Name: _____ Date: _____

Lab Activity: Reactivity of Metals

Learning goal
After completing this activity, you will be able to …

- Determine the relative activity of different metals in aqueous solutions.

Introduction: What causes some reactions to happen, and others to not happen at all? In many single-displacement reactions, this is determined by the reactivity of the elements involved. The format of a single displacement reaction is as follows:

$$A + BX \rightarrow B + AX$$

For element A to substitute for the element B in the compound BX, it must be more reactive than B. This can only occur if element A forms compounds with X more readily than element B. If A and B are metals, this means A gives up its electrons more easily than B and/or A gives up fewer electrons than B when forming ions. You can compare the reactivity of different metals by placing metals in various salt solutions.

Procedure

1. Put on lab coat or apron, goggles, and rubber gloves.
2. Measure 100 mL of water into each beaker. (Note: Accuracy is not vital here.)
3. Use the balance to measure approximately 10 grams of KNO_3. Add approximately 10 grams of KNO_3 to the first beaker, stir, and label this beaker "KNO_3."
4. Repeat with the other four salts [$Mg(NO_3)_2$, ($Zn(NO_3)_2$, $CuSO_4$, and $AgNO_3$]. Stir each solution and label each beaker. (Note: You may use 2 grams of $AgNO_3$ because it is expensive.)
5. Pour about 10 mL of KNO_3 solution into the 50-mL beaker. Use forceps to add an iron strip. Record whether there was a reaction or not. Evidence of a reaction includes discoloration of the metal strip, bubbles, and/or the formation of a precipitate.
6. Rinse the 50-mL beaker, then repeat step 5 with the other salt solutions. Record your results.

Materials

- **Salts: KNO_3, $Mg(NO_3)_2$, $Zn(NO_3)_2$, $CuSO_4$, $AgNO_3$**
- **5 copper strips**
- **5 iron strips**
- **5 magnesium strips**
- **5 zinc strips**
- **5 tin strips**
- **Five 250-mL beakers**
- **One 50-mL beaker**
- **Triple beam balance**
- **Forceps**
- **Laboratory scoop**
- **Stirring rods**

Safety Equipment

- **Apron/lab coat**
- **Goggles**
- **Rubber gloves**

7. Repeat steps 5 and 6 with the other metal strips. (Note: Do not add a metal to the salt solution with the same metal ion, such as adding magnesium to $Mg(NO_3)_2$.)

Results:
In the table below, write "Reaction" if you see evidence of a reaction. If there is no evidence of a reaction, write "NR" for "no reaction."

	Iron	Copper	Magnesium	Zinc	Tin
KNO_3					
$Mg(NO_3)_2$					
$ZnNO_3$					
$CuSO_4$					
$AgNO_3$					

Record additional observations here: _____

_____

Analysis
If a reaction occurs, the metal you added is more reactive than the metal in the salt. If no reaction occurs, the metal in the salt is more reactive than the metal strip.

1. For each metal below, list the metals that are more reactive than the given metal to the left and the metals that are less reactive to the right.

More reactive	Metal	Less Reactive
	Iron (Fe)	
	Copper (Cu)	
	Magnesium (Mg)	
	Zinc (Zn)	
	Tin (Sn)	
	Potassium (K)	
	Silver (Ag)	

2. Based on your table on the previous page, create a reactivity series for these seven metals by listing them from most reactive to least reactive.

   (Hint: Start with the most reactive element and work your way down the list.)

Reactivity series

3. Which two metals on the list are impossible to order based on the results from this experiment? Why?

   _____

   _____

   _____

4. Describe an experiment you could perform that would establish the relative reactivity of these two metals.

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5. Suppose you wanted to extract a rare pure metal from a metal ore. How could knowledge of the reactivity of this metal help in the process of extracting the pure metal?

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6. On your own: Obtain a copy of the full reactivity series for metals and compare this list to the periodic table. What patterns do you notice in the reactivity of metals? What causes these patterns to be true? (Hint: Focus on the first two columns of the periodic table.)

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