

$$Molarity = \frac{\text{moles}}{L}$$



Key

Molarity & Titration

Calculate the molarity of a solution made by dissolving 15.0 g of KNO_3 in 200. mL of water.

3 sig fig 3 sig fig

$$mL \rightarrow L: 200.0 \text{ mL} \cdot \frac{1 L}{1000 \text{ mL}} = 0.200 L$$

molar mass

$$39.098 \text{ g/mol} + 14.007 \text{ g/mol} + 3 \cdot (15.999) = 101.1 \text{ g/mol}$$

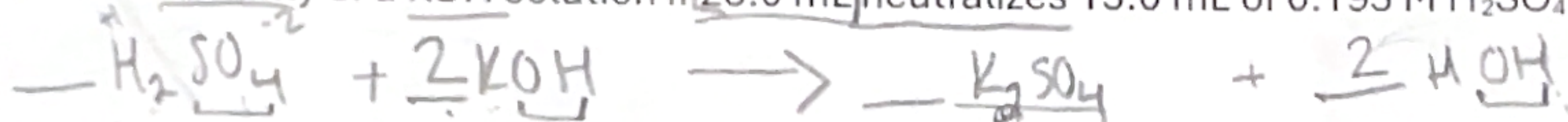
$$15.0 \text{ g } KNO_3 \cdot \frac{1 \text{ mol}}{101.1 \text{ g}} = 0.148 \text{ mol } KNO_3$$

$$M = \frac{0.148 \text{ mol } KNO_3}{0.200 L}$$

$$= 0.74$$

$$\boxed{0.740 M}$$

What is the molarity of a KOH solution if 28.0 mL neutralizes 15.0 mL of 0.195 M H_2SO_4 ?



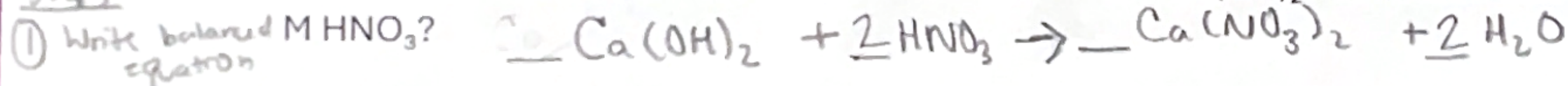
$$15.0 \text{ mL} \rightarrow 0.015 L \quad 0.195 M \cdot 0.015 L = 0.002925 \text{ mol } H_2SO_4$$

$$0.002925 \text{ mol } H_2SO_4 \cdot \frac{2 \text{ mol } KOH}{1 \text{ mol } H_2SO_4} = 0.00585 \text{ mol } KOH$$

$$28.0 \text{ mL} \rightarrow 0.0280 L \quad M = \frac{0.00585 \text{ mol } KOH}{0.0280 L} = 0.2089285714 \rightarrow \boxed{0.209 M KOH}$$

Steps

What is the molarity of a $Ca(OH)_2$ solution if 50.0 mL of $Ca(OH)_2$ neutralizes 40.0 mL of 0.250



② Calculate moles for HNO_3 + mL $\rightarrow$ L

$$0.250 M HNO_3 \cdot 0.0400 L = 0.0100 \text{ mol } HNO_3$$

③ Calculate moles for $Ca(OH)_2$

$$0.0100 \text{ mol } HNO_3 \cdot \frac{1 \text{ mol } Ca(OH)_2}{2 \text{ mol } HNO_3} = 0.00500 \text{ mol } Ca(OH)_2$$

④ Calculate Molarity + mL $\rightarrow$ L

$$50.0 \text{ mL} \rightarrow 0.0500 L \quad M = \frac{0.00500 \text{ mol } Ca(OH)_2}{0.0500 L} = \boxed{0.100 M Ca(OH)_2}$$

Calculate the molarity of the following solution and its ions: 15.6 g of potassium hydroxide (KOH) is dissolved in water to make 300 mL of solution.

