$\qquad$ Score $\qquad$ / 5

## AP Chemistry: Solution Stoichiometry ; Titrations

For each problem below, write the equation and show your work. Always use units and box in your final answer.

1. What mass of NaCl is required to precipitate all the silver ions from 20.0 mL of $0.100 \mathrm{M} \mathrm{AgNO}_{3}$ solution?
2. a. What volume of $0.115 \mathrm{M} \mathrm{HClO}_{4}$ solution is required to neutralize 50.00 mL of 0.0875 M NaOH ?
b. What volume of 0.128 M HCl is required to neutralize 2.87 g of $\mathrm{Mg}(\mathrm{OH})_{2}$ ?
c. If 25.8 mL of $\mathrm{AgNO}_{3}$ is required to precipitate all the $\mathrm{Cl}^{1-}$ ions in a 785 mg sample of KCl (forming AgCl ), what is the molarity of the $\mathrm{AgNO}_{3}$ solution?
d. If 45.3 mL of 0.108 M HCl solution is required to neutralize a solution of KOH , how many grams of KOH must be present in the solution?
3. Some sulfuric acid is spilled on a lab bench. It can be neutralized by sprinkling sodium bicarbonate on it and then mopping up the resultant solution. The sodium bicarbonate reacts with sulfuric acid as follows:

$$
2 \mathrm{NaHCO}_{3}(\mathrm{~s})+\mathrm{H}_{2} \mathrm{SO}_{4}(\mathrm{aq})-->\mathrm{Na}_{2} \mathrm{SO}_{4}(\mathrm{aq})+2 \mathrm{H}_{2} \mathrm{O}(\mathrm{I})+2 \mathrm{CO}_{2}(\mathrm{~g})
$$

Sodium bicarbonate is added until the fizzing due to the formation of $\mathrm{CO}_{2}(\mathrm{~g})$ stops. If 35 mL of 6.0 M $\mathrm{H}_{2} \mathrm{SO}_{4}$ was spilled, what is the minimum mass of $\mathrm{NaHCO}_{3}$ that must be added to the spill to neutralize the acid?
4. A sample of solid $\mathrm{Ca}(\mathrm{OH})_{2}$ is stirred in water at $37^{\circ} \mathrm{C}$ for a long time, until the solution contains as much dissolved $\mathrm{Ca}(\mathrm{OH})_{2}$ as it can hold. A 100 mL sample of this solution is withdrawn and titrated with 5.00 x $10^{-2} \mathrm{M} \mathrm{HBr}$. It requires 48.8 mL of the acid solution for neutralization.
a. What is the molarity of the $\mathrm{Ca}(\mathrm{OH})_{2}$ solution?
b. What is the solubility of $\mathrm{Ca}(\mathrm{OH})_{2}$ in water, at $30^{\circ} \mathrm{C}$, in grams of $\mathrm{Ca}(\mathrm{OH})_{2}$ per 100 mL of solution?
5. A solution of 100.0 mL of 0.200 M KOH is mixed with a solution of 200.0 mL of $0.150 \mathrm{M} \mathrm{NiSO}_{4}$.
a. Write the balanced chemical equation for the reaction that occurs.
b. What precipitate forms?
c. What is the limiting reactant?
d. What is the concentration of each ion that remains in solution?

