

Metal/Metal Ion Reactions A Laboratory Simulation

URL:[http://www.chem.iastate.edu/ChemEdGroup/GREENBOWE/sections/projectfolder/flashfiles/redo x/home.html](http://www.chem.iastate.edu/ChemEdGroup/GREENBOWE/sections/projectfolder/flashfiles/redo%20x/home.html)

Problem Statement: How do metals and metal ions react?

I. Data Collection: Eight Solutions

- Open the software and go to the opening activity. You should see a graphic that appears in part like figure A.
- Hold the magnifier over each beaker and "click" to view its submicroscopic contents. Record what you see on the beakers in Figure A.

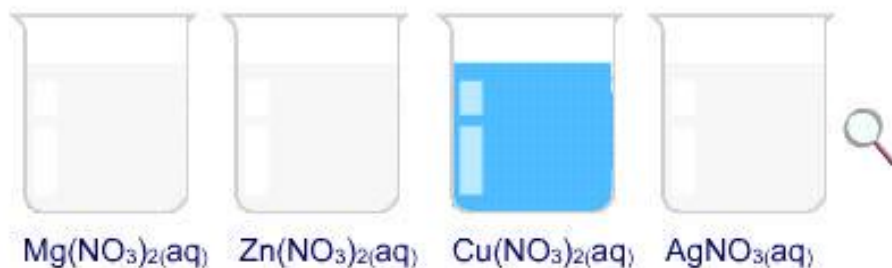


Figure A

- Data Analysis. Record the number of each species in each beaker. How are these numbers related to the formula of the compound?

III. Interpretation

- List three characteristics that are the same for all of these solutions and three characteristics that make them different.
- Identify the species that accounts for the color of each of the four solutions. What evidence did you use to arrive at your conclusions?

IV. Data Collection: Activity One

- Go to Activity One in the simulation, pick one of the metals and follow the instructions to test its interaction with each of the solutions. Record your observations in Table 1 below. Describe any evidence you see for a chemical reaction. What changes do you see in the metal? What changes do you see in the solutions?
- Repeat this process with each of the metals.

Data Table for Part 1:

	Mg ⁺²	Cu ⁺²	Zn ⁺²	Ag ⁺¹
Mg				
Cu				
Zn				
Ag				

Table 1

V. Data Analysis

A. Write a chemical equation for each chemical reaction you observed.

B. Rank the metal ions in order of reactivity using Table 2a below. Rank the metals in reverse order of reactivity using table 2b below. What criteria did you use for your rankings?

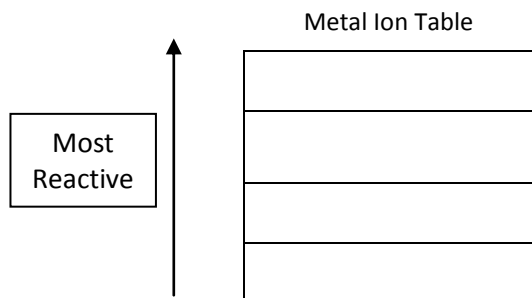


Table 2a

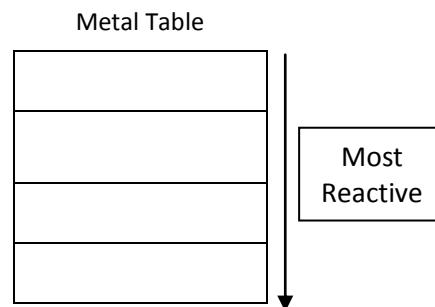


Table 2b

VI. Interpretation

- A. How are Tables 2a and 2b in the previous section related to each other? Write a balanced equation relating each metal ion to its corresponding metal.
- B. Pick one of the metals in Table 2b. Using the reactivity data you collected (Table 1), mark the metal ions in Table 2a that chemically reacted with it. Note the position of these reacting ions in relation with the position of those that don't react. Repeat this process for each of the metals.

Summarize your findings concerning the combination of non-reacting metals and metal ions in Tables 2a and 2b.

- C. "Click" on the molecular scale button in the laboratory simulation to view the metal/metal ion interactions at the submicroscopic level. Follow the instructions in the software. Describe your observations of reacting combinations and non-reacting combinations. Write a chemical equation for one of the reacting combinations. Relate your submicroscopic observation with your macroscopic observations for one example of a reacting and one example of a non-reacting combination.

VII. Data Collection: Activity Two Go to Activity Two and repeat what you did in the previous sections with a new set of metal/metal ions.

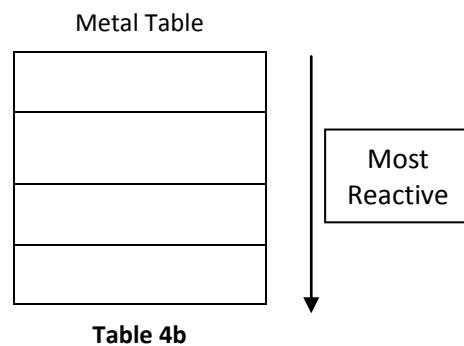
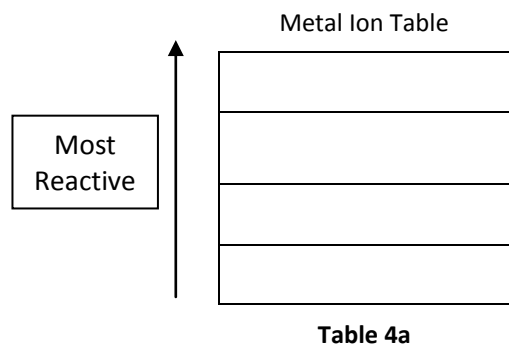
	Fe^{+2}	Pb^{+2}	Ni^{+2}	Sn^{+2}
Fe				
Pb				
Ni				
Sn				

Table 3

VIII. Data Analysis and Interpretation

A. Write chemical equations for the chemical reactions you observed.

B. Rank the metal ions in order of reactivity using Table 4a below. Rank the metals in reverse order of reactivity using table 4b below.



IX. Data Collection: Activity Three

A. Go to Activity Three and repeat what you did in sections IV, V, and VI with a combination of metal/metal ions taken from Activities One and Two.

	Zn^{+2}	Cu^{+2}	Fe^{+2}	Pb^{+2}
Zn				
Cu				
Fe				
Pb				

Table 5

X. Data Analysis and Conclusions

- A. Use the data you collected in Activities One, Two, and Three (Tables 1,3 and 5) to rank the eight metal ion and metals you have studied. Write balanced equations relating the metal/metal ion combinations.

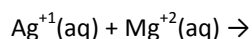
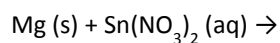
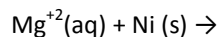
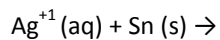
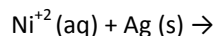
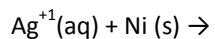
Metal Ion Table	
↑ Most Reactive	

Table 6a

Metal Table	
	↓ Most Reactive

Table 6b

- B. Predict the products of the following reactions.



- C. Mental Model: Draw a picture(s) that illustrates what happens at the molecular level when Ag^{+1} ion and Sn metal are mixed. In words explain what is happening in your picture(s).

- D. An unknown metal, M, is found to react with Ag^{+1} ion, Pb^{+2} ion and Cu^{+2} ion, but not with Ni^{+2} ion, Mg^{+2} ion or Zn^{+2} ion. Where does the unknown metal, M, appear in your activity series?