

CHEM 231

Experiment 8

Activity Series of the Metals

This is an “open-ended” experiment without specific directions. You are to decide on procedures to answer the question presented in the lab in consultation with your lab partners. Your report should justify the experiments you perform and should explain how you reached your conclusions.

The purpose of the lab is to investigate the activity series of metals and, in small groups, or as an entire lab section, determine the order of the following common metals in the activity series:

Na Pb Zn Cu K Mg Ag Ca Fe

The result of the experiment will simply be a list of these metals written in order from most active to least active with the order justified by observations.

Background

Most metals have a tendency to give up electrons to form positive ions. The greater the tendency to give up electrons, the more “active” the metal is said to be. Certain metals can give up electrons to water (are oxidized by water) forming hydrogen gas. These would be the most active metals; most metals will not undergo this reaction. Some other active metals can be oxidized by strong acids such as HCl. The least active metals (the most stable ones) will resist oxidation even by strong acids.

Another type of indicator of activity is the reaction of a metal with the ion of another metal. If metal A is able to give its electrons to an ion of metal B, then metal A is more active than metal B.

Procedure

A couple of reactions involving group 1 metals will be done as a demonstration for the entire group. Write observations of those demonstrations in your lab notebook.

Following the demonstrations, meet with your assigned lab partners to devise experiments to ascertain the activity series. Consult with the instructor before carrying out these experiments. You may wish to suggest follow-up experiments on the basis of initial results.

The following supplies will be available to you:

Assorted glassware

Well plates and droppers for carrying out small-scale reactions

Samples of the following metals:

Calcium

Zinc

Magnesium

Copper

Iron

Lead

Solutions of the following compounds:

$\text{Ca}(\text{NO}_3)_2$

$\text{Zn}(\text{NO}_3)_2$

$\text{Mg}(\text{NO}_3)_2$

$\text{Cu}(\text{NO}_3)_2$

$\text{Fe}(\text{NH}_4)_2(\text{SO}_4)_2$: Ferrous ammonium sulfate

AgNO_3

HCl

You may carry out any reaction of any of the metals with any of the solutions provided or with water. Write down your observations for each reaction attempted, as well as what this observation tells you regarding the activity series. If you can, also write a balanced equation for each observed reaction.

You are free to share data among different groups or devise a scheme to divide the labor among different groups. Your lab instructor may help facilitate such cooperative efforts.

Finally, please be warned that the absence of visible reaction does not necessarily mean that a reaction won't take place. Some reactions which are favored by energy considerations may proceed so slowly that a reaction may not be apparent in the short time after mixing reagents. The absence of a reaction should only be counted as a **probable** negative result. An observed reaction, on the other hand, may be taken as a definitive positive result.

Conclusions and report

The final report should give your conclusions regarding the activity series and should justify those conclusions in a detailed manner with reference to your observations.