



# Which Powder is It?

## Challenge:

Can you identify an unknown white powder by comparing it with common household powders?



## General Description:

Visitors will do a series of simple chemical tests with three white powders.

Each powder reacts differently with each of three liquids.

Visitors will use their observations of the results of the chemical reactions to determine which powder is in an unlabeled container.

## Objectives:

Participants will experience the basic principles of simple chemical qualitative analysis by comparing chemical reactions of known compounds with the chemical reactions of unknown compounds.

## Materials:

### For 5 stations (1 child per station)

- 25 ml Water
- 25 ml Vinegar
- 25 ml Phenolphthalein (PHTH) solution
- 15 labeled dropping bottles with water
- 15 labeled dropping bottles with vinegar
- 15 labeled dropping bottles with a phenolphthalein solution
- 5 plastic laminated reaction grids
- 9 labeled plastic containers with about 10 grams of baking soda.
- 9 labeled plastic containers with about 10 grams of baking powder
- 9 labeled plastic containers with about 10 grams of washing soda
- 1 cup with baking soda labeled A
- 1 cup with baking powder labeled B
- 1 cup with washing soda labeled C
- 20 thin sticks, small spoons, or spatulas
- Several liters of distilled water for rinsing well plates
- Paper towels for spills
- A container of clean water
- A safe container to dump solutions into and seal (waste container)



## Activity Preparation (approx. 20 min.):

Mix 5 drops commercial Phenolphthalein (PHTH) alcohol solution with 25 ml of water

### Each station includes:

- A laminated grid,
- 3 dropping bottles (one each with water, vinegar, and PHTH)
- 3 containers, each with a different white powder (shared between 2 stations).  
Put only 10 grams of powder in each container in order to minimize clean up in case of spills.

## Directions:

### Have visitors do the following:

1. Participant **must** wear a pair of safety goggles before beginning!
2. Using the small stick, place a small amount of powder to the appropriate powder square on the grid.  
"Small amount" means about the size of a chocolate chip.
3. Add a drop of water to each water square. Watch what happens.
4. Add a drop of vinegar to each vinegar square. Watch what happens.
5. Add a drop of PHTH to each PHTH square. Watch what happens.
6. Give the visitor an unknown powder and ask them to determine what it is by examining its reactions with vinegar, water, and PHTH.

## Clean Up (approx. 15 min):

- Wipe off chemicals with a damp sponge and rinse the sponge in tap water.
- All extra powders can be saved.
- All liquids can be saved.
- Clean goggles with window cleaner and white paper towels.
- Disinfect in goggle cabinet for full 15 minutes.

## Safety Issues:

Participant must wear a pair of safety goggles before beginning!  
Goggles must be sterilized before use.

Washing soda is caustic and should be washed off hands or clothing with water or vinegar.  
Large spills should be swept up and wiped with water.



## Tips For Doing the Activity:

- You may need to show the visitor the amount of powder to put on each grid (a small amount, the size of a chocolate chip).  
Young children have trouble putting only a small amount of powder on a square. They may need help with this.
- You may need to show the visitor how to use the dropping bottle.  
Only one or two drops of solution are needed.
- Test the baking powder with water ahead of time.  
If it doesn't fizz or bubble with water get a new container.  
Baking powder reacts with water vapor in the air and degrades over time.

## Background Information:

- **Baking powder** contains sodium bicarbonate and a powdered acidic compound. When water is added, the powdered acid dissolves and reacts with the sodium bicarbonate to produce carbon dioxide bubbles.
- **Baking soda** is pure sodium bicarbonate, which reacts with acidic solutions such as vinegar to produce carbon dioxide bubbles.
- **Washing soda** is sodium carbonate. It also reacts with the acidic substance to produce carbon dioxide, but unlike sodium bicarbonate it produces a basic solution in water that reacts with PHTH to produce red color.
- **Phenolphthalein** is an acid/base indicator that turns pink or red in base. We are using PHTH for Phenolphthalein because it is awkward to pronounce for young children.

### Before Powders Alone



### During Adding water, vinegar, and PHTH



### After Results



## Expected Reaction Results:

|               | Water     | Vinegar | PHTH                 |
|---------------|-----------|---------|----------------------|
| Baking powder | fizzes    | fizzes  | colorless            |
| Baking soda   | no change | fizzes  | colorless/light pink |
| Washing soda  | no change | fizzes  | dark pink/red        |

## Questions:

Which powder fizzed with water?

Which powder fizzed with vinegar?

Which powder(s) changes the color of PHTH?

What was the powder in the unlabeled cup?

## Credits and Disclaimer



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|    | Water | Vinegar | PHTH |
|---|-------|---------|------|
| Baking Powder   |       |         |      |
| Baking Soda   |       |         |      |
| Washing Soda  |       |         |      |
|  |       |         |      |