Lesson 12

Chemistry 0

Jan 2022, L. Tracey Gao

Week 11 HW Review

- Please balance the following chemical equations and also identify the chemical reaction type:

$HgO \rightarrow Hg + O_2$
Balancing the equation: $2HgO \rightarrow 2Hg + O_2$
Reaction type: Decomposition reaction

$N_2O_5 + H_2O \rightarrow HNO_3$
Balancing the equation: $N_2O_5 + H_2O \rightarrow 2HNO_3$
Reaction type: Synthesis reaction

$MgCO_3 \rightarrow MgO + CO_2$
Balancing the equation: $MgCO_3 \rightarrow MgO + CO_2$
Reaction type: Decomposition reaction

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$Al + FeO \rightarrow Al_2O_3 + Fe$

Balancing the equation: $2Al + 3FeO \rightarrow Al_2O_3 + 3Fe$

Reaction type: Single replacement reaction

$Ca(OH)_2 + H_2SO_4 \rightarrow CaSO_4 + H_2O$

Balancing the equation: $Ca(OH)_2 + H_2SO_4 \rightarrow CaSO_4 + 2H_2O$

Reaction type: Double replacement reaction

$KI + Pb(NO_3)_2 \rightarrow KNO_3 + PbI_2$

Balancing the equation: $2KI + Pb(NO_3)_2 \rightarrow 2KNO_3 + PbI_2$

Reaction type: Double replacement reaction

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$K_2O + H_2O \rightarrow KOH$

Balancing the equation: $K_2O + H_2O \rightarrow 2KOH$

Reaction type: Synthesis reaction

$MgNH_4PO_4 \rightarrow Mg_2P_2O_7 + NH_3 + H_2O$

Balancing the equation: $2MgNH_4PO_4 \rightarrow Mg_2P_2O_7 + 2NH_3 + H_2O$

Reaction type: Decomposition reaction

$H_2 + NO \rightarrow H_2O + N_2$

Balancing the equation: $2H_2 + 2NO \rightarrow 2H_2O + N_2$

Reaction type: Single replacement reaction

$SiO_2 + HF \rightarrow SiF_4 + H_2O$

Balancing the equation: $SiO_2 + 4HF \rightarrow SiF_4 + 2H_2O$

Reaction type: Double replacement reaction

Week 11 HW Review

- Please balance the following combustion reactions:

$C_7H_6O_2 + O_2 \rightarrow CO_2 + H_2O$
Step 1): $C_7H_6O_2 + O_2 \rightarrow 7\ CO_2 + 3H_2O$
Step 2): $2\ C_7H_6O_2 + 15\ O_2 \rightarrow 14\ CO_2 + 6H_2O$

$C_8H_{18} + O_2 \rightarrow CO_2 + H_2O$
Step 1): $C_8H_{18} + O_2 \rightarrow 8\ CO_2 + 9\ H_2O$
Step 2): $2\ C_8H_{18} + 25\ O_2 \rightarrow 16\ CO_2 + 18\ H_2O$

$CH_3OH + O_2 \rightarrow CO_2 + H_2O$
Step 1): $CH_3OH + O_2 \rightarrow CO_2 + 2\ H_2O$
Step 2): $2\ CH_3OH + 3\ O_2 \rightarrow 2\ CO_2 + 4\ H_2O$

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$C_7H_{16} + O_2 \rightarrow CO_2 + H_2O$

Step 1): $C_7H_{16} + O_2 \rightarrow 7\ CO_2 + 8\ H_2O$

Step 2): $C_7H_{16} + 11\ O_2 \rightarrow 7\ CO_2 + 8\ H_2O$

$C_2H_2 + O_2 \rightarrow CO_2 + H_2O$

Step 1):$C_2H_2 + O_2 \rightarrow 2CO_2 + H_2O$

Step 2): $2C_2H_2 + 5O_2 \rightarrow 4CO_2 + 2H_2O$

Conservation of Mass in Chemical Reactions

- In a chemical reaction, atoms in the reactant molecules unbond from one another and then rearrange and rebond in different ways to form the products.

- The equal number of atoms on each side of the equation shows that mass is conserved during a chemical reaction.

Counting Atoms

Vinegar **Baking Soda**

$$C_2H_4O_2 + NaHCO_3 \rightarrow NaC_2H_3O_2 + H_2O + CO_2$$

(Acetic Acid) (Sodium Bicarbonate) (Sodium Acetate)

