

Name:



Date:



Lab 22: Student Exploration: Reaction Energy

Directions: Follow the instructions to go through the simulation. Respond to the questions and prompts in the orange boxes.

Vocabulary: calorimeter, chemical bond, endothermic, enthalpy, exothermic, Hess's law

Prior Knowledge Questions (Do these BEFORE using the Gizmo.)

- Two magnets are stuck together. What might you have to do to get them to separate?

Pull them apart

- Suppose you held two magnets a short distance apart, then let go. What would happen?

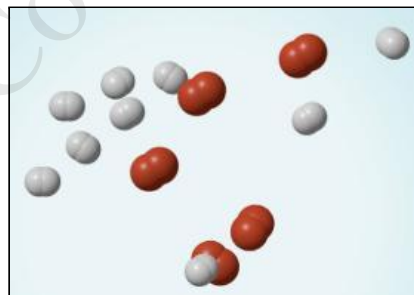
Depends on which poles of the magnets were facing each other. If one was positive and one was negative, they would be attracted to each other. If they were either both positive or negative, they would repel.

- Think about the magnets in terms of energy. In which case do you increase the potential energy of the magnets? In which case do you increase the kinetic energy of the magnets?

Kinetic energy increases if you were to move magnets with the same charge towards each other because they are going to repel. Potential energy would increase if they were different poles because they are attracted to each other.

Gizmo Warm-up

Just like magnets, atoms of different elements are attracted together to form **chemical bonds**. Breaking these bonds requires energy. When a new bond forms, energy is released and temperatures rise. In the *Reaction Energy* Gizmo, you will explore how the energy of chemical bonding relates to temperature changes that occur during chemical reactions.



To begin, check that **Reaction 1** and **Forward** are selected. In this reaction, hydrogen (H_2) and oxygen (O_2) react to form water (H_2O). The reaction takes place inside a device called a **calorimeter**. Inside the calorimeter, a small chamber holds the reactants. The rest of the calorimeter is filled with water.

- Click **Play** (▶). What happens? _____

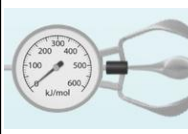
Temperature increases, moving molecules.

- How does the temperature change? _____

Increases

This study source was downloaded by 100000826990473 from CourseHero.com on 06-16-2021 15:38:01 GMT -05:00

Reproduction for educational use only. Public sharing or posting prohibited. © 2020 ExploreLearning™ All rights reserved
<https://www.coursehero.com/file/87674338/GIZMO-Reaction-Energy-Answerspdf/>

<p>Activity A:</p> <p>Energy of chemical bonds</p>	<p>Get the Gizmo ready:</p> <ul style="list-style-type: none"> • Check that Reaction 1 and Forward are selected. • Select the INVESTIGATION tab. 	
--	--	---

Introduction: The heat energy stored in a chemical system is called the **enthalpy** (H) of the system. When atoms are joined by a chemical bond, energy must be added to pull them apart. This increases the enthalpy of the system. When a chemical bond forms, energy is released as shared electrons move into lower-energy orbitals. This causes the enthalpy to decrease.

Question: How can you predict how much energy is released in a chemical reaction?

1. **Predict:** In the warm-up activity, you observed how the reaction inside the chamber affected the temperature of the surrounding water. Based on what happens to the surrounding water, do you think heat energy (enthalpy) is absorbed in the reaction or released? Explain.

Heat is released because the surrounding water is absorbing the heat (which we know because the temperature increases).

2. **Observe:** In the Gizmo, the energy required to break a chemical bond is modeled by placing a molecule into a set of mechanical claws. Place one of the hydrogen (H_2) molecules between the claws, and press the Break **bond**.

A. What happens? The bond between the atoms is broken and energy is absorbed.

- B. Look under the **Energy absorbed** column of the table. How much energy was required to break this bond? _____

436kJ/mol

Note: The energy is given here in units of kilojoules per mole (kJ/mol). This is the energy, in kilojoules, required to break all of the H–H bonds in one mole of H_2 gas.

- C. Remove the hydrogen atoms from the claws and then break apart the other H–H molecule. __

What is the total energy absorbed so far? 872kJ/mol

3. **Measure:** Notice that the oxygen atoms are connected by a double covalent bond. This is because the oxygen atoms share two pairs of electrons. Place the oxygen molecule in the claws and press the Break **bond**.

- A. How much energy is required to break the first O–O bond?

349kJ/mol