

Chemical and Physical Changes Lab Explained in detail.

Objective/introduction: This lab is to show the differences between physical and chemical changes, it's to show us a variety of chemical change indicators, and to help us begin to see the beginnings of real chemistry in the lab.

TOPIC-B is the acronym for the six indicators of a chemical reaction. They are not the rules, but indicate when 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 any chemical reaction, but that takes extra smarts and sometimes special equipment, and energy (often electricity).

Physical changes result in a rearrangement of particles relative to themselves, but no new substances form. The same original substances keep their properties.

Chemical changes result from chemical reactions. The original reactants are transformed into new substances, and these new substances have new properties particular to themselves.

Describe each of the seven experiments...

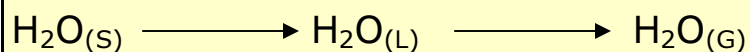
1. Ice melts to water, and then you heat it up to steam. Both changes are physical only (phase changes). You start and end with H_2O , just in different phases.
2. Barium acetate solution is clear. It's combined with the yellowy colored potassium chromate. When mixed the color changes to deep yellow. The color, if you give it some time, will actually settle out. There is a color change, but it's caused by the precipitate. You can't tell it's a precipitate at first because you're new chemists, and because the particles are so small they float. By letting it settle, you end up with a clear solution (potassium acetate) and the new solid barium dichromate precipitate.
3. The baking soda and vinegar (do this at home but have paper towels handy) experiment. Sodium hydrogen carbonate and the acetic acid combine and react. The busy product is the carbon dioxide gas. Also forming is water, and a new compound that stays dissolved in the water called sodium acetate. Some of the water comes from the vinegar (acid). Acids are aqueous solutions (dissolved in water). There is some new water formed as well.
4. The heated copper wire gets so hot it is able to combine with oxygen in the air. The reaction is copper plus oxygen forms copper oxide. This new product is a black powder. Continued heating of the copper wire will allow for continued synthesis of copper oxide, and at some point all the copper wire will be transformed into copper oxide (you never run out of oxygen in the air. You can thank Oprah for that).
5. The baking soda, sodium hydrogen carbonate will decompose when heated in a test tube. It's a white powder to start, and you don't know it, but once it does decompose, one of the

three products it makes is a different white powder. The products are carbon dioxide gas, water gas (which usually condenses at the top of the tube where it's a bit less hot), and the new white powder called sodium oxide.

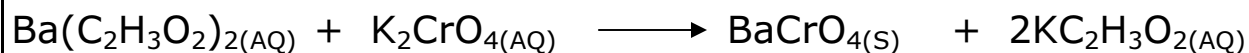
6. Magnesium when heated will combine rapidly with the oxygen in the air to form magnesium oxide. It is totally different than either the metal or the gas oxygen. It has new properties because it's a new substance that you formed in this reaction.
7. This last experiment was a sort of "tricky" one, because I knew that there would be a measurable temperature change, but it's only a physical change after all. If you put regular table salt (sodium chloride) into water it will in fact cool that water down, but only a very, very little bit. You never noticed, but that's because you are new chemists. This potassium nitrate is a different kind of salt. It too dissolves into water. The solid salt dissolves, or becomes aqueous. That's a phase change. It does change chemically, but it does change physically. If you evaporate the water from your sodium chloride solution, or this potassium nitrate solution, you get your salt back (good as new).

What follows is the chemical equations and the word equations of what you did. Look over the symbols, and realize that I already know that you don't know what they mean. I want you to stick your toes into the chemistry pool (that's a metaphor), and look. Don't be afraid, the water is fine (that's a qualitative measurement of the temperature).

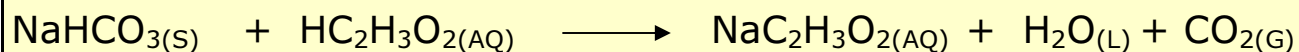
Ice melts to water, which boils into steam.
These are only phase changes, which are physical changes.



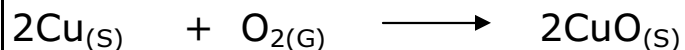
Barium acetate & potassium chromate solutions react and form barium chromate (SOLID, precipitate) and potassium acetate solution.



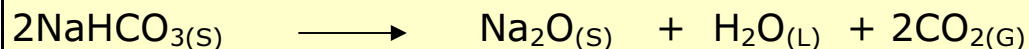
Baking soda (sodium hydrogen carbonate) and vinegar (acetic acid) react and form sodium acetate solution, water, and carbon dioxide bubbles.



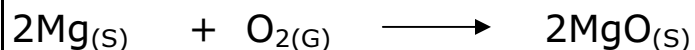
Copper plus heat reacts with oxygen to form a type of copper oxide.



Baking soda (sodium hydrogen carbonate) decomposes with heat into sodium oxide solid, water and carbon dioxide gas.



Magnesium metal heated combines with oxygen to form Magnesium oxide.



Potassium nitrate solid is dissolved into water. It gets cold, but it's only a phase change, from solid to aqueous, which means dissolved in water. Evaporation would get the potassium nitrate crystals back, unchanged.

