

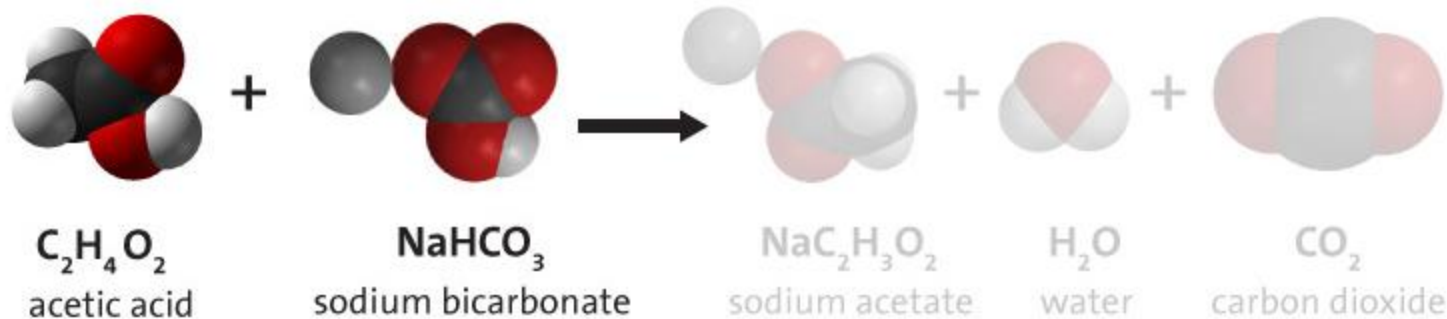


Controlling the Amounts of Product in a Chemical Reaction

Objectives:

1. To be able to explain that for a chemical reaction to take place, the bonds between atoms in the reactants are broken, the atoms rearrange, and new bonds between the atoms are formed to make the products.
2. To be able to count the number of atoms on the reactant side and on the product side of a chemical equation.
3. To be able to explain that the equal number of atoms on each side of the equation shows that mass is conserved during a chemical reaction.
4. To be able to explain, on the molecular level, why changing the amount of one or more reactants changes the amount of products.

Reactants



Which atoms make up a molecule of acetic acid (vinegar)?

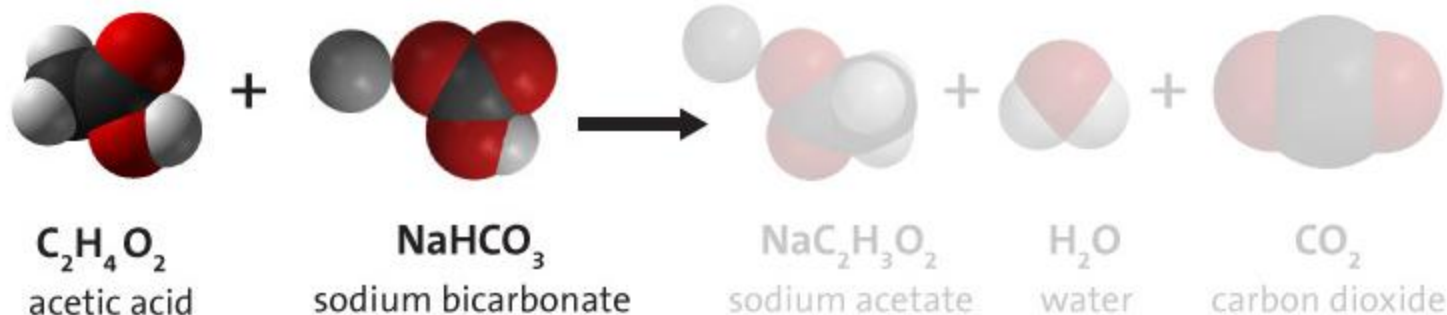
Carbon, hydrogen and oxygen (C, H and O)

What do the little numbers below and to the right of each letter mean?

These are the number of that particular atom in the acetic acid molecule. There are two carbon atoms, four hydrogen atoms, and two oxygen atoms in an acetic acid molecule.