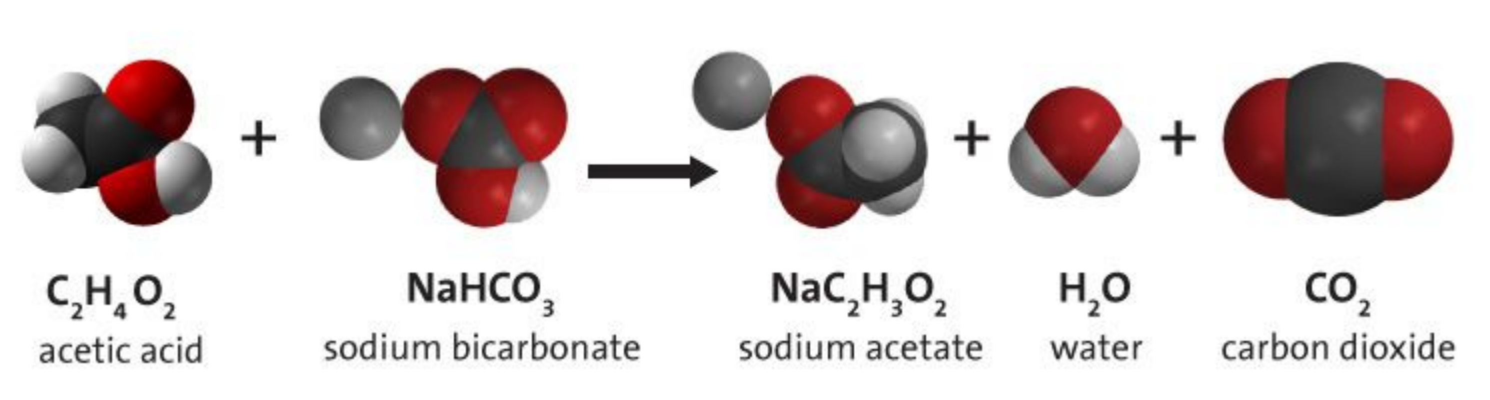
	Left (reactants)	Right (products)
Sodium	1 from baking soda- total 1	1 from sodium acetate- total 1
Carbon	2 from vinegar, 1 from baking soda- total 3	2 from sodium acetate, one from carbon dioxide- total 3
Hydrogen	4 from vinegar, 1 from baking soda- total 5	3 from sodium acetate, 2 from water- total 5
Oxygen	2 from vinegar, 3 from baking soda- total 5	2 from sodium acetate, 1 from water, 2 from carbon dioxide- total 5

Mass is conserved

Vinegar Baking Soda

$$C_2H_4O_2 + NaHCO_3 \rightarrow NaC_2H_3O_2 + H_2O + CO_2$$

(Acetic Acid) (Sodium Bicarbonate) (Sodium Acetate)



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Vinegar Baking Soda

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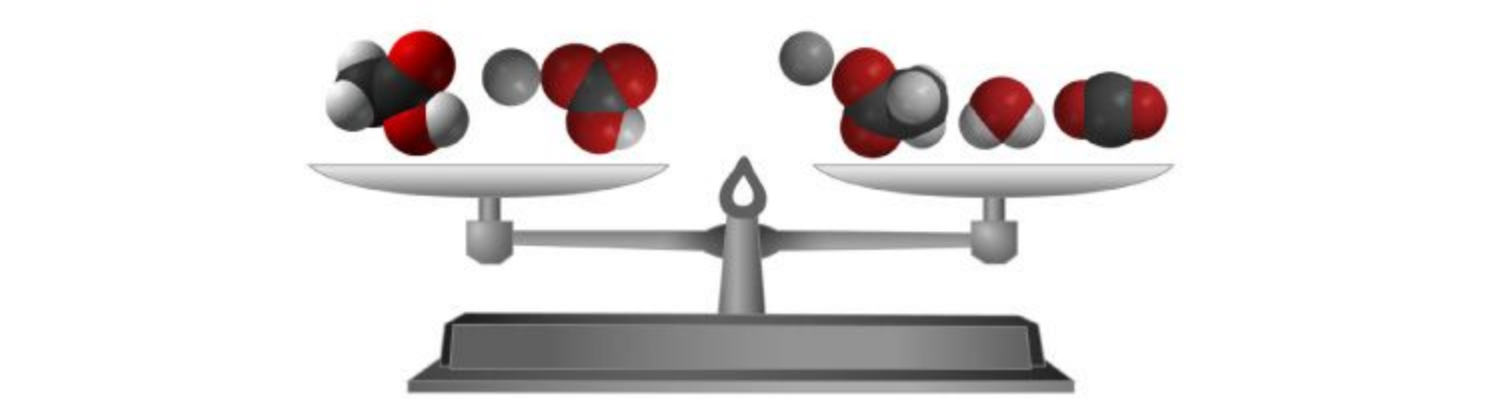

- All of the atoms in the reactants are in the products.
- The mass of the reactants and products is the same.

Controlling amount of products formed

Vinegar **Baking Soda**

$$C_2H_4O_2 + NaHCO_3 \rightarrow NaC_2H_3O_2 + H_2O + CO_2$$

(Acetic Acid) (Sodium Bicarbonate) (Sodium Acetate)

- Products are made from the reactants, so adding more reactants will produce more of the products.
- Using less baking soda, produces less carbon dioxide gas because there are fewer atoms from the baking soda to produce the carbon dioxide.
- Question: Could you just keep adding more and more baking soda to the same amount of vinegar to get more carbon dioxide?

Glow stick experiment

- How can you tell whether the chemical reaction is happening faster or slower in each glow stick?
- Some people place glow sticks in the freezer to make them last longer. Why do you think this works?
- Do you think that starting with warmer reactants increases the rate of other chemical reactions? Why?

Effect of temperature on the rate of chemical reaction

- Reactants must be moving fast enough and hit each other hard enough for a chemical reaction to take place.
- Increasing the temperature increases the average speed of the reactant molecules.
- As more molecules move faster, the number of molecules moving fast enough to react increases, which results in faster formation of products.

Summary

- The equal number of atoms on each side of the equation shows that mass is conserved during a chemical reaction.
- Increasing the temperature increases the average speed of the reactant molecules, which results in faster formation of products.
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