Lab 1.2a
Physical and Chemical Changes

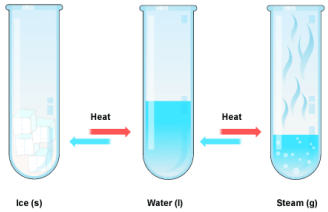
Chemistry I/H

BACKGROUND

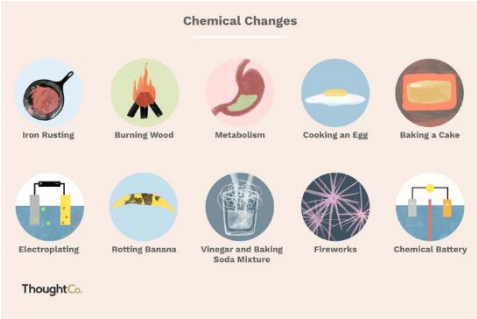
One of the primary foci of chemistry is the study of how substances change. Change may result in the formation of a new substance being created (chemical change) or it may alter the appearance of a substance without changing its identity (physical change). In order to understand the properties of substances, the differences in these types of changes must be understood. In this lab several changes will be studied to learn the signs of chemical and physical change in the laboratory.

Physical Changes

A physical change is when a substance does not change the identity of the original substance. An example of this change is a paper being cut into small pieces; the size and shape is different, but the substance remains the same. Another prime example of physical change is water and its different forms. Though water changes appearance in different temperatures its chemical properties remain the same even though the appearance has not. In addition, physical changes can be reversed. The diagram to the right demonstrates what a physical change is.



There are some occasions, however, where it may seem a change is irreversible, but it is still a physical change. The addition of sugar into water is a physical change. This is because if the water was heated and later evaporated, the sugar and its crystalline structure would remain.



Chemical Changes

Chemical changes are significantly different than physical changes in that they are irreversible. This change (also referred to as a 'chemical reaction') produces a substance that was not present before the experiment. Some indicators are light, heat, color change, gas production, odor, and in some cases sound. The substance is unable to return to its original state without any extraordinary measures. Heat is a prime factor that facilitates chemical reactions. When heat is given off from a reaction it is called an exothermic reaction. When heat is absorbed in a chemical change or reaction, it is called an exothermic reaction. The image to the left is a short list of chemical changes. There are, however, more additions to this list.

Chemical change is usually represented by a chemical equation such as: $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$.
Examples of chemical changes include:

Safety

- Nitric acid (HNO_3) and hydrochloric acid (HCl) are highly corrosive to skins and eyes.
- Copper (II) nitrate is an eye and lung irritant and may be toxic if ingested. It reacts violently with strong oxidants and decomposes to form toxic substances when heated strongly.
- Spills should be neutralized and cleaned up immediately. Any solutions that contact skin should be rinsed off with plenty of water.
- Standard fire precautions should be taken (hair tied back, loose clothing secured or removed, etc.)
- Goggles and aprons must be worn.
- Wash hands with soap and water before leaving the laboratory.

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Chemistry I/H

I. PURPOSE

To learn how to recognize physical and chemical changes in matter.

II. MATERIALS

1. disposable test tube
2. test tubes
3. Bunsen burner
4. utility clamp
5. glass slide
6. wood splint
7. test tube rack
8. NaCl (cr)
9. $Cu(NO_3)_2$ (cr)
10. 6*M* HNO_3
11. 6*M* HCl
12. 1*M* Na_2SO_3
13. 0.1*M* $FeCl_3$
14. 0.1*M* KSCN
15. 0.1*M* $AgNO_3$

III. PROCEDURES

Record observations before, during and after for each of the following procedures.

Part A

1. Break a wood splint into small pieces and place in a **disposable test tube** provided by your instructor. Heat the test tube for several minutes keeping the Bunsen burner moving with your hand. ***CAUTION: beware of hot glass and fumes from test tube.*** Dispose of the disposable test tube in the broken glass container.

Part B

1. Mix a few crystals (size of half a green pea) of NaCl with 2 or 3 mL of distilled water in an evaporating dish. Place a few drops of the solution on a glass slide and **heat very gently** over the Bunsen burner flame holding the glass slide with crucible tongs. After the liquid has evaporated and the slide has cooled, observe the substance on the slide.

Part C

1. Place a few crystals of $Cu(NO_3)_2$ (size of half a green pea) in a test tube. Heat the crystals slowly at first and then increase the heat until the reaction is complete (black). Let the test tube cool, then add 10 drops of 6*M* HNO_3. Heat gently but not to dryness and observe. ***CAUTION: do not inhale the fumes.***

Part D

1. Obtain 3 clean test tubes and mix the following solutions:
   a. Mix vigorously 5 drops of $FeCl_3$ solution with 3 drops of KSCN solution.
   b. Mix vigorously 5 drops of $FeCl_3$ solution with 2 drops of $AgNO_3$ solution.
      - Let stand in test tube rack at least 2 minutes. Record your observations.
   c. Mix vigorously 5 drops of Na_2SO_3 solution with 1 drop of 6*M* HCl.
      - Check the test tube for odor. Record your observations.

IV. PRE-LAB QUESTIONS

1. What is the basic difference between chemical and physical changes?
2. What is the purpose of breaking the splint into small pieces in Part A?
3. What is the correct procedure for checking for odor in Part D?
4. What types of observations are made in this lab?

V. DATA & CALCULATIONS

A. DATA

This should be a list of all observations made during the lab. Make subheadings for each part of the lab.

B. CALCULATIONS

None

VI. POST-LAB QUESTIONS

1. List all of the physical changes observed in this lab.
2. List all of the chemical changes observed in this lab.
3. What kinds of observations indicate chemical change?
4. What kinds of observations indicate physical change?

VII. CONCLUSION