Chemistry 159 – Experiment 1

Classification of Materials

The classification of materials is crucial to chemical knowledge. To do this we use both **physical** and **chemical** methods. Physical methods involve measurements and observations in which the chemical composition of the material does not change. In fact, a physical change allows a substance to be converted back to its original form without a great expenditure of energy. Some examples of physical methods of experimentation include measurements of boiling point, density, solubility, and observations of color, state of matter, etc.

Chemical methods involve a change in which the original matter cannot be recovered without a great deal of energy expended. Here, the chemical composition changes. Burning, or the addition or removal of an acid or base, are examples of this.

We will be classifying a selection of materials using these two methods and categorizing them into two main groups. **Organic** and **Inorganic**.

Organic material can be primarily determined by the presence of carbon. These materials burn in the presence of oxygen. Organic materials are usually insoluble (although some do dissolve in solution, and some inorganic material does not). If they are soluble, they tend to be neutral in pH, being neither an acid nor a base.

Different organic materials burn differently. Those that contain aromatic bonds (rich in carbon) will generally burn with a sooty flame, similar to paraffin or candle wax. Those that contain a halogen (such as chlorine. See Period table VIIb) will show a green flame when tested with a copper wire test, and generally burn with a stench.

Inorganic materials can be classified as acids, bases, or salts. One can test for this by using pH paper or any other method for testing acidity and basicity. Inorganic materials usually dissolve in water producing ions that conduct electricity (electrolytes). These materials do not support combustion.

In this lab you will classify the following materials into the two main groups: organic vs. inorganic. Next, you will determine which of the materials contain a **halogen** atom. Finally, you will determine which of the organic materials are **aromatic**.

Materials to be tested:

Sodium Chloride	Ethanol	Polyethylene (plastic tube)
Hydrochloric Acid	Sugar	Polystyrene (paper cup)
Sodium Hydroxide	Acetone	Polyvinyl Chloride (electrical insulation)
Sodium Carbonate	Mineral Oil	

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Procedure:

1. Put your goggles on!
2. Fill your plastic wash bottle with distilled water.
3. Make a data table like the one shown on the following page
4. **Solubility Test:** Squirt a small amount of distilled water into each of the 11 test tubes you've prepared. Then, using your spatula, place a small amount of each solid (chunk or powder) into the tubes and try to dissolve the material with your glass rod. (You can speed up the process by heating the test tube over the Bunsen Burner). For the liquid samples, just pour a small amount into each tube and stir with your glass rod. After you have tested each material, DO NOT discard the contents of the tubes, since you will need them again for the next tests.
5. **pH Test:** Using the same 11 test tubes from the previous test, test each solution by using pH paper. Record your findings. Now you may discard your solutions.
6. **Combustion Test:** For the powders and liquids, place a small amount in your watch glass and try to light up the material with match. For solids, pick up a small piece with your crucible tongs and hold in the flame of the Bunsen Burner. Remember, if the material burns and produces lots of smoke, it is organic and aromatic.
   CAUTION: use a diluted solution of acetone and ethanol when testing for combustion!
7. **Beilstein Copper Wire Test:** Take a piece of copper wire, clean it with sandpaper until it shines, and rinse it with distilled water. Now heat the wire in the flame, touch it to your liquids or powders in your watch glass or your solids in your tongs, and return the wire to the flame. If the flame turns green, a halogen is present. Be sure to clean the copper wire before your next test. **REMEMBER**: Both organic and Inorganic compounds may contain halogens.
8. In the "Comments" section of your data table, indicate which materials were: organic, inorganic, organic and aromatic, or contained a halogen. ***Be sure to indicate in your CONCLUSION section the reason why you classified each as such***.
9. Clean up your station before leaving.

Sample DATA table

Substance	Solubility in water	pH	Burning	Beilstein Copper wire test	Comments
Sodium Chloride					
HCl					

Review Questions: Use questions on p. E18 in lab manual.