Chemical & Physical Changes Lab

Fun in the Lab, safely observing some fancy chemical reactions
and some physical changes.

In this lab I observed 7 experiments and tried to determine if they were chemical reactions (new products form with new properties) or physical changes (phase changes only).
I used the "TOPIC-B" acronym to help me think. I then copied the word and chemical equations to begin to familiarize myself with the "real" chemistry that's right around the corner.

Your name
your class period
date

Lab handout

TOPIC-B is the acronym for the six indicators of a chemical reaction. These are indicators, not proof that a chemical reaction has likely taken place. They stand for temperature change, odor change, precipitate, irreversibility*, color change, and bubbles of a new gas.

*Irreversibility means that a reaction will not "spontaneously" revert backwards. Chemists can reverse nearly all chemical reaction, but that takes extra smarts and sometimes special equipment, and energy (often electricity).

The circle diagram has two lines.

The top one is for Chemical changes result from chemical reactions. The original reactant atoms are rearranged into new substances, and these new substances have new properties.

Physical changes result in a rearrangement of particles also, but no new stuff forms. These "products" have the same formulas that they started with, too.

In each of the boxes, print the WORD EQUATION and the balanced chemical equations with phase symbols. You can read the observations of what happened to remind you of what you did in each reaction.

1. Word Equation: Ice melts to water, which boils into steam.

   Balanced chemical equation: $H_2O_{(S)} \rightarrow H_2O_{(L)} \rightarrow H_2O_{(G)}$

Observations: ice cubes $H_2O_{(S)}$ in a beaker, which melted, then I heated the beaker with a Bunsen burner, and turned the water into steam. Ice is solid, holds it's shape. Water is liquid, taking the shape of the bottom of the container it's in. Steam has water in the gas phase, and the particles are very far apart, and would FILL any container it's put into. This is 2 physical changes, no TOPIC-B

2. Word Equation: Lithium carbonate solution & cobalt (II) chloride solutions react and form lithium chloride solution and cobalt (II) carbonate (solid, the precipitate)

Balanced chem eq: $Li_2CO_{3(AQ)} + CoCl_{2(AQ)} \rightarrow CoCO_{3(S)} + 2LiCl_{(AQ)}$

Observations: a clear solution (lithium carbonate) and a red solution (cobalt II chloride) get mixed. When mixed the color changed to a pink/purple color. Upon further observation, I realized that this color change was caused by a precipitate. This was a chemical reaction, it had Color Change, Precipitate and was Irreversible.

3. Word Equation: Baking soda (sodium hydrogen carbonate) and vinegar (acetic acid) react and form sodium acetate solution, water, and carbon dioxide bubbles.

   Balanced chem eq: $NaHCO_{3(S)} + HC_2H_3O_{2(AQ)} \rightarrow NaC_2H_3O_{2(AQ)} + H_2O_{(L)} + CO_{2(G)}$

Observations: a white powder (baking soda) named sodium hydrogen carbonate and I poured in some weak acetic acid (vinegar). Out came lots and lots of bubbles. This was a chemical change (bubbles of a new gas, and irreversible)

4. Word Eq: Heated Copper metal reacts with oxygen in the air to form copper (II) oxide.

Balanced chemical equation: $2Cu_{(S)} + O_{2(G)} \rightarrow 2CuO_{(S)}$

Observations: a copper metal wire get heated up in the Bunsen burner flame. The metal did get red-hot, but once cooled the metal had a black coating. That was copper (II) oxide. This was a chemical change (color change, irreversible).

5. Word Eq: Baking soda (sodium hydrogen carbonate decomposes with heat into sodium oxide solid, water and carbon dioxide gas.

Balanced chem eq: $2NaHCO_{3(S)} \rightarrow Na_2O_{(S)} + H_2O_{(L)} + 2CO_{2(G)}$

Observations: baking soda being heated up in a test tube. It started out as a white powder, and when heated gave off gas. One gas was the water steam, and the other was carbon dioxide. The left over solid was white, but was no longer baking soda. It was sodium oxide (another white crystal). This was a chemical change (bubbles of 2 new gases, irreversible).

6. Word Eq: Magnesium metal heated combines with oxygen to form Magnesium oxide.

Balanced chem eq: $2Mg_{(S)} + O_{2(G)} \rightarrow 2MgO_{(S)}$

Observations: flexible magnesium metal is spiraled into a spring shape around a pencil. It's held it in the Bunsen burner flame and the metal ignites on fire! The heat it generated was intense, and it's crazy bright. The left over ash was white and crumbly, and I rubbed it into my fingerprints. This was clearly a chemical reaction (temperature change, color change, irreversible).

7. Potassium nitrate solid is dissolved into water.

Balanced chem eq: $KNO_{3(S)} \xrightarrow{H_2O_{(L)}} KNO_{3(AQ)}$

Observations: I was nearly tricked by this one, I measured out some deionized water, which is nearly pure H_2O. It's temperature was 23.4°C (nearest 10th degree) and then I poured in some potassium nitrate salt. After stirring it got colder, down to 19.8°C, which led me to think that a chemical reaction occurred. Second thought made me realize that when a salt is dissolved into water, I can easily get the salt back by evaporating the water, this was a phase change, the salt went from solid to aqueous.
The temperature change was just cool, but this was a physical change, solid to aqueous.

Chemical and Physical Changes Lab Conclusion

In this lab we observed 7 experiments to determine if they were chemical reactions or were physical changes. I used TOPIC-B to help. TOPIC-B stands for the indicators of a chemical reaction (but not the proof). Temperature change, odor change, irreversibility, color change and bubbles of a new gas. When these things occur, often it's because of a chemical reaction (but not always).

In a chemical reaction there is a rearrangement of particles or atoms, and they form new substances which have new, unique properties. In a physical change, the particles or atoms also get rearranged, but NO new substances form. Physical changes are just phase changes, or breaking a big rock into pebbles.

In this lab I saw many kinds of chemical reactions, such as decomposition, synthesis and double replacement reactions.

In a chemical reaction, the stuff to the left of the arrow, the stuff I start with, are called reactants. What the reactants form into, on the right hand side of the arrow, are the products. You can have one or more reactant or product, depending upon the particular reaction.

Word equations explain with words what the substances did. A balanced chemical reaction is something that I have not learned to do, but represents the perfect balance of chemistry in symbols, of the reactants and products, in their proper place, with their phase symbols. Because of the Law of Conservation of Matter, the balanced equation allows me to be sure that I can keep track of all atoms and particles from start to end of the equation.

I preferred the reaction between the baking soda and the acetic acid because the excess of bubbles, that were safe enough to eat, was silly fun. And, because I like vinegar on my salad and acetic acid is really the same thing as vinegar. Chemistry is everywhere.

I love chem, the end.