Spacecraft Materials and the Chemistry of Space Exploration

List the observed metal reactivity order, from highest to lowest:

Magnesium, Aluminum, Zinc, Iron, Lead, Copper

1. Explain why putting zinc into magnesium sulfate would NOT produce a reaction.

$Zn + MgSO_4 \longrightarrow$ no reaction

Zinc is lower on the activity series than magnesium. Only metals higher on the activity series can displace magnesium.

2. Use the activity series of metals list to predict whether or not the following reactions will occur.

$Zn + PbSO_4 \longrightarrow Pb + ZnSO_4$

$Cu + FeSO_4 \longrightarrow$ no reaction

$Al + AgNO_3 \longrightarrow 3Ag + Al(NO_3)_3$

3. The clouds on Venus contain droplets of sulfuric acid (H_2SO_4). If we were building a satellite or a rover that would travel to Venus, which metals should we use? Which ones should we avoid? Explain your reasoning below.

Acids are on the activity series as H. So, any metal higher on the activity series will react with acid, causing our vehicle to get damaged. Copper, silver or gold would be good choices. Metals like iron or aluminum would not be good choices.

4. It may be difficult or expensive to build satellites and rovers entirely out of unreactive metals. Other factors may come into play, such as cost, weight, or melting point. Discuss some pros and cons of some of the less reactive metals as candidates for your space craft. How could you incorporate more reactive metals into a design without having to worry about your rover dissolving before the mission is complete.

Student responses will vary, but could include ideas about using cheap yet reactive metals for the design, then coating them with the more expensive but unreactive material.

If students observed the oxide forming on aluminum or magnesium samples throughout the lab (causing a black layer to form), they may suggest we use the reacted form instead of the pure element.