### Water on a Penny Lesson Background and Concepts for Teachers

Water is notable because of the presence of hydrogen bonds within its molecular structure. Although hydrogen bonds are the weakest of the chemical bond types, they are of sufficient strength to make water unusually cohesive. This cohesiveness gives water its high degree of surface tension, which is visible in the small indentations made by the legs of certain insects that can literally walk on water. It is also water's cohesiveness that allows it to form a nearly spherical "bead" when a single drop is placed on a flat, nonporous surface.

In contrast, oils have few, if any, hydrogen bonds amongst their large, organic molecules. When oil is dropped onto a flat, nonporous surface, it quickly spreads and forms a thin layer coating considerably more surface area than would a drop of water. Rubbing alcohol, on the other hand, is a mixture consisting of 70% isopropyl alcohol and 30% water. It does contain some hydrogen bonds within its structure, but not nearly as many as occur in pure water. Rubbing alcohol will form a bead when dropped onto a flat, nonporous surface, but the bead will be slightly flatter and larger in diameter than a corresponding bead of pure water.

When water is dropped carefully onto the surface of a penny, it can pile up into a dome shape before spilling over the small lip around the penny's perimeter. Rubbing alcohol can pile up as well, but spills over before forming a well-rounded dome. Oil will not pile up much at all, as students discover.

### ACTIVITY II: STEM-Integrated Lesson: Water on a Penny

### Vocabulary/

oxygen; hydrogen; molecular; chemical, cohesive, spherical; non-porous

### Vocabulary/Definitions

### [Images](https://www.google.com/search?q=water+cohesion+and+adhesion&client=safari&hl=en-us&prmd=ivsn&tbm=isch&tbo=u&source=univ&fir=BMnzIo5GwD24kM%253A%252Cap2-iIlia-Y3kM%252C_%253Bch_y_RP45od0nM%253A%252COTuZvxAmFGmlyM%252C_%253B_I0FXnALSj7C5M%253A%252COTuZvxAmFG):

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| [*cohesion*](https://en.wikipedia.org/wiki/Special:Search?search=cohesion)*:* | The chemical attraction between adjacent molecules of the same type. |
| [*hypothesis*](https://en.wikipedia.org/wiki/Special:Search?search=hypothesis)*:* | A tentative explanation for a fact or set of observations, which can be tested objectively. |