Chemical & Physical Changes Lab

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

Intro
In this lab I observed 7 experiments and tried to determine if they were chemical reactions with new products forming with new properties, or if a physical change happened instead, and the "products" were identical to the reactants, except for phase changes.

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
today's date

Chemical & Physical Changes Lab - KEY

name_____ Put your name here _____
80/1200

OBJECTIVE: In this lab, you will perform seven experiments, and you will determine if a chemical reaction or physical change has occurred.

SAFETY ISSUES: Goggles on at all times, pay attention to Bunsen burners, be careful and do NOT watch the magnesium burning which is on the dangerous side.

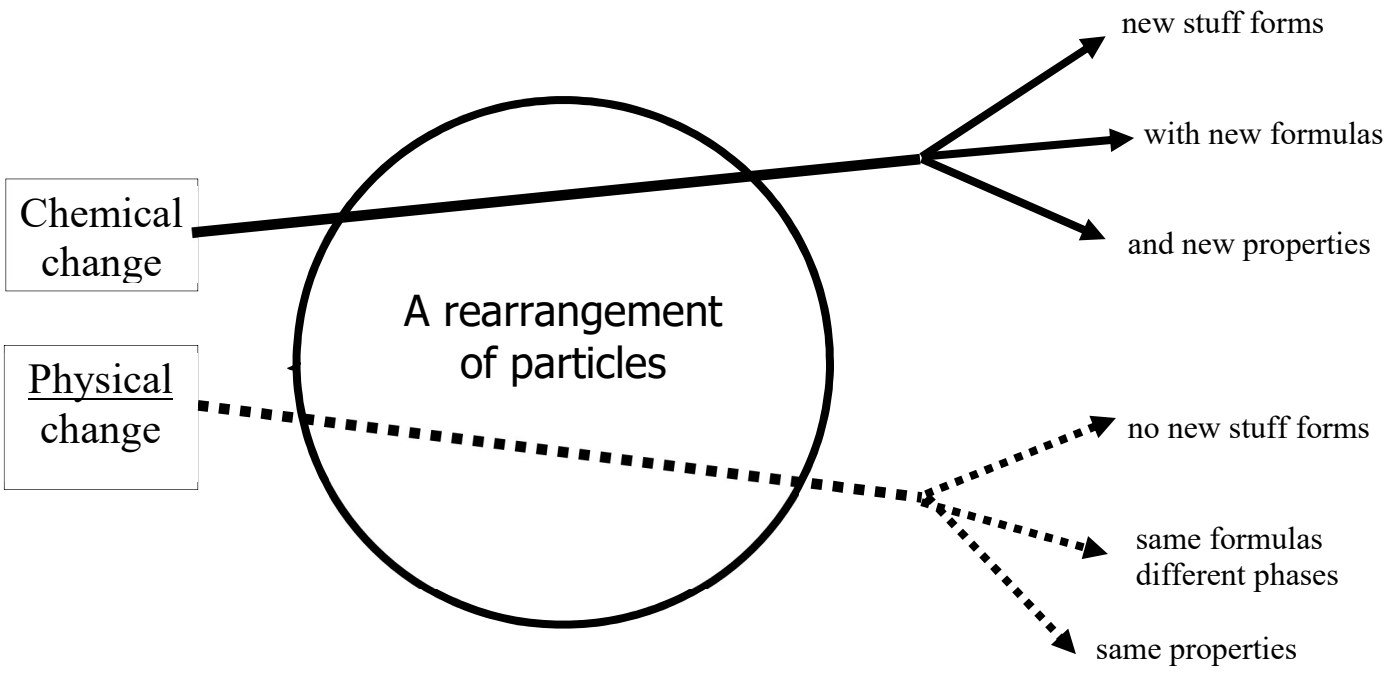
Background: what do the letters "TOPIC-B" stand for
(they are the indicators that a chemical reaction has PROBABLY occurred.

T	Temperature change. Usually when substances come together and get hotter (emit heat exothermically) or get colder (absorb heat endothermically) that means a chemical reaction has probably happened.
O	Odor change. Usually when a new smell appears, or a smell you started with disappears, that means what you had is gone, or new stuff has formed, that means a chemical change has probably happened.
P	Precipitate forms. When 2 aqueous solutions (look like KoolAde, homogeneous) and solids fall out of solution, that means one part of a solution bonds to another part of the other solution, forming an INSOLUBLE solid that is new (chemical change)
I	Irreversibility, it won't "go backwards". All chemical reactions are reversible, but MOST chemical reactions can't go in reverse on their own, like a big rock can't roll bac up a hill on its own. Chemistry can reverse all reactions; this means not spontaneously reversible.
C	Color change. Substances have colors, white, black and all in between. Color change means what you had is gone, and new substances have formed, chemical change.
B	Bubbles of a new gas. When bubbles appear where they were not before, that means a new gas must have formed, new stuff = a chemical reaction happened.

What are the phase symbols (and their English names) common to chemistry?

S solid	L liquid	G gas	AQ aqueous

This diagram represents chemical + physical changes. Label the right side



PART	This lab report includes...	Points
cover	Title, introduction sentence	1
2	Fill in the chart and the blanks on the first page of the handout	14
3	Observations, on white paper	1
4	Conclusion - for this lab report LIST the indicators of chemical reactions. Explain the difference between a chemical reaction and a physical change in reference to particles changing places, formulas, and properties. What are reactants and products. Explain what a balanced chemical equation represents. Tell which reaction was your favorite, and why you choose that one.	4
this lab is due on:		25

There are 7 parts to this lab experience, do them in ANY order, just keep track of your observations on WHITE PAPER. Do not write on this page today (or tonight).

