Name Answer Key Hour ____

NEUTRALIZATION REACTIONS

For the following acid-base reactions, write a balanced chemical equation and solve.

1. How much 2.0 *M* H_2SO_4 is needed to neutralize 1.0-L of 2.0 *M* NaOH?

$H_2SO_4 + 2\,NaOH \rightarrow 2\,H_2O + Na_2SO_4$

$2.0\ mol \left| \frac{1\ mol}{2\ NaOH} \right. = 1\ mol\ H_2SO_4$ $\qquad \frac{1\ mol\ H_2SO_4}{2\ mol/L} = .5\text{-}L\ of\ 2.0M\ H_2SO_4$

2. How much 5.0 *M* H_2SO_4 is needed to neutralize 1.0-L of 2.0 *M* NaOH?

* 1 mol H_2SO_4 needed

$\frac{1\ mol\ H_2SO_4}{5.0\ mol/L} = .2\text{-}L\ of\ 5.0M\ H_2SO_4$

3. If 1.0-L of H_2SO_4 is needed to neutralize 1.0-L of 2.0 *M* NaOH, what is its concentration?

* 1 mol needed

$\frac{1\ mol}{1.0\text{-}L} = 1.0M\ H_2SO_4$

4. If 4.0-L H_2SO_4 is needed to neutralize 1.0-L of 2.0 *M* NaOH, what is its concentration?

* 1 mol needed

$\frac{1\ mol}{4.0\text{-}L} = .25\text{-}M\ H_2SO_4$

5. How much 2.0 *M* HCl is needed to neutralize 0.5-L of 5.0 *M* $Ca(OH)_2$?

$2\,HCl + Ca(OH)_2 \rightarrow 2\,H_2O + CaCl_2$

$2.5\ mol\ Ca(OH)_2 \left| \frac{2\ mol\ HCl}{1\ mol\ Ca(OH)_2} \right. = 5\ mol\ HCl\ Needed$ $\qquad \frac{5\ mol\ HCl}{2\ \frac{mol}{L}} = 2.5\text{-}L\ of\ 2.0M\ HCl$

6. How much 1.0 *M* HCl is needed to neutralize 0.5-L of 5.0 *M* $Ca(OH)_2$?

* 5 mol HCl needed

$\frac{5\ mol}{1.0\ \frac{mol}{L}} = 5\text{-}L\ of\ 1.0M\ HCl$

7. If 1.5-L of HCl is needed to neutralize 1.0-L of 5.0 *M* $Ca(OH)_2$, what is its concentration?

$\frac{5 \text{ mol } Ca(OH)_2 \mid 2 \text{ mol HCl}}{1 \text{ mol } Ca(OH)_2} = \frac{10 \text{ mol}}{1.5\text{-L}} = \boxed{6.67 \text{ M HCl}}$

* 10 mol HCl needed

8. If 10.0-L of HCl is needed to neutralize 0.5-L of 5.0 *M* $Ca(OH)_2$, what is its concentration?

* 5 mol HCl needed

$\frac{5 \text{ mol}}{10.0\text{-L}} = \boxed{.5 \text{ M HCl}}$

9. How much 2.0 *M* H_3PO_4 is needed to neutralize 0.5-L of 5.0 *M* KOH?

$H_3PO_4 + 3KOH \rightarrow 3H_2O + K_3PO_4$

$\frac{2.5 \text{ mol KOH} \mid 1 \text{ mol } H_3PO_4}{3 \text{ mol KOH}} = \text{*} .83 \text{ mol needed}$ $\quad \frac{.83 \text{ mol}}{2 \frac{\text{mol}}{\text{L}}} = \boxed{.415\text{-L of } 2.0 \text{ M } H_3PO_4}$

10. How much 1.0 *M* H_3PO_4 is needed to neutralize 0.5-L of 5.0 *M* KOH?

* .83 mol needed

$\frac{.83 \text{ mol}}{1. \frac{\text{mol}}{\text{L}}} = \boxed{.83\text{-L of } 1.0 \text{M } H_3PO_4}$

11. If 1.5-L of $H_3PO_4$is needed to neutralize 1.0-L of 5.0 *M* KOH, what is its concentration?

$\frac{5 \text{ mol KOH} \mid 1 \text{ mol } K_3PO_4}{3 \text{ mol KOH}} = \text{*} 1.67 \text{ mol } H_3PO_4 \text{ needed}$

$\frac{1.67 \text{ mol}}{1.5\text{-L}} = \boxed{1.11 \text{ M } H_3PO_4}$

12. If 10.0-L of H_3PO_4 is needed to neutralize 0.5-L of 5.0 *M* KOH, what is its concentration?

$\frac{.5\text{-L} \mid 5 \text{ mol} \mid 1 \text{ mol } H_3PO_4}{1\text{-L} \mid 3 \text{ mol KOH}} = \frac{\text{*} .83 \text{ mol } H_3PO_4 \text{ needed}}{10\text{-L}} =$

$\boxed{.083\text{-M } H_3PO_4}$