

Law of Definite Proportions

Reacting Ratios

Purpose

Students need to see the relationship between observed laws of matter and the models that explain that behavior, specifically, the relationship between the Dalton model and the law of constant composition. Students also need to begin to understand that reacting ratios (either by atom or by mass) can be used to predict reactant and product quantities (stoichiometry).

Objectives

- The mass ratio of the elements that form a compound are constant.
- The mass ratio of reacting substances is constant.
- There is a convention (balance by atom rather than mass) used to represent chemical reactions as equations.

Comments

Students have already been introduced to a Dalton type model of the atom. They understand (hopefully) that the mass of an atom of a certain element is "constant", and that the masses of the atoms of different elements are different.

Students generally draw the conclusion that the reacting ratio of the sulfur and fluorine is constant. However, when it comes to writing a "shorthand representation for this chemical reaction" (chemical equation) they have not responded well without some prompting. They generally do not include the balancing of the equation. I (smw) ask them to balance the equation by mass and by atom, and then to choose which method they prefer. They have always chosen the accepted "atom method". During ensuing discussions of stoichiometry, I often tell the students that it was their choice to write chemical equations in this way, and that the equation represents our connection between the theoretical world of the atom and the observable world of the laboratory. [Primary Contact: Steve Wright]

Implementation

The intended setting is: in-class; take-home assignment; laboratory.

This section is: primarily for the students; primarily for the instructor.

The following data are for a chemical reaction that can take place when sulfur is combined with fluorine to form one compound, sulfur hexafluoride. Fill in the missing blanks on the Table. Are these data consistent with our current understanding of the Dalton Atomic Model? Explain your answer. Write a shorthand representation for this chemical reaction.

Table 1
Observed Masses for a Reaction Between Sulfur and Fluorine

Mass of sulfur reacting (grams)	Mass of fluorine reacting (grams)	Mass of product formed (grams)
3.21	11.40	14.61
5.62	19.95	25.57
7.22	25.65	32.87
11.40	40.47	51.87
14.96	53.12	68.08
		74.76