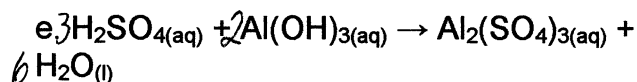
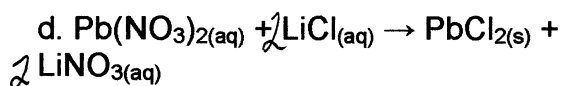
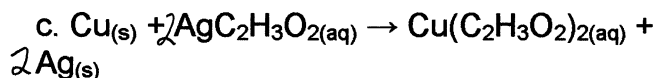
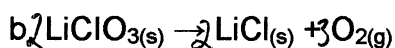
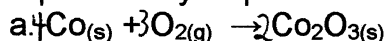


# Additional Aqueous Solution Review Problems

Name Key Period \_\_\_\_\_

## Balancing Chemical Equations

1. Balance each of the following chemical equations by inspection.

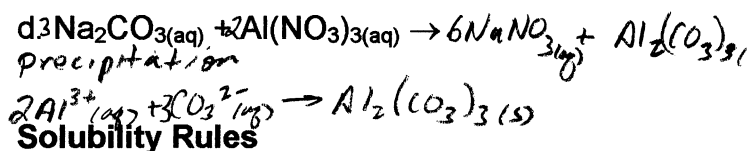
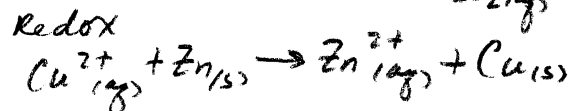
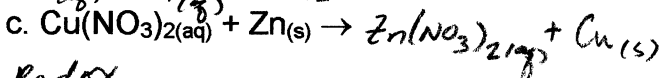
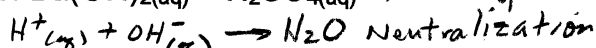
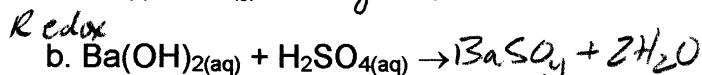
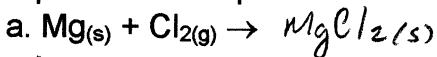


## Reaction Types

2. Classify each reaction in exercise 1 as one of the following: combination (synthesis), decomposition, single replacement, double displacement, or neutralization.

- Synthesis (Redox)
- Decomposition (Redox)
- Single Replacement (Redox)
- Double displacement
- Neutralization

3. Classify each (unbalanced) reaction as precipitation, acid-base neutralization or oxidation-reduction. Write a net ionic equation where possible.



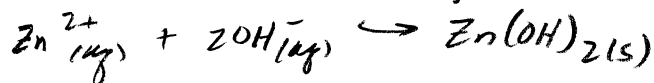
4. Predict which of the following compounds are soluble in water.

- cobalt(II)hydroxide,  $\text{Co(OH)}_2$  insoluble
- iron(II)sulfate,  $\text{FeSO}_4$  Soluble
- tin(II)chromate,  $\text{SnCrO}_4$  insoluble
- lead(II)acetate,  $\text{Pb(C}_2\text{H}_3\text{O}_2)_2$  Soluble

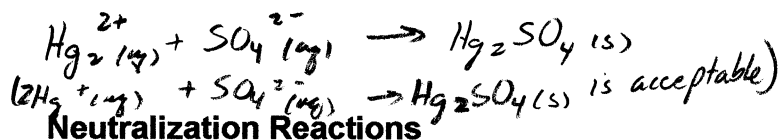
## Double Displacement Reactions

5. Write a balanced net ionic equation for each of the following double-displacement reactions.

a. Aqueous solutions of zinc chloride and ammonium hydroxide react to give ammonium chloride and zinc hydroxide.



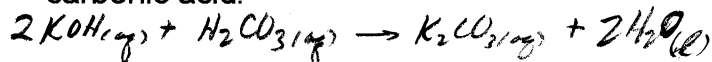
b. Aqueous solutions of nickel(II)sulfate and mercury(I)nitrate react to give nickel(II)nitrate and mercury(I)sulfate.



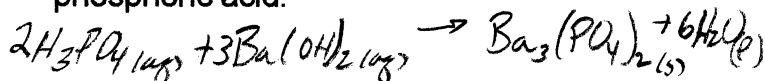
## Neutralization Reactions

6. Write a balanced molecular equation for each of the following neutralization reactions.

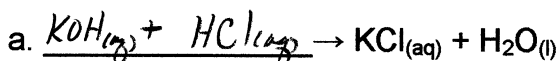
a. Potassium hydroxide solution is added to carbonic acid.

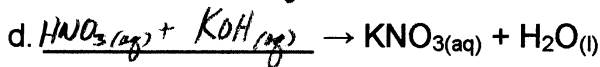
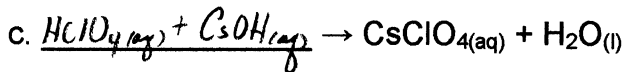
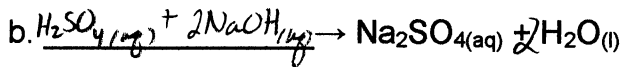


b. Barium hydroxide solution is added to phosphoric acid.



