

Measuring Mass in Reactions

A group of students has just finished their science homework about word equations which represent the changes that occur when elements and compounds undergo chemical changes. Because they love learning, they started talking about what happens to the quantities of the substances in a chemical reaction.

Q1. They wondered when matter changes, if the mass of matter also changes. Specifically, they wondered when two solutions are mixed together and a solid forms, would the mass increase? What do you think?



Figure 1 Apparatus used in the experiment

The students decided to perform an experiment to answer the question. They poured about 10–15 mL of iron(III) chloride solution into a flask. They then filled a test tube about one-half full with sodium hydroxide solution and carefully dried off the outside of the test tube with a paper towel. They placed the test tube gently in the flask, being careful not to spill the solutions. After putting a stopper in the flask opening, they dried the outside of the flask. (See Figure 1.)

The students measured the combined mass of the reactants and apparatus and recorded it in Table 1. They then inverted the flask to mix the iron(III) chloride solution in the flask with the sodium hydroxide in the test tube. They noticed that a precipitate formed when the solutions mixed. (See Figure 2.)

Q2. Why did the students dry the outside of the test tube and the flask before measuring the mass?

Q3. Knowing the mass at the beginning and the qualitative observations of the students, predict the mass of the products and apparatus and add it to the table.

Table 1 Mass of reactants, apparatus and products

Total mass of reactants and apparatus (g)	Predicted mass of products and apparatus (g)	Qualitative observations of reactants and products
352.1		<ul style="list-style-type: none">• sodium hydroxide solution was clear and colorless• iron(III) chloride solution was brownish in color• Red precipitate formed after mixing



Figure 2 Appearance of compounds after mixing

Q4. Identify any evidence that a chemical reaction occurred in the flask?

Q5. The students measured the combined mass of the products and apparatus to be 352.15 g.

a) Do you think the difference in mass is significant?

b) What did their investigation teach them?

c) Suggest why the mass the students observed after the reaction wasn't exactly the same as the mass before the reaction.

d) Suggest an improvement to their procedure.

(P, D) Q6. a) Write a word equation for this reaction.

b) Write the equation using the chemical formula for each compound.

(D) Q7. Imagine the students repeated the investigation using a different pair of reactants: sodium carbonate solution and calcium chloride

solution. Predict the products of this reaction and write its word equation.