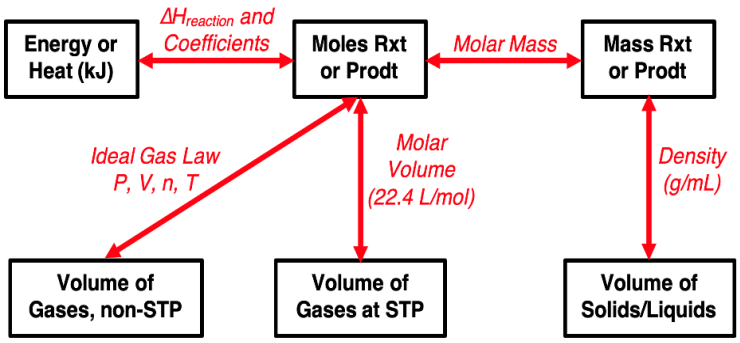
Thermal Stoichiometry

Read from **Lesson 2e: Thermal Stoichiometry** in the **Chemistry Tutorial Section, Chapter 12** of **The Physics Classroom**

Thermal stoichiometry examines the quantitative relationships between heat energy and the reactants or products in a chemical reaction. It combines **stoichiometry**—the calculation of chemical quantities in reactions—with **thermochemistry**, which focuses on energy changes, particularly heat, during chemical processes.

This graphic organizer shows the relationships between different quantities in a thermal stoichiometry problem. Use it to solve the following problems. *Remember: always start with a balanced equation!*



Thermal Stoichiometry Problems

Answer these questions for each problem:

a. What is the balanced equation for the reaction?
b. What type of reaction is occurring?
c. What is the amount of energy or amount of substance to be determined?

1. A new brand of self-heating hot chocolate releases 63.7 kJ of heat per mole of calcium oxide in its heating pack. The heat is generated by the reaction of calcium oxide (CaO) with water, forming calcium hydroxide. If the heating pack contains 15.0 g of CaO, how much heat is released to warm the drink?

Balanced equation:

Reaction type:

Stoichiometry work:

2. The combustion of one mole of glucose ($C_6H_{12}O_6$) releases 2820 kJ of heat. During his morning workout, Ben Pumpiniron burns off 5550 kJ of energy. How many grams of carbon dioxide did he theoretically exhale while generating this amount of heat?

Balanced equation:

Reaction type:

Stoichiometry work:

Thermochemistry

3. Al Pizzaiolo, the owner of the local pizzeria, is famous for his piping-hot, delicious pizza pies. To maintain their temperature, he uses an energy-efficient propane oven. Given that one mole of propane releases 2220.1 kJ of energy when combusted, how many grams of propane are required to produce 10,000 kJ of heat for warming the pizzas?

Balanced equation:

Reaction type:

Stoichiometry work:

4. The thermite reaction, in which iron(III) oxide reacts with aluminum to produce iron and aluminum oxide, is used in underwater welding. This process helps reclaim iron from rust, releasing 827 kJ of heat per mole of iron(III) oxide during the reaction. How much energy is released when 1000.0 g of iron is produced?

Balanced equation:

Reaction type:

Stoichiometry work:

5. Ima Hurt needs a cold pack to treat her sprained ankle. In her first aid cold pack, barium hydroxide octahydrate ($Ba(OH)_2 \cdot 8H_2O$) reacts with ammonium chloride, producing barium chloride, ammonia, and water. This reaction absorbs 21.0 kJ of heat per mole of barium hydroxide octahydrate. How many grams of ammonium chloride need to react with an excess of $Ba(OH)_2 \cdot 8H_2O$ are required to absorb 10.0 kJ of heat?

Balanced equation:

Reaction type:

Stoichiometry work: