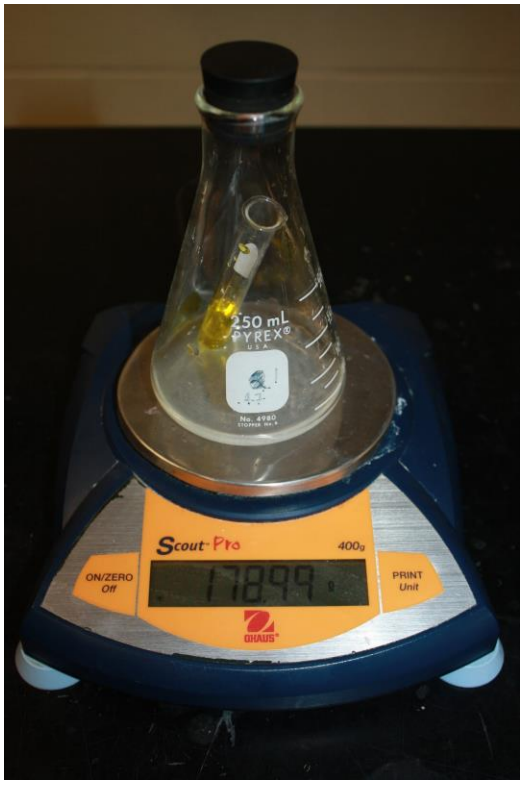
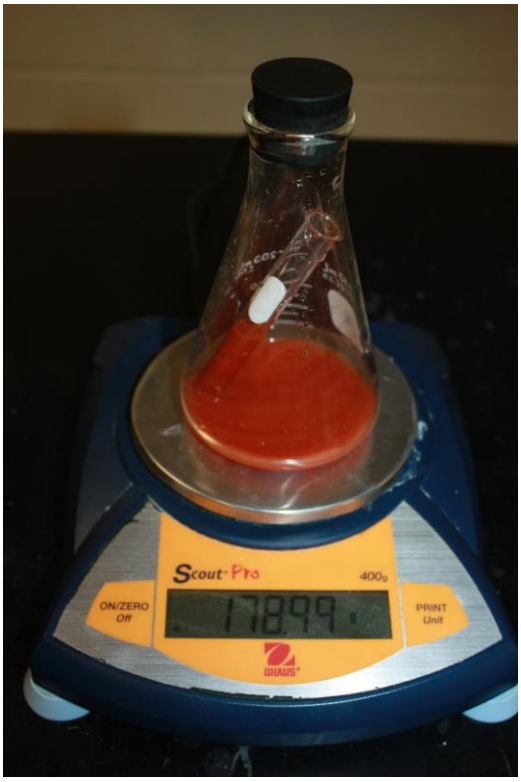
Conservation of Mass Demonstration

Background:

In baking, what you start with you end up with, but in a different arrangement. This also relates to the masses of the reactants compared to the products. Twenty-five pounds of flour, sugar, and chocolate chips produces twenty-five pounds of chocolate chip cookies. When chemical reactants combine, new substances or products are formed. In the demonstration below, potassium chromate (K_2CrO_4) is reacted with silver nitrate ($AgNO_3$) in solution to form potassium nitrate and a precipitate. In the figure at the left, the $K_2CrO_{4(aq)}$ and $AgNO_{3(aq)}$ are placed into the test tube and flask, respectively. The flask is tipped upside down, and the $K_2CrO_{4(aq)}$ and $AgNO_{3(aq)}$ mix together to form $KNO_{3(aq)}$ and the orange precipitate in the figure at the right.





Applications

1. Predict the chemical formula of the missing product in the chemical reaction.

$$K_2CrO_{4\,(aq)} + AgNO_{3\,(aq)} \rightarrow \_\_\_\_\_ + KNO_{3(aq)}$$

2. Identify the type of chemical reaction represented in question 1.

3. State the number of significant figures recorded in the measurements displayed by the balance.

4. State evidence that a chemical reaction has occurred.

5. Identify the element in K_2CrO_4 responsible for the yellow color.

6. State the oxidation state of chromium in K_2CrO_4.

7. Write the IUPAC name for the precipitate formed in the reaction.

8. Classify the type of mixture found in the products.

9. Describe one process that can be used to recover the precipitate from the mixture.

10. If a student reacts 97.0g K_2CrO_4 with 169.00 g $AgNO_3$ to produce 101.00g KNO_3 , how many grams of Ag_2CrO_4 are produced?

11. A source of hydrogen ions was added by dropping 10 drops of HCl into the solution shown below:

$$2CrO_4^{-2} + 2H^+ \Leftrightarrow Cr_2O_7^{-2} + H_2O$$

(yellow) (orange)

a) Explain, in terms of Le Chatelier's Principle, why the concentration of $Cr_2O_7^{-2}$ increases.

b) Compare the rate of the forward reaction to the rate of the reverse reaction for this system.

Answer Key

1. Ag_2CrO_4
2. Double Replacement Reaction, Precipitation.
3. 5
4. Color change, formation of a precipitate, formation of a solid
5. Cr
6. 6^+ $^+6$
7. Silver chromate
8. Heterogeneous
9. Filtration
10. 165.00 g
11. a) The addition of H^+ causes the reaction to shift forward, shift right
    b) The rate of the forward and reverse reactions are equal.