

Neutralization Calculations

THESE NEUTRALIZATION (ACID-BASE) CALCULATION ARE THE SAME AS ANY REACTION STOICHIOMETRY QUESTION. SO FOLLOW YOUR DIRECTIONS.

- 2) THE ONLY NEW CONCEPT IS THAT TO FIND MOLES YOU NEED TO KNOW THE CONCENTRATION AND VOLUME OF SOLUTION. THE EQUATION TO GET MOLES IS:

$$M \cdot V = \text{moles}$$

SO YOU DO THESE CALCULATIONS THE SAME AS ANY OTHER REACTION STOICHIOMETRY QUESTION.

FOR EXAMPLE: How many liters of a 0.45 M sulfuric acid solution do I need to add to 455 ml of a 0.65 M sodium hydroxide solution to completely neutralize the solutions.

Step 1: Balanced reaction: $\text{H}_2\text{SO}_4(\text{aq}) + 2\text{NaOH}(\text{aq}) \rightarrow \text{Na}_2\text{SO}_4(\text{aq}) + 2\text{H}_2\text{O}$

Step 2: Convert known info to moles:

$$455 \text{ ml} \left(\frac{1 \text{ L}}{1000 \text{ ml}} \right) = 0.455 \text{ L}$$

$$\# \text{ moles}_{\text{NaOH}} = M_{\text{NaOH}} \cdot V_{\text{NaOH}}$$

$$x = \left(0.65 \frac{\text{mole NaOH}}{\text{L solution}} \right) (0.455 \text{ L solution}) = 0.2958 \text{ mole NaOH}$$

Step 3: Using molar ratio to go from mole known to mole unknown

$$0.2958 \text{ mole NaOH} \left(\frac{1 \text{ mole H}_2\text{SO}_4}{2 \text{ mole NaOH}} \right) = 0.1479 \text{ mole H}_2\text{SO}_4$$

Step 4: Convert unknown moles to desired units:

$$\# \text{ moles}_{\text{H}_2\text{SO}_4} = M_{\text{H}_2\text{SO}_4} \cdot V_{\text{H}_2\text{SO}_4}$$

$$0.1479 \text{ mole H}_2\text{SO}_4 = \left(0.45 \frac{\text{mole H}_2\text{SO}_4}{\text{L solution}} \right) x$$

$$0.1479 \text{ mole H}_2\text{SO}_4$$

$$\frac{0.1479 \text{ mole H}_2\text{SO}_4}{0.45 \text{ mole H}_2\text{SO}_4} = x = 0.3286 \text{ L} = \boxed{0.329 \text{ L}} \text{ or } \boxed{329 \text{ ml}}$$