AP Chemistry Summer Homework

Welcome to AP Chemistry!

This class is a full-year college level class where we cover the concepts and lab skills taught in General Chemistry semesters 1 and 2. There is a lot that goes on in this class and it is math-based. (I'm not trying to scare you, but make sure that you understand it.) The last few years have been difficult for some students science-wise, so I will give you an idea of what we plan to cover.

Semester 1 will review some general Pre-AP Chemistry concepts and will go over the periodic table, gases, bonding, chemical reactions, stoichiometry and hopefully thermochemistry in more detail.

Semester 2 will look at kinetics (rates) of reactions, equilibrium, acids and bases, and electrochemistry. We are hoping for 1-2 weeks of review before the AP test in May.

This class will also include several labs that may cover one day or multiple days in class. Lab skills are extremely important in life and in college, so we do place an emphasis on them.

Your two part summer homework assignment is below. If you have questions, you may reach me at ralvarado@hicd.org or on Teams as Rachel Alvarado. Be aware that I will only answer messages and emails in June and August and those responses may be sporadic depending on the timing, but I will respond when I can.

Have a great summer!

Mrs. Alvarado

Part 1: Introductory Lab

Ever wondered why candies are different colors? Many candies contain colored dyes. Bags of M&Ms or Skittles contain candies of various colors. The labels tell us the names of the dyes used in the candies. But which dyes are used in which candies? We can answer this by dissolving the dyes out of the candies and separating them using a method called chromatography.

This process is called chromatography. (The word "chromatography" is derived from two Greek words: "chroma" meaning color and "graphein" to write.) The salt solution is called the mobile phase, and the paper the stationary phase. We use the word "affinity" to refer to the tendency of the dyes to prefer one phase over the other. The dyes that travel the furthest have more affinity for the salt solution (the mobile phase); the dyes that travel the least have more affinity for the paper (the stationary phase).

For this experiment you will need:

• M&M or Skittles candies (1 of each color) • coffee filter paper • a tall glass

• water • table salt • a pencil (a pen or marker is not good for this experiment)

• scissors • a ruler • 6 toothpicks • aluminum foil • an empty 2 liter bottle with cap

Procedure:

1. Cut the coffee filter paper into a 3 inch by 3 inch (8 cm by 8 cm) square. Draw a line with the pencil about ½ inch (1 cm) from one edge of the paper. Make six dots with the pencil equally spaced along the line, leaving about ¼ inch (0.5 cm) between the first and last dots and the edge of the paper. Below the line, use the pencil to label each dot for the different colors of candy that you have. For example, Y for yellow, G for green, BU for blue, BR for brown, etc.
2. Next make solutions of the colors in each candy. Take an 8 inch by 4 inch (20 cm by 10 cm) piece of aluminum foil and lay it flat on a table. Place six drops of water spaced evenly along the foil. Place one color of candy on each drop. Wait about a minute for the color to come off the candy and dissolve in the water. Remove and dispose of the candies.
3. Now "spot" the colors onto the filter paper. Dampen the tip of one of the toothpicks in one of the colored solutions and lightly touch it to the corresponding labeled dot on your coffee filter paper. Use a light touch, so that the dot of color stays small - less than 1/16 inch (2 mm) is best. Then using a different toothpick for each color, similarly place a different color solution on each of the other five dots.
4. After all the color spots on the filter paper have dried, go back and repeat the process with the toothpicks to get more color on each spot. Do this three times, waiting for the spots to dry each time.
5. When the paper is dry, fold it in half so that it stands up on its own, with the fold standing vertically and the dots on the bottom.
6. Next make what is called a developing solution. Make sure your 2-liter bottle or milk jug is rinsed out and add to it ⅛ teaspoon of salt and three cups of water .). Then screw the cap on tightly and shake the contents until all of the salt is dissolved in the water. You have just made a 1% salt solution.
7. Now pour the salt solution into the tall glass to a depth of about ¼ inch (0.5 cm). The level of the solution should be low enough so that when you put the filter paper in, the dots will initially be above the water level. Hold the filter paper with the dots at the bottom and set it in the glass with the salt solution.
8. When the salt solution is about ½ inch (1 cm) from the top edge of the paper, remove the paper from the solution. Lay the paper on a clean, flat surface to dry.

