Laws of Mass Conservation, Definite Proportions, and Multiple Proportions

1. State the Law of Mass Conservation:
   Mass is neither created nor is it destroyed in a chemical reaction
   Mass is conserved.
2. State the Law of Definite Proportions:
   All samples of a compound have the same composition—the same proportions by mass of the constituent elements.

3. State the Law of Multiple Proportions:
   If two elements form more than a single compound, the masses of one element combined with a fixed mass of the second are in the ratio of small whole numbers.

4. Two compounds that contain sulfur and oxygen have the following percent composition by mass.

   Compound 1: 50.1% S and 49.9% O
   Compound 2: 40.1% S and 60.0% O

   Show the law of multiple proportions is followed. What is the formula of the second compound if the formula of the first compound is SO_2?

   Assume 100 g of each compound
   Compound 1: 49.9 g O/50.1 g S = 1.0
   Compound 2: 60.0 g O /40.1 g S = 1.5

   1.5/1.0 = 1.5/1 * 2 = 3/2 The formula is SO_3. There is a 3:2 ratio.

5. Solid sodium bicarbonate, $NaHCO_3$, is heated to form solid sodium carbonate, Na_2CO_3, liquid water, and carbon dioxide gas. If 336.02 g of sodium bicarbonate was heated, and 36.04 g of water and 211.98 sodium carbonate are formed, how much carbon dioxide gas was formed? Which law is followed here?

This is the law of mass conservation.

Mass of CO_2 = 336.02 g – (211.98 g + 36.04 g) = 88.00 g