**Let’s Get Physical (and Chemical)!**

**Identification of Household Chemicals Using Chemical and Physical Properties**

**Standards:**

* 3.2.10.A - Know that science uses both direct and indirect observation means to study the world and

the universe.

* 3.2.10.B.1 - Describe materials using precise quantitative and qualitative skills based on observations.
* 3.2.10.B.3 - Use process skills to make inferences and predictions using collected information and

to communicate, using space / time relationships, defining operationally.

* 3.2.10.C - Organize experimental information using a variety of analytic methods.

**Introduction and background:**

We can categorize and identify materials often on the basis of characteristics and behaviors. These characteristics and behaviors can be defined as physical and chemical properties. Although some materials are very similar in many ways, no two chemical compounds behave exactly the same. To help understand the importance of knowing what you are working with, we will look at an example of poor organization. Old Mother Hubbard may not have any food in her cupboard, but she does have a mess of chemicals. Unfortunately, she dumped common household chemicals into plastic containers with their chemical name on the lid, to use the original containers in order to heat her humble home.

In the following lab, we will investigate some properties, both chemical and physical, of various household chemicals to help Old Mother Hubbard get reorganized. The data and observations you make in Part 1 are very useful to help identify the chemical names of common household chemicals. In Part 2, your lab group will be given a set of household chemicals by common name. These chemicals correspond to the substances you tested in Part 1. You must determine the chemical identities of the household substances based upon chemical and physical properties. Old Mrs. Hubbard will be much safer and so will her poor little dog, who is still hungry for a bone.

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**Guiding questions:**

1. What is a physical property?
2. What is a chemical property?
3. What are examples of properties that can be used to help identify unknown substances?

**Vocabulary**:

Conductivity – the ability to transmit electricity

pH – the measure of acidity or basicity of a solution

Precipitate – the solid that forms when two substances react

Solubility – the ability of a substance to dissolve in a liquid

Reactivity – ability of a substance to combine chemically with another substance

**Materials:**

Sodium chlorid e

O-alpha-D- glucopyranosyl-(1-2)-beta -D-

Fructofuranoside

Sodium bicarbonate

Magnesium sulfate

Salicylic acid

Aspirin

Baking Soda

Epsom Salts

Sugar

Table Salt

Beakers

Test tubes

Scoopulas

Conductivity Meters

pH Meters

Barium chloride

**Safety:**

* + Safety goggle should be worn at all times during the lab.
  + All solutions can be poured down the drain with plenty of water.

**Procedure:**

Solubility:

1. Test the following solids to see which will dissolve in water:
2. Put 20 mL of water into each beaker; add 4 spatulas full of the following solids. (You should have 5 different solutions once you are finished: sodium chloride, O-alpha-D-glucopyranosyl- (1-2)-beta -D- fructofuranoside, sodium bicarbonate, magnesium sulfate, Salicylic acid)
3. Save these solutions for conductivity tests.

Conductivity:

BE CAREFUL OF SHOCKING! Do not let prongs touch each other!!!

1. Use the conductivity meter to measure each solution above for its ability to conduct an electric current.
2. Turn on the meter, place probes in solution and watch for red &/or green lights.
3. Record the intensity from the conductivity meter in the data table. (Intensity of light information is on the back of the meter.)
4. Save the solutions for the pH test.

Acidity:

1. Use pH meters to measure the acidity/basicity of each solution above.
2. Record the value from the probe in the data table below.
3. Then, using the following info, write if the solution is an acid, base or neutral.

pH 1-6 is acidic

pH 7 is neutral

pH 8-14 is basic

1. Keep the solutions for the reactivity test.

Reactivity:

1) Put a dropper full of Barium chloride into each beaker and stir.

2) Observe what occurs when you add BaCl2 to each solution in the table below.

3) Note any color change/solid formation in the data table. Record all observations.

**Data tables:** In the margin to the left of the data table, label each test as a chemical and/or physical change.

Table 1: Observations from part 1 using chemical names.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *SUBSTANCES*  **TESTS** | *Sodium chloride* | *O-alpha-D-glucopyranosyl- (1-2)-beta -D- fructofuranoside.* | *Sodium bicarbonate* | *Magnesium sulfate* | *Salicylic acid* |
| **Solubility in water**  \*Insoluble =I  \*Soluble = S |  |  |  |  |  |
| **pH**  (from probe)  Acid,Base, Neutral |  |  |  |  |  |
| **Conductivity**  Y or N  Low, Med, High, Very High |  |  |  |  |  |
| **Reactivity with BaCl2**  Solid forms = ppt  No solid = NR  **COLOR CHANGE** |  |  |  |  |  |

Table 2: Observations from part 2 using common household names.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *SUBSTANCES*  **TESTS** | *Aspirin* | *Baking Soda* | *Epsom Salts* | *Sugar* | *Table Salt* |
| **Solubility in water**  \*Insoluble =I  \*Soluble = S |  |  |  |  |  |
| **pH**  (from probe)  Acid, Base, Neutral |  |  |  |  |  |
| **Conductivity**  Y or N  Low, Med, High, Very High |  |  |  |  |  |
| **Reactivity with BaCl2**  Solid forms = ppt  No solid = NR  **COLOR CHANGE** |  |  |  |  |  |

**Conclusion & Questions:**

Identify the household chemicals by chemical name and **complete the sentence below & show charts offering evidence (use your data tables from above)** to support your identifications.

I believe sugar is also known as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

*(Fill out the chart & comment on similarities in the properties of sugar and the chemical substance.)*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Solubility | Conductivity | pH | Reactivity with BaCl2 |
| Sugar |  |  |  |  |
|  |  |  |  |  |

I believe table salt is also known as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

*(Fill out the chart & comment on similarities in the properties of sugar and the chemical substance.)*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Solubility | Conductivity | pH | Reactivity with BaCl2 |
| Table salt |  |  |  |  |
|  |  |  |  |  |

I believe Epsom salts are also known as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_because \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

*(Fill out the chart & comment on similarities in the properties of sugar and the chemical substance.)*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Solubility | Conductivity | pH | Reactivity with BaCl2 |
| Epsom salts |  |  |  |  |
|  |  |  |  |  |

I believe baking soda is also known as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

*(Fill out the chart & comment on similarities in the properties of sugar and the chemical substance.)*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Solubility | Conductivity | pH | Reactivity with BaCl2 |
| Baking soda |  |  |  |  |
|  |  |  |  |  |

I believe aspirin is similar to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

*(Fill out the chart & comment on similarities in the properties of sugar and the chemical substance.)*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Solubility | Conductivity | pH | Reactivity with BaCl2 |
| Aspirin |  |  |  |  |
|  |  |  |  |  |

1. How are physical and chemical properties useful in identifying unknown substances?
2. What other properties could have been used to help in matching the chemical name to the common name?
3. Could the solutions have been identified using only one physical or one chemical property? Why or why not?