AP Chemistry Summer Homework Part 1 Write-Up

1. Title your paper: AP Chemistry Summer Homework Write-Up
2. Underneath the title, list all of the materials used for both parts of the experiment
3. Sketch your setup.
4. Answer the following questions in complete sentences:
    a. What does the salt solution do?
    b. As the solution climbs up the filter paper, what do you begin to see?
    c. What could chromatography be used for in chemistry?
    d. Compare the spots from the different colored candies, noting similarities and differences.
        i. Which colors contained mixtures of dyes?
        ii. Which ones seem to have just one dye?
        iii. Can you match any of the colors on the paper with the names of the dyes on the label?
        iv. Do similar colors from different candies travel up the paper the same distance?
5. Redo the experiment with another type of colored candy, colored drink mix or colored washable markers. Answer the following questions comparing your initial results with your new results.
    a. Compare the spots from the different experiments, noting similarities and differences.
    b. Which colors contained mixtures of dyes?
    c. Which ones seem to have just one dye?

6. Write a summary paragraph including your results, any results you did not expect, what you learned from this experiment, and how it could be applied to chemistry in the real world.
7. Turn in the answers to these questions with your dried coffee filter papers on the first day of class.

Part 2: Common Ions and Their Charges

A mastery of the common ions, their formulas and their charges, is essential to success in AP Chemistry. You are expected to know all of these ions by the second full week of class, when I will give you a quiz on them. You will always be allowed a periodic table (without names), but you will NOT be allowed to use polyatomic ion reference sheets on the tests or quizzes in this class. Make flashcards for each below with the formula and charge on one side and the name on the other. You must show me the flashcards for a grade.

Polyatomic Ions

Polyatomic ions are a group of atoms that are covalently bonded with a positive or negative charge. They appear quite frequently in both organic and inorganic chemistry, so knowing their names, formulas, and charges is important. This can sometimes be easier said than done; therefore, listed below are a few tricks that will help with these substances and their names.

What does oxygen have to do with the name?

There are two common endings for polyatomic ions: ***-ate*** and -***ite***. The ***-ate*** ending often refers to the polyatomic ion with the greater number of oxygens; however, it never indicates the specific amount. The polyatomic ions with the ***-ite*** endings will always have one less oxygen than the polyatomic ions with the ***-ate*** endings.

Nitrate → NO_3^{-1} Nitrite → NO_2^{-1}

Sulfate → SO_4^{-2} Sulfite → SO_3^{-2}

Some polyatomic ions have more than two different combinations with oxygen. To differentiate between these, prefixes are added to the polyatomic ions: ***hypo-*** and ***per-***. The ***hypo-*** prefix can be added to indicate one less oxygen than the respective ion, whereas, the ***per-*** prefix is added to indicate one additional oxygen.

Hypochlorite → ClO^{-1} Chlorite → ClO_2^{-1} Chlorate → ClO_3^{-1} Perchlorate → ClO_4^{-1}

Note, the ***hypo-*** prefix is always written with the ***-ite*** suffix, and the ***per-*** prefix is always written with the ***-ate*** suffix.

Miscellaneous Ions

Name	Formula	Name	Formula
Cadmium Ion	Cd^{2+}	Silver Ion	Ag^{+}
Zinc Ion	Zn^{2+}	Ammonium	NH_4^{+}
Mercury (I)	Hg_2^{2+}	Mercury (II)	Hg^{2+}

List of common polyatomic ions with 1- charge

Name	Formula	Name	Formula
Acetate	$C_2H_3O_2^-$	Bicarbonate (Hydrogen carbonate)	HCO_3^-
Bromate	BrO_3^-	Perchlorate	ClO_4^-
Chlorate	ClO_3^-	Chlorite	ClO_2^-
Hypochlorite	ClO^-	Hydroxide	OH^-
Iodate	IO_3^-	Nitrate	NO_3^-
Nitrite	NO_2^-	Permanganate	MnO_4^-
Cyanide	CN^-	Thiocyanate	SCN^-

List of common polyatomic ions with 2- charge

Name	Formula	Name	Formula
Carbonate	CO_3^{2-}	Chromate	CrO_4^{2-}
Dichromate	$Cr_2O_7^{2-}$	Oxalate	$C_2O_4^{2-}$
Silicate	SiO_3^{2-}	Sulfate	SO_4^{2-}
Sulfite	SO_3^{2-}	Peroxide	O_2^{2-}

List of common polyatomic ions with 3- charge

Name	Formula
Phosphate	PO_4^{3-}
Arsenate	AsO_4^{3-}