Questions and Possible Answers for *How Lead Gets into Water*

1. What is Tomas' question about lead and water?

He wants to know how lead gets into drinking water.

2. What are the students' testable questions?

They want to know if steel wool will rust when wetted with hot water, with hot salt water, and with hot vinegar. They also want to test if rust forms when steel wool sits in water, salt water and vinegar.

3. What can the students claim about what turns iron into rust? What is their evidence?

Students can claim that after being wetted with hot water, with hot salt water, and with hot vinegar and then left sitting in the air, steel wool does rust. The evidence for this is the change of the silvery metal surface of the steel wool to a dark red-brown material forming on the surface and possibly flaking off as well. The amounts of rust are different, but they all have in common air and water, since the vinegar contains water. So, it seems likely that something in the air and something about water cause rust to happen.

Students can claim that being submerged in hot water or hot salt water also causes steel wool to rust. The evidence for this is the same red-brown color in the water as observed on the surface of the steel wool in air. If you look very closely, you can see that the orange color is made up of little grainy pieces of solid material in the water. Since color is a property of a material, this is evidence that the two materials could be the same thing. Since some of the rust flaked off the pieces that were in the air, maybe in the ones that were submerged, the rust flaked off and fell into the water. Since rust formed on steel wool that was under water, something needed for rust to form could be present both in the air ***and*** *under water.*

4. Why did rust form on the steel wool rinsed in hot vinegar and left in the air but **not** on the steel wool submerged in vinegar?

Something different is happening to the steel wool in vinegar. It is the only one without orange color, so it does not appear to be rusting. It is the only one where the steel wool piece got much smaller. When you put solid things in water and they start to get smaller, they might be dissolving, like sugar in coffee. So, possibly the steel wool in vinegar is dissolving instead of rusting. It is also possible that the steel wool is reacting in a chemical reaction in the vinegar.

[**Teacher Note:** The picture in the story includes a few bubbles in the cup with vinegar and steel wool, but they are difficult to see. If students do this experiment themselves, they will see evidence for a chemical reaction as small bubbles slowly form on the surface of the steel wool and then float to the top of the solution. This formation of a gas fits with the idea that the solid iron metal is changing to a different form. The background reading introduces the idea that this different form is a metal ion.]

5. What is the class' second testable question?

They want to know if alginate causes a change in the test solutions, especially the vinegar that steel wool was soaking in. The change in the test solution could indicate the presence of a metal ion.

6. What are the claims that the class can make about how a metal can get into water? What is their evidence?

Students can claim that metals can get into water as part of metal compounds that have dissolved in water. Their evidence is that two of the solutions that formed gel beads with the alginate contained dissolved metal compounds that their teacher identified for them. In this story these are calcium chloride in water and alum in water. Vinegar from the rusting test, in which some of the steel wool seemed to "disappear," also formed gel beads. This is evidence for iron from the steel wool getting into the vinegar. So instead of "disappearing," some of the steel wool is now in the liquid.

[**Teacher Note:** After completing the background reading, students should recognize that metals get into water in the form of metal ions. These metal ions may be introduced as part of a water soluble compound, such as making a solution of calcium chloride or formed through a chemical reaction such as steel wool in vinegar or chlorine in lead pipes. Iron ions can also get into water by dissolving rust from the steel wool in vinegar. If students test the resulting solution with alginate, they will see gel beads form due to the iron 2+ ions.]