 \frac{\text{mol}}{\text{L}}}{1000 \text{ mL Ba(OH)}_2} \times \frac{2 \text{ mol H}_2\text{O}}{1 \text{ mol Ba(OH)}_2} = 0.00600 \text{ mol H}_2\text{O}$$

Difference is related to XS:

$$\frac{0.00400 \frac{\text{mol}}{\text{L}} \times 1 \text{ mol Ba(OH)}_2}{2 \text{ mol H}_2\text{O}} \times 0.150 \text{ L solution} = 0.0133 \frac{\text{mol Ba(OH)}_2}{\text{L solution}}$$

7. (3 Pts) If 200 mL of 2.00 M H₃PO₄ solution is added to 600 mL of 2.00 M NaOH solution, the resulting solution will be _____ molar in Na₃PO₄.



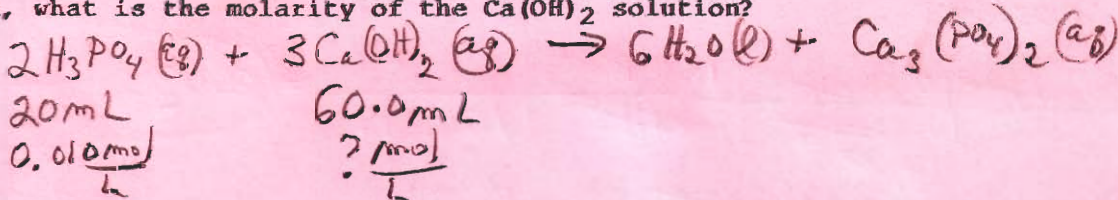
Based on H₃PO₄:

$$\frac{200 \text{ mL H}_3\text{PO}_4 \times 2.00 \frac{\text{mol}}{\text{L}}}{1000 \text{ mL H}_3\text{PO}_4} \times \frac{1 \text{ mol Na}_3\text{PO}_4}{1 \text{ mol H}_3\text{PO}_4} \times 0.8 \text{ L solution} = 0.500 \frac{\text{mol Na}_3\text{PO}_4}{\text{L solution}}$$

Based on NaOH:

$$\frac{600 \text{ mL NaOH} \times 2.00 \frac{\text{mol}}{\text{L}}}{1000 \text{ mL NaOH}} \times \frac{1 \text{ mol Na}_3\text{PO}_4}{3 \text{ mol NaOH}} \times 0.8 \text{ L solution} = 0.500 \frac{\text{mol Na}_3\text{PO}_4}{\text{L solution}}$$

8. (3 Pts) If 20 mL of 0.010 M H₃PO₄ solution is completely neutralized by 60.0 mL of Ca(OH)₂ solution, what is the molarity of the Ca(OH)₂ solution?



$$\frac{20 \text{ mL H}_3\text{PO}_4 \times 0.010 \frac{\text{mol}}{\text{L}}}{1000 \text{ mL H}_3\text{PO}_4} \times \frac{3 \text{ mol Ca(OH)}_2}{2 \text{ mol H}_3\text{PO}_4} = 0.0050 \frac{\text{mol Ca(OH)}_2}{\text{L Ca(OH)}_2}$$