

CHEMISTRY DAILY PLAN

Class:

Date:

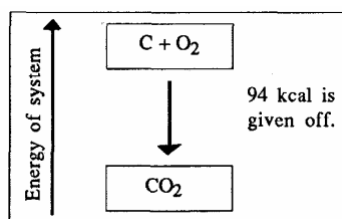
Subject: *Energy Changes in Chemical Reactions*

Time:

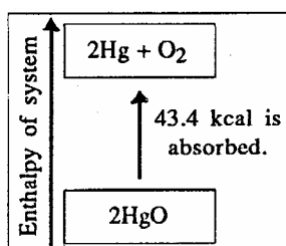
We have considered the structure of matter, and the changes in the structure of matter or chemical reactions. But we neglected an important aspect of chemical reactions: energy changes accompanying chemical reactions. Most energy produced in our modern society comes from the chemical reactions, especially combustion of coal, petroleum, and natural gas. Even all-living organisms maintain their life with the energy supplied by chemical reactions. In this chapter, we shall take a close look at the energy changes that accompany chemical reactions, and we will see how to calculate the quantity of energy released or absorbed by a reaction.

Almost all reactions absorb or release energy. What is the source of this chemical energy?

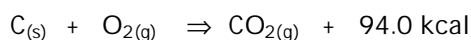
When you compress a spring, spring stores energy. The energy stored in the spring is equal to the energy you supplied. When you lift your book you also store some energy into your book. Just as in these two examples it is possible to store energy in substances in several ways. *Whenever two attracting objects are pulled apart, their energy (potential energy) increases. Whenever two repelling objects are pushed together, their potential energy increases too.* In atoms there are protons, neutrons, and electrons among which there are attraction and repulsion forces. Because of these forces atoms possess potential energy. On the other hand a molecule possesses kinetic energy because of its motion, such as *vibrational motion, rotational motion, and translational motion.* Look at figure 8.1. We see that a substance has a specific quantity of energy. If the total energy content of reactants is greater than that of products, heat energy is released during the reaction. *A reaction that gives off energy is called an exothermic reaction.* The combustion of coal is an exothermic reaction.



exothermic reaction.



endothermic reaction.



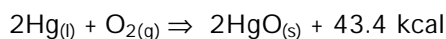
EXAMPLE Calculating the Amount of Heat Released

Problem: How many grams of carbon must be burned to heat 23.5 grams of water from 20 °C to 80 °C?

If the energy content of the products is greater than that of the reactants energy is absorbed during the reaction. The reaction in which energy is absorbed is called an endothermic reaction. **For example**, the decomposition of mercury (II) oxide at high temperatures is an example of endothermic reaction.



Recall that the reverse of an exothermic reaction is an endothermic reaction.



As a general rule, chemical reactions leading to a more stable state is exothermic, and chemical reactions leading to a less stable state is endothermic.

Problem: How many calories are needed to produce 1.12 liter of O₂ gas at STP from the decomposition of HgO_(s)?

Problem: Given the reaction $4\text{NH}_{3(g)} + 5\text{O}_{2(g)} \Rightarrow 4\text{NO}_{(g)} + 6\text{H}_2\text{O}_{(g)} + 216 \text{ kcal}$.

- How many kilocalories are released when 1 mol of NH₃ is burned?
- How many kcal are evolved when 4.48 L of NO at STP is produced?