

## Curiosity Probe

# The Rusty Nails

## Teacher notes

### The probe

Let's say you are investigating *chemical change*. You think to yourself, "I wonder what would happen to the mass of nails if they were allowed to rust".

To make the comparison, you first place shiny new dry nails in an open dish and then weigh and record the combined mass. Then expose the nails, still in their dish, to both moisture and air. Some weeks later you notice the nails have rusted. Let the nails and dish dry completely and then reweigh being careful not to allow any rust to fall out of dish.

### Who thinks:

- The mass of the dry rusted nails will be less than the mass of the dry nails before they rusted.
- The mass of the dry rusted nails will be more than the mass of the dry nails before they rusted.
- The mass of the dry rusted nails will be the same as the mass of the dry nails before they rusted.

**Firstly, gather student choices, then, have a discussion to glean the reasoning behind their choices.**

**Look at the cumulative data gathered from the Science Roadshow here:**

[www.roadshow.org/content/scienceRoadshow/rustyNails.php](http://www.roadshow.org/content/scienceRoadshow/rustyNails.php)

**Perform the experiment to find the answer.**



### Purpose of probe

The purpose of this probe is to elicit students' ideas about a common chemical change. It will find out if students think rusting is a change in which mass decreases, akin to the notion of rusting being similar to a decay process.

### Explanation

The best answer is B. Rusting is a chemical reaction between oxygen in the air and iron (in the nail). The additional mass is from oxygen in the new compound that has formed — iron oxide (or rust). Although it looks like the nails are breaking down, they are actually gaining mass as they change from iron to iron oxide.

Some students might claim the mass won't change (conservation of mass reasoning). This would be true if the nails were kept in a closed system, but the probe specifically says the nails were in an open dish.

## **Considerations**

### **Junior Primary**

This probe is useful for introducing ideas about changes in objects and materials and making observations — the appearance of rust. It could also be useful to illicit students' initial notions of rusting, particularly if they view rusting as a “decomposing” process.

### **Senior Primary**

This is a time when students link ideas about chemical change and the formation of new compounds. The probe is useful in determining students' initial ideas about what rust and the rusting process are. The appearance of rusty nails may influence students' thinking that the nail is breaking down and losing mass. Knowing the ideas students hold prior to learning that oxygen combines with iron during the rusting process is useful in designing learning experiences that challenge their intuitive notions influenced by observation.

### **High School**

Students make the transition from a basic understanding of types of chemical changes, to understanding the mechanisms for such changes. The probe is useful in determining whether students still hold onto preconceived ideas about rusting (as a mass reducing “decomposition process”).

Adapted from Keeley, P., Eberle, F. and Farrin, L. (2005) Uncovering Student Ideas in Science: 25 Formative Assessment Probes. National Science Teachers Association, David Beacom Publisher, USA.

***[www.roadshow.org](http://www.roadshow.org)***