

DEVELOP AN ACTIVITY SERIES

Background: Some metals are more reactive than others. By comparing how different metals react with the known ions in aqueous solutions, an activity series for the tested materials can be developed. The activity series will reflect the relative reactivity of the tested metals.

Question: How is an activity series developed?

Materials

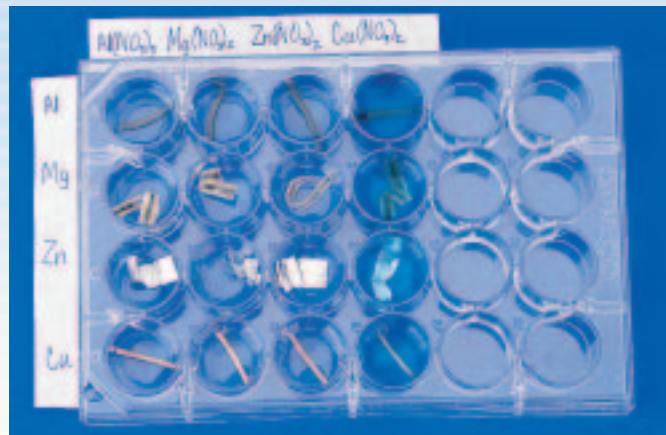
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|---------------------------------|--------------------------|
| 1.0M $\text{Zn}(\text{NO}_3)_2$ | Al wire |
| 1.0M $\text{Al}(\text{NO}_3)_3$ | Mg ribbon |
| 1.0M $\text{Cu}(\text{NO}_3)_2$ | Zn metal strips (4) |
| 1.0M $\text{Mg}(\text{NO}_3)_2$ | Emery cloth or sandpaper |
| pipettes (4) | 24-well microscale |
| wire cutters | reaction plate |
| Cu wire | |

Safety Precautions



Procedure

1. Read and complete the lab safety form.
2. Create a table to record your data.
3. Use a pipette to fill each of the four wells in column 1 of the reaction plate with 2 mL of 1.0M $\text{Al}(\text{NO}_3)_3$ solution.
4. Repeat the procedure in Step 3 to fill the four wells in column 2 with 2 mL of 1.0M $\text{Mg}(\text{NO}_3)_2$.
5. Repeat the procedure in Step 3 to fill the four wells in column 3 with 2 mL of 1.0M $\text{Zn}(\text{NO}_3)_2$.
6. Repeat the procedure in Step 3 to fill the four wells in column 4 with 2 mL of 1.0M $\text{Cu}(\text{NO}_3)_2$.
7. With the emery cloth or sandpaper, polish 10 cm of aluminum wire until it is shiny. Use wire cutters to carefully cut the aluminum wire into four 2.5-cm pieces. Place a piece of the aluminum wire in each well of row A containing solution.
8. Repeat the procedure in Step 7 using 10 cm of magnesium ribbon. Place a piece of Mg ribbon in each well of row B containing solution.
9. Use the emery cloth or sandpaper to polish each small strip of zinc metal. Place a piece of Zn metal in each well of row C containing solution.
10. Observe what happens in each well. After 5 minutes, record your observations in the data table you made.



11. **Cleanup and Disposal** Dispose of the chemicals, solutions, and pipettes as directed by your teacher. Wash and return all lab equipment to the designated location. Wash your hands thoroughly.

Analyze and Conclude

1. **Observe and Infer** In which wells of the reaction plate did chemical reactions occur? Which metal reacted with the most solutions? Which metal reacted with the fewest solutions? Which metal is the most reactive?
2. **Sequence** The most-active metal reacted with the most solutions. The least-active metal reacted with the fewest solutions. Order the four metals from most active to least active.
3. **Apply** Write a chemical equation for each single-replacement reaction that occurred on your reaction plate.
4. **Real-World Chemistry** Under what circumstances might it be important to know the activity tendencies of a series of elements?
5. **Error Analysis** How does your answer from Question 2 above compare with the activity series in **Figure 9.13**? What could account for the differences?

INQUIRY EXTENSION

Design an Experiment Think of three “what if” questions about this investigation that might affect your results. Design an experiment to test one of them.