Do you think every acetic acid molecule has this formula? Yes

Reactants



Sodium bicarbonate is baking soda. What atoms is sodium bicarbonate made of? Sodium (Na), Hydrogen (H), Carbon (C) and Oxygen (O)

How many of each type of atom are there in the compound

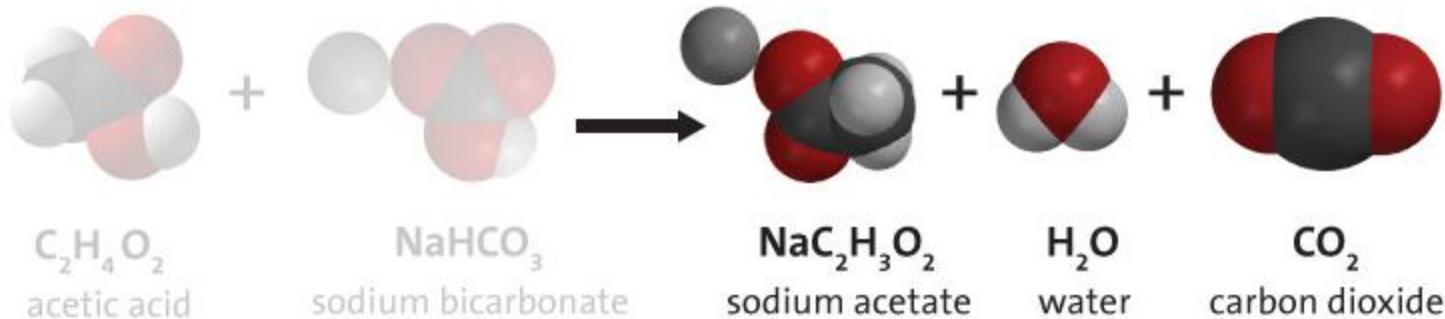
sodium bicarbonate? Sodium = 1
Hydrogen = 1
Carbon = 1
Oxygen = 3

Answer first part of question 2 on lab activity sheet.

Demonstration:

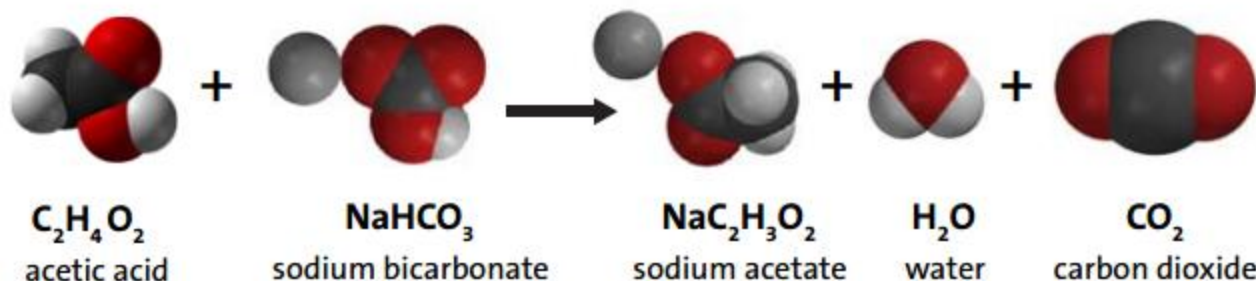
I combined a liquid and a solid, and you saw bubbling, which is made from gas. Do you think a chemical reaction occurred? Why?

Products



What else is produced in this chemical reaction?

Answer second part of question 2

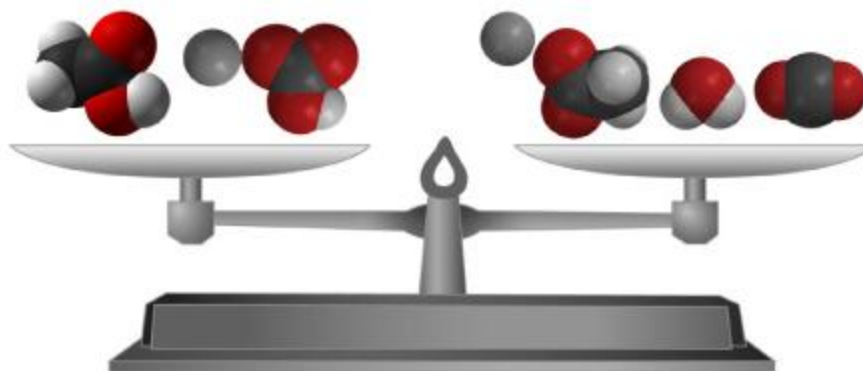


How many of each type of atom appears on each side of the chemical equation?