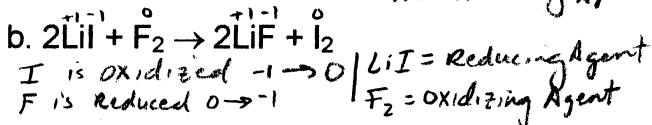
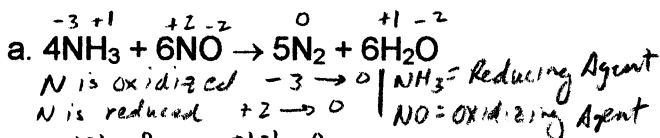
7. Below are indicated the products of acid-base reactions. Complete (and balance) the equations to show which strong acids/strong bases have reacted to form these products.





### Oxidation-Reduction Reactions

8. In each reaction determine: a) the oxidation number of each element, b) which element is oxidized and which is reduced, c) the oxidizing agent and the reducing agent.



### Dilutions

9. Water is added to 25.0mL of 0.866M  $KNO_3$  solution until the volume of the solution is exactly 500.mL. What is the molarity of the final solution?

$$M_1V_1 = M_2V_2 \Rightarrow M_2 = \frac{(0.025L)(0.866 \text{ mol/L})}{(0.500L)} = \boxed{0.0433M}$$

10. You have 505mL of a 0.125M HCl solution and you want to dilute it to exactly 0.100M. How much water should you add?

$$M_1V_1 = M_2V_2 \Rightarrow V_2 = \frac{(505 \text{ mL})(0.125M)}{(0.100M)} = 631.25 \approx 631 \text{ mL}$$

$631 \text{ mL} - 505 \text{ mL} = \boxed{126 \text{ mL}}$

11. 60.0mL of a .014M HCl solution is combined with 125.0mL of a .023M HCl solution. What is the molarity of the combined solution?

$$\frac{(0.060L)(0.014) + (0.125L)(0.023)}{(0.185L)} = \boxed{0.020M}$$

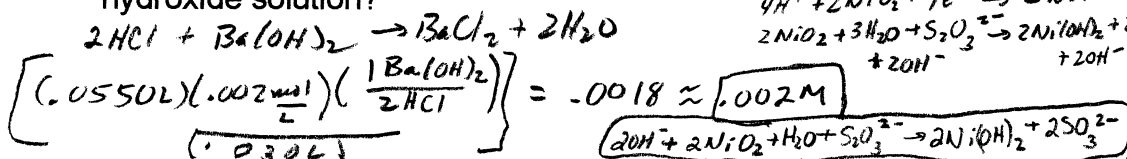
12. How many grams of sodium nitrate should be added to enough water to produce 350.mL of a .55M solution?

$$.55 \text{ mol/L} (0.350L) = .1925 \text{ mol } NaNO_3 \left( \frac{84.99 \text{ g}}{\text{mol}} \right)$$

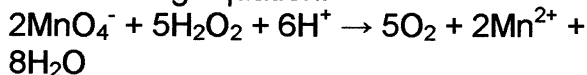
$= 16.36 \text{ g} \approx \boxed{16 \text{ g}}$

### General Reaction Questions

13. 55.0mL of .002M HCl was required to titrate a 30.0mL sample of  $Ba(OH)_2$  to its endpoint. What is the molarity of the barium hydroxide solution?



14. The concentration of a hydrogen peroxide solution can be conveniently determined by titration against a standardized potassium permanganate solution in an acidic medium according to the following equation:



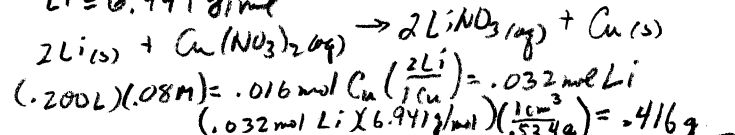
If 36.44mL of a 0.01625M  $KMnO_4$  solution are required to completely oxidize 25.00mL of a  $H_2O_2$  solution, calculate the molarity of the  $H_2O_2$  solution.

$$(.03644L)(0.01625M) \left( \frac{5 H_2O_2}{2 MnO_4^-} \right) = .001480 \text{ mol } H_2O_2$$

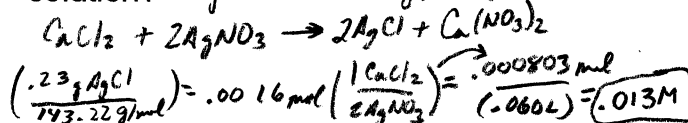
$$M = \frac{n}{V} = \left( \frac{.001480 \text{ mol } H_2O_2}{.02500L} \right) = \boxed{0.05922M}$$

15. How many cubic centimeters of lithium metal are required to react completely with 200.mL of a .08M Cupric nitrate solution?

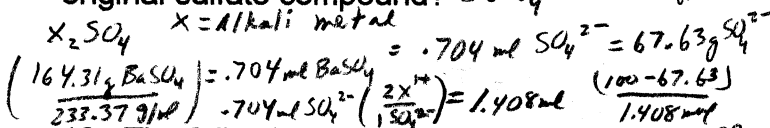
The density of lithium is  $5.34 \times 10^2 \text{ kg/m}^3 = .534 \frac{g}{cm^3}$



16. A 60.0mL sample of a solution known to contain calcium chloride is mixed with an excess of silver nitrate solution. If .23g of silver chloride is produced, what was the molarity of the original calcium chloride solution?  $AgCl = 143.32 \text{ g/mol}$



17. A 100.g sample of an unknown alkali metal sulfate compound is dissolved in water. When excess barium nitrate is added, 164.31g of insoluble barium sulfate is produced. What is the identity of the original sulfate compound?  $BaSO_4 = 233.37 \text{ g/mol}$



18. The following reaction takes place in a basic solution. Use the half-reaction method to write a balanced ionic equation.

