Finding the ratio of moles of reactants in a chemical reaction

Science, Chemistry

Finding the Ratio of Moles of Reactants in a Chemical Reaction Purpose: The goal of the lab is to determine the mole ratio of two reactants in a chemical reaction (AgNO3 and K2CrO4). However, the formulas for the products are unknown. Introduction: When determining the molar ratio of a chemical equation, usually the formulas of the reactants and the products are known. With that information, it is particularly easy to determine the ratio. However, since the products and the formulas for the products are unknown, another property of the reaction must be analyzed to find the ratio. This property depends on the amount of the product formed or on the amount of reactant that remains. Properties may include the color intensity due to the product, the mass of the precipitate that forms, or the volume of a gas evolved. In this experiment, the method of continuous variations will be used to determine the mole ratio of two reactants. With this method, the total number of moles of reactants is kept constant for the series of measurements. The property that is going to be measured is the change in temperature. The temperature change, or the heat produced, will be directly proportional to the amount of reaction occurs and to the total extent of it. The optimum ratio, which is the ratio of the reactants in the balanced chemical reaction, will form the greatest amount of product, or generate the most heat, and will be key to determining the molar ratio. Corrosive liquids, which burn the skin, will be used in the experiment. When this liquid reacts with acid, a toxic gas will formed. Keep away from the gas and protect your skin and clothing. Work in a fume hood or well-ventilated lab. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron. Wash hands thoroughly with soap and water before leaving the laboratory.

The molar ratio of the reactants is the ultimate goal of the lab. In order to achieve that, secondary observations on the temperature change will have to be made and analyzed. The data and graph made after the data is attained will assist in that. Procedure: 1) Obtain 2 beakers with 175mL of NaClO in one and 175mL of “ Solution B" in another. 2) Measure the temperature of each and make sure they are the same. 3) Measure 5. 0mL of NaClO and 45. 0mL of “ Solution B" with the appropriate graduated cylinders and add them to a Styrofoam cup. 4) Stir the solution with a thermometer, and record the max temperature reached. 5) Pour the solution out, rinse the cup, and repeat steps 1-4 using a different ratio of the two substances, keeping the total volume at 50. 0mL. 6) Continue testing various ratios until you have at least 3 measurements on either side of the peak temperature difference. Conclusion: When the formula of the products are unknown in a chemical reaction, experiments must be done to find the mole ratio of the reactants. In our experiment, we used the method of continous variations to determine to the mole ratio of the two reactants. The property measured was the change of temperature, as indicated in the data table. The method of continous variations keeps the total number of moles of reactants constant through a series of titrations. Each titration varies the mole fraction of each reaction from mixture to mixture by adjusting the ratio of NaClO to Na2SO3, which is also indicated in the data table. Theoretically, the maximum temperature change occurs when teh mole fraction of the reactants is closest to the actual stoichiometric mole ratio, which signals the mole ratio based on the mole fraction in the titration. According to the analysis, the mole ratio is 1: 2 in the order of NaClO to Na2SO3. This ratio

was concluded by the graph, in which the lines of best fit were extrapolated to intersect at the optimum ratio point. However, there was room for error when measuring the liquids in each titration. The measurements weren't always exact which could affect the change in temperature. Also, when measuring the temperature it might not have been exact due to inconsistent stirring. Nonetheless, the goal of the lab was to find the mole ratio of the two reactants and it was concluded to be 1: 2.