Laboratory Investigation Name _____

Chemistry Form L10.2A Date _____ Period _____

Testing Metal Activity

PROBLEM

How can the activity of metals be tested?

INTRODUCTION

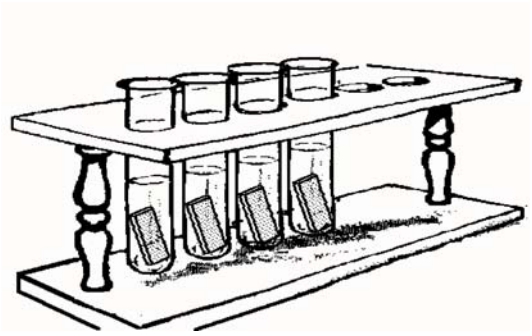
Metals are losers! They participate in chemical reactions by losing electrons. The more easily a metal loses electrons, the more active it is. Metal activity increases toward the left side and toward the bottom of the *Periodic Table of the Elements*. Based on its location on the *Periodic Table*, we would predict that magnesium is more active than silver even though it is closer to the top of the table because it is much further to the left. We can test our prediction by dropping a piece of magnesium into a solution containing a silver compound such as silver nitrate. If the magnesium is more active, it will take the place of the silver, and silver crystals will form on the surface of the magnesium [$Mg + 2AgNO_3 \rightarrow Mg(NO_3)_2 + 2Ag$]. In this laboratory investigation, you will predict the relative activity of four metals. Then, you will test your predictions by determining which metals replace each other in compounds.

MATERIALS (*per group*)

Metals [copper, lead, magnesium, zinc]; *Periodic Table of the Elements*; 0.1M solutions [HCl, $AgNO_3$, $Pb(NO_3)_2$, $CuSO_4$, $Zn(NO_3)_2$]; steel wool; test tube rack; test tubes (4)

PROCEDURE

1. Predict the relative activity of copper, lead, magnesium, and zinc based on their locations on the periodic table. Record your predictions in the data table on the next page by ranking the metals from 1 to 4, with 1 being the most active.
2. Fill each of four test tubes to a height of 2 cm with 0.1M HCl solution and place them in a test tube rack.
3. Using steel wool, polish a strip of copper, a strip of lead, a strip of magnesium, and a strip of zinc.
4. After polishing the strips of metal, place the copper into one of the four test tubes, the lead into another of the test tubes, the magnesium into a third test tube, and the zinc into the fourth test tube. Leave the metals in the HCl solutions for 3 to 5 minutes.



5. Look for bubbles on the surfaces of the metal strips to show that hydrogen has been replaced. Place a check mark in the appropriate space on your data table for each replacement that has taken place.
6. Rinse your test tubes and discard the used metal strips.
7. Fill each of the four test tubes to a height of 2 cm with one of the other solutions and place them in a test tube rack. Polish a new metal strip of each of the four different types of metal with steel wool. Then drop each strip into a separate test tube and wait for 3 to 5 minutes.
8. Look for crystals or color changes on the surfaces of the metal strips to show that the metal in the solution has been replaced. Place a check mark in the appropriate space on your data table for each replacement that has taken place.
9. Rinse your test tubes and discard the used metal strips. Then repeat steps 7-9 of the procedure until each of the metals has been tested with each of the solutions.

10. Determine the relative activity of each of the metals by counting the number of check marks in each row. The row with the most check marks is the most active metal while the row with the fewest check marks is the least active metal. Record the observed activity in the data table by ranking the metals from 1 to 4, with 1 being the most active.

OBSERVATIONS

Metal	Predicted Activity	Solutions					Observed Activity
		HCl	$AgNO_3$	$Pb(NO_3)_2$	$CuSO_4$	$Zn(NO_3)_2$	
Copper							
Lead							
Magnesium							
Zinc							

CONCLUSIONS

1. Which metal was the most active? Which metal was the least active? _____

2. How does your predicted activity compare to your observed activity? _____

3. All the reactions you observed occurred in water. Did your predictions regarding the metal activity take into account the way in which the reactions might be effected by water? _

4. Why might your predictions differ from your observations? _____

5. The *Activity Series* is based on observed reactions in aqueous solutions. How does the *Activity Series* compare to your observed results? Which is a better predictor, the position on the *Periodic Table* or the *Activity Series*? Why? _____