$\text{C}_2\text{H}_4\text{O}_2 + \text{NaHCO}_3 \longrightarrow \text{NaC}_2\text{H}_3\text{O}_2 + \text{H}_2\text{O} + \text{CO}_2$		
Atom	Reactant side	Product side
Carbon	3	3
Hydrogen	5	5
Oxygen	5	5
Sodium	1	1

What does the statement “Mass is conserved during a chemical reaction” mean? (question)

Mass is Conserved



Second Demonstration:

What could you change to create a foam that rises as close as possible to the top of the cylinder without overflowing?

10 mL of vinegar and $\frac{1}{2}$ teaspoon of baking soda caused the foam to overflow. You need to consider these amounts you plan how much of each reactant you will use as you start their trials.

The amount of detergent should not be varied in this activity because it is used as an indicator to help measure the amount of gas produced in the reaction.



Questions to consider on next slide...

Can you add the baking soda first and then the vinegar on one trial and then switch it for the other trials? No. Why not?

Should you rinse the graduated cylinder each time? Yes. Why?

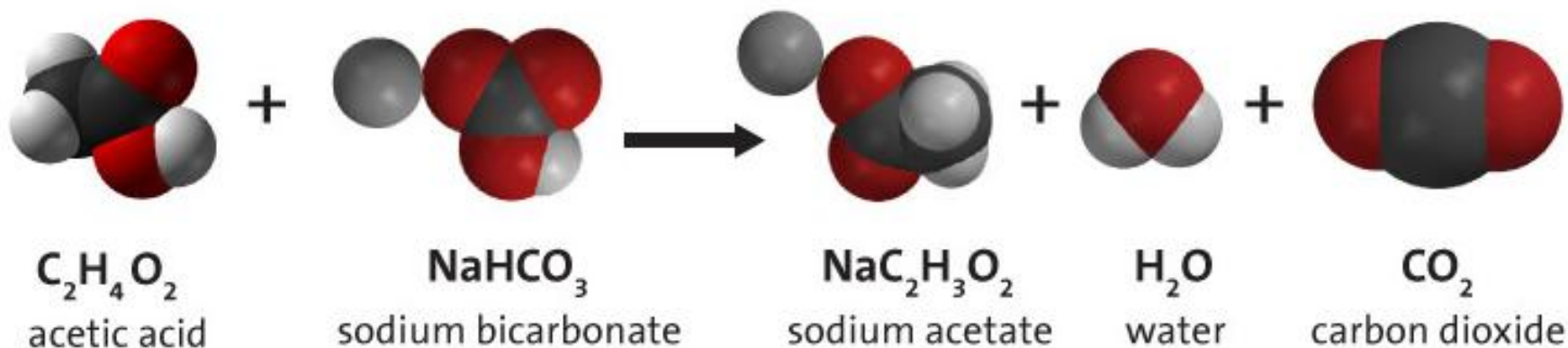
How will you remember the amounts you used in each trial?

Activity:

↓ You will work with your group to come up with a solution to the Question to Investigate.

↓ **15 minutes**

Controlling Amount of Products Formed



- Adding more of one reactant will make more products as long as there is still enough of the other reactant to react.
- If you add more and more of one reactant the other will eventually run out and no more products will be formed.

Why, on the molecular level, does changing the amount of baking soda or vinegar affect the amount of carbon dioxide gas produced?

Products are made from the reactants, so adding more reactants will produce more of the products.

Key Concepts:

- ↓ Changing the amount of reactants affects the amount of **products** produced in a chemical reaction.
- ↓ In a chemical reaction, only the atoms present in the **reactants** can end up in the **products**.
- ↓ Mass **is conserved** in a chemical reaction.