1	Put 4 cubes of ice into a 100 mL beaker. Let it sit for 20 minutes. Light up your Bunsen burner (capital B for Mr. Bunsen please) and boil this water away. Take the temperature of the boiling water. (let beaker cool off before you wash it with soap).
2	Put one full eyedropper full of lithium carbonate solution into a small clean beaker. Put another full eyedropper full of cobalt (II) chloride solution into the same beaker. Observe and record anything noticeable. Then, let this sit for 20 minutes at least, and observe again. Pour down drain with water.
3	Place a scoop of sodium hydrogen carbonate ($NaHCO_3$) into a small beaker. Pour in 30 mL of acetic acid ($HC_2H_3O_{2(AQ)}$) Observe carefully. Move your papers away from beaker before pouring in the acid.
4	Obtain some copper wire. Set up your Bunsen burner. Using tongs, put wire into the hottest part of the flame. Turn as if it were a hot dog at a campfire. Put the wire onto the table (it's still hot!). Observe what forms on the wire. Which of the 2 kinds of copper oxide formed on your wire? Put wire in trash.
5	Put a large scoop of the sodium hydrogen carbonate into a DRY, large test tube. Attach the tube to the ring stand. Heat with the Bunsen burner flame. While heating, SOFTLY tap the tube with the metal tongs. Watch closely. What's in the top of the test tube now? Where did that come from? When cooled off you may dump this down the drain with plenty of soap and water.
6	Obtain a piece of magnesium metal. Spiral the metal around your pen making a "spring". Hold it on one end with crucible tongs. Put the metal into the Bunsen burner flame. When metal ignites, take out of the flame. DO NOT LOOK DIRECTLY AT THE BURNING METAL! Do not let the burning metal go onto you or the floor! When it cools down, rub some of the residue on your finger and observe the ash. Wipe up with damp paper towels, put into trash cans.
7	Obtain approximately 40 mL deionized water in a small, clean beaker. Measure the temperature of this water to the nearest 10th degree. Measure 7.50 grams of $KNO_{3(S)}$ (potassium nitrate), then pour this into your water. Carefully stir it using the thermometer. Measure the temperature again. Wash down the drain with lots of water. Do not get this stuff in your mouth!

	For each experiment write the WORD EQUATION, and then a BALANCED CHEMICAL EQUATION with PHASE SYMBOLS.
1	Word Equation: Ice melts to water, which boils into steam. Balanced chemical equation: $H_2O_{(S)} \rightarrow H_2O_{(L)} \rightarrow H_2O_{(G)}$
2	Word Equation: Lithium carbonate & cobalt (II) chloride solutions to form Lithium chloride solution & solid cobalt (II) carbonate (precipitate) Balanced chem equation: $Li_2CO_{3(AQ)} + CoCl_{2(AQ)} \rightarrow CoCO_{3(S)} + 2LiCl_{(AQ)}$
3	Word equation: Sodium hydrogen carbonate and acetic acid react to form sodium acetate solution, water, and carbon dioxide. Balanced chem equation: $NaHCO_{3(S)} + HC_2H_3O_{2(AQ)} \rightarrow NaC_2H_3O_{2(AQ)} + H_2O_{(L)} + CO_{2(G)}$

4	Word Equation: Copper symthesizes with oxygen to form copper (II) oxide. Balanced chemical equation: $2Cu_{(S)} + O_{2(G)} \rightarrow 2CuO_{(S)}$
5	Word Equation: Sodium hydrogen carbonate decomposes into sodium carbonate, water and carbon dioxide. Balanced chem equation: $2NaHCO_{3(S)} \rightarrow Na_2CO_{3(S)} + H_2O_{(L)} + 2CO_{2(G)}$
6	Word Equation: Magnesium metal synthesizes with oxygen to form magnesium oxide. Balanced chem equation: $2Mg_{(S)} + O_{2(G)} \rightarrow 2MgO_{(S)}$
7	Word equation: Potassium nitrate solid is dissolved into water. Balanced chem equation: $KNO_{3(S)} \xrightarrow{\text{water}} KNO_{3(AQ)}$

Conclusion

In this lab I did 7 experiments to learn how to tell the difference between a physical change and a chemical reaction. A physical change is just a phase change; no new substances are made. A chemical reaction requires some bonds to break or to form, or both to happen, and that results in the products being different from the reactants. New substances form with their own formulas and properties.

There are 6 phase changes: melting (S to L), freezing (L to S), vaporization (L to G), condensation (G to L), sublimation (S to G), and deposition (G to S). The melting point is the same temperature as the freezing point, it is the phase change temperature between the solid and liquid phase. The boiling point is the same temperature as the condensation point, it is the phase change temperature between the liquid and gas phase.

TOPIC-B is the acronym that reminds me that a chemical reaction probably happened (but there are exceptions, as I saw in this lab). Temperature change, Odor change, Precipitate of a new solid, Irreversibility of what happened, Color change and then Bubbles of a new gas form, is what it stands for.

An exception to the TOPIC-B was in the last experiment where potassium nitrate powder was put into water. The temperature cleared dropped but this was only a phase change, Solid to Aqueous. If the water evaporated away, the dry white powder $KNO_{3(S)}$ would be left in the beaker, unchanged. No new compound formulas, and no new properties (but the temperature changes nonetheless!)

I love chem, the end.