① Find molar mass KOH: $39.1 + 16 + 1.0 = 56.1 \text{ g/mol KOH}$

② Calculate mole KOH: $15.6 \text{ g} \cdot \frac{1 \text{ mol}}{56.1 \text{ g}} = 0.278 \text{ mol KOH}$

③ Convert mL $\rightarrow$ L: $300 \text{ mL} \cdot \frac{1 L}{1000 \text{ mL}} = 0.300 L$

④ Calculate Molarity: $M = \frac{0.278 \text{ mol KOH}}{0.300 L} = 0.927 M$

⑤ Determine concentration of ions: * For every 1 mol of KOH, it dissolves into 1 mol K^+ and 1 mol OH^- .

$$[K^+] = 0.927 M$$

$$[OH^-] = 0.927 M$$

What is the equation for dilution?

$$M_1 V_1 = M_2 V_2$$

How many milliliters of 12.0 M HCl are needed to make 1.5 L of 0.50 M HCl?

$$(12.0 \text{ M}) V_1 = (0.50 \text{ M})(1.5 \text{ L})$$

$$V_1 = \frac{(0.50 \text{ M})(1.5 \text{ L})}{(12.0 \text{ M})}$$

$$= 0.0625 \text{ L} \cdot \frac{1000 \text{ mL}}{1 \text{ L}} =$$

$$\boxed{62.5 \text{ mL HCl}}$$

200 mL of a 6.0 M HCl solution is diluted by adding water to make the total volume 1.0 L.

What is the new concentration of the HCl solution?

$$1.0 \text{ L} \rightarrow 1000 \text{ mL}$$

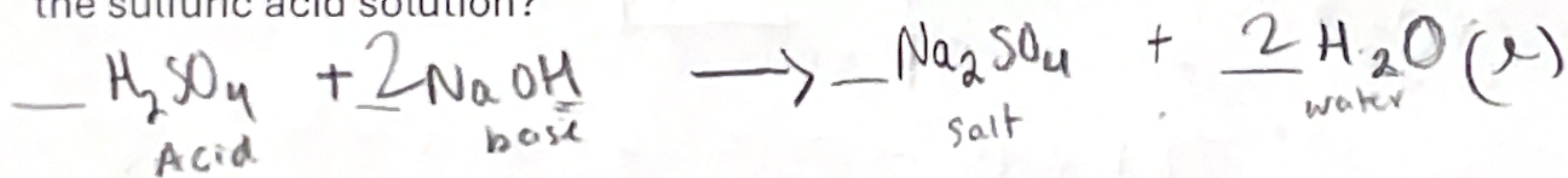
$$M_1 V_1 = M_2 V_2$$

$$(6.0 \text{ M})(200 \text{ mL}) = M_2 (1000 \text{ mL})$$

$$M_2 = \frac{(6.0 \text{ M})(200 \text{ mL})}{1000 \text{ mL}}$$

$$M_2 = \boxed{1.2 \text{ M HCl}}$$

A 40.0 mL sample of a sulfuric acid (H_2SO_4) solution is titrated with 0.250 M sodium hydroxide (NaOH). It takes 50.0 mL of NaOH to reach the endpoint. What is the molarity of the sulfuric acid solution?



$$0.250 \text{ M NaOH} \cdot 0.0500 \text{ L} = \boxed{0.125 \text{ mol NaOH}}$$

$$0.125 \text{ mol NaOH} \cdot \frac{1 \text{ mol H}_2\text{SO}_4}{2 \text{ mol NaOH}} = 0.0625 \text{ mol H}_2\text{SO}_4$$

$$M = \frac{0.0625 \text{ mol H}_2\text{SO}_4}{0.0400 \text{ L}} = \boxed{1.56 \text{ M H}_2\text{SO}_4}$$

40.0 mL $\frac{1 \text{ L}}{1000 \text{ mL}}$ →

