

INVESTIGATION 1: Elements, Compounds, Mass and Volume

In Investigation One, you observed physical, quantitative properties of mass and volume to explore the identity of various unknown elements and compounds. During this Investigation, you:

1. Observed physical properties such as size, shape, color, and texture of six unknown substances.
2. Measured the mass in grams (g) of each substance using a triple beam balance.
3. Measured the volume in cubic centimeters (cm³) using the water displacement method in a graduated cylinder.

Through these experiments, you concluded that:

1. It is unlikely to discern the difference between substances that are elements and those that are compounds because many of the properties such as color, texture, visual appearance, mass, and volume are similar for many of the substances.
2. Without previous knowledge of the properties of all elements and compounds or samples of known elements or compounds, a definite identification using just mass and volume is not possible. However, comparison to known properties is advantageous, and should be used with previous knowledge to begin making hypotheses.

INVESTIGATION 2: Density and Chemical Reactions

In Investigation Two, you calculated the density of six unknown substances then observed these substances undergo a chemical reaction. During this Investigation, you:

1. Calculated the density of six unknown substances using the mass and volume recorded from Investigation 1 using the formula:
mass/volume.
2. Observed six unknown substances undergo a chemical reaction when placed in iron chloride, acetic acid, or silver nitrate.

Through these experiments, you concluded that:

1. It is not possible to discern the difference between substances that were elements and those that were compounds simply by observing

density and chemical reactions. Elements and compounds may share similar properties such as color, texture, density, and chemical reactivity and these similarities can be used as a comparison to more familiar, known elements or compounds.

2. Possible identities of substances can be based on similarities of color and texture to substances that are encountered in everyday life. For example, the solid, cylindrical shape of chalk, the bronze color and luster of copper, or the metallic silver color of aluminum foil. However, without a direct comparison to known substances, a definitive identity cannot be concluded. In addition, properties such as density and chemical reactivity are helpful in the determination of an unknown substance's identity if compared with substances with known densities and chemical reactivities. Physical and chemical properties of an element or compound are distinctive. The greater the number of properties, both physical and chemical, that can be tested or measured, the more likely a scientist is to determine the identity of the substance, especially when those properties can be compared to a list of properties for known substances.

INVESTIGATION 3: Solubility and Miscibility

In Investigation Three, you explored the solubility and miscibility of several substances in water. During this Investigation, you:

1. Observed whether five solid compounds were soluble in water or not.
2. Observed whether three liquid compounds were miscible in water or not.

Through these experiments, you concluded that:

1. Compounds composed of the same elements do not necessarily have identical properties. It is possible for compounds to share similar elements, however some may be solids and other are liquids. In addition, some are soluble and miscible in water whereas others are not.
2. Alternatively, compounds composed of different elements may indeed share similar properties.

INVESTIGATION 4: Compounds and pH

In Investigation Four, you explored the pH of several solid and liquid compounds. During this Investigation, you:

1. Determined the pH of several liquid and solid compounds in solution.
2. Identified each solution as acidic, neutral, or alkaline (basic).

Through these experiments, you concluded that:

1. Compounds composed of the same elements may have a pH that is either similar or dissimilar to each other. For example, vinegar and vitamin C are composed of the same elements and have a similar pH in that they are both acidic. However, when vinegar and vitamin C are compared to sugar or vegetable oil, which are also composed of the elements carbon, hydrogen, and oxygen, there is a difference in pH. The sugar solution was neutral and the vegetable oil was slightly basic.
2. The pH of each liquid compound in this investigation was dissimilar from that of the other liquid compounds. Although the number of samples investigated were limited. It could be hypothesized that the pH of liquid compounds is dependent more upon the chemical composition of the compound rather than its state of matter.
3. All solid compounds may or may not have the same pH. Salt and sugar each had a pH of approximately 7. However, the pH of vitamin C was acidic and the pH of baking soda was basic as compared to the neutral pH of salt and sugar. Although the number of samples investigated was limited, it could be hypothesized that the pH of solid compounds is dependent more upon the chemical composition of the compound rather than its state of matter.