



## Creating a Bleach Substitute Design Challenge

### DESIGN CHALLENGE Notes:

This design challenge explores the role bleach plays in biology, health and sanitation. For a better understanding in the biophysics of how bleach works go here.

**Problem:** We need the cleaning and sterilizing power of bleach but we do not have bleach

**Challenge:** Bleach is a powerful salt that causes the molecular bonds to oxidize (rust) away. Bleach is also an example of a base material. As opposed to an acid material, bases interact by dissolving ions and have a PH that is very high (11) whereas acids have a PH that is very low and acids strip apart materials or bond with materials at the atomic or molecular level.

So to create a bleach substitute we need a salt that can be mixed into a base liquid that will pull things apart and oxidize like chlorine bleach does.

### Materials:

We need a few salts, like aluminum sulfate or magnesium chloride  
We need an oxidizer like hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>)  
We need water  
A mixing vessel

### Brainstorm:

1. How does bleach work on dissolving stains and color?
2. What does H<sub>2</sub>O<sub>2</sub> do that is similar?
3. Have you seen H<sub>2</sub>O<sub>2</sub> working on dissolving things? Where?

### Design/Build:

1. In a nonreactive bowl (glass or stainless steel) mix the three ingredients.
2. Determine the best way to add materials together so that they are roughly equal
3. You must leave enough material to create at least two batches

### Test:

Now you need to see if the bleach substitute is working  
How could you determine if the bleach substitute is destroying pathogens or dissolving dirt?

### Evaluate:

- How will you record your results?
- How will you know how much of each component you have is doing what?
- Can you create different types of dirty materials and test them?
- What would you do differently?

### Share:

- Record your Bleach substitute tests on a chart.
- Which combination or ratio of salts to solvent worked best?
- How did you know?