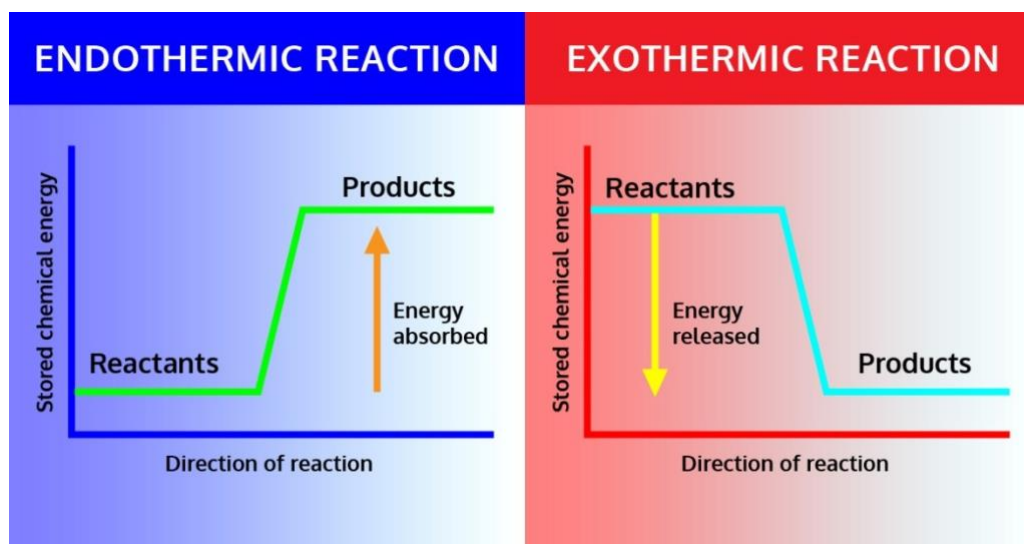


# Bond Energy and the Types of Reactions Lab Answers

## Exothermic or Endothermic?

### Background Information and Theory:

During a chemical reaction, energy is either transferred to or from its surroundings. Reactions which involve heat energy being released into the surrounding environment are called exothermic reactions. By contrast, endothermic reactions draw heat energy from their surroundings. This causes the temperature of the surrounding environment to decrease.



### Curriculum Link:

- **HS-PS1-4.** Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.

### Objectives:

- Accurately read temperatures on a thermometer
- Classify a reaction as exothermic or endothermic based on observation.
- Draw energy level diagrams to represent endothermic and exothermic reactions

### What you'll need:

- Test tubes
- Thermometers
- Reagents : Hydrochloric acid (0.5M), magnesium ribbon, ammonium nitrate, sulfuric acid (0.5M), iron filings, sodium carbonate, ethanoic acid (0.5M),
- Distilled water

### What to do:

1. Measure 3ml of reactant 1 into a clean test tube.
2. Place thermometer into the test tube and record the initial temperature.
3. Add 3ml of reactant 2 and watch the reaction for 1 minute (approximately) before recording the final temperature.
4. Calculate the change in temperature

Name: \_\_\_\_\_ Period: \_\_\_\_\_ Date: \_\_\_\_\_

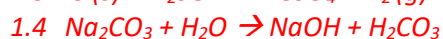
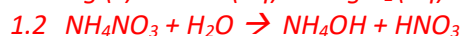
## Bond Energy and the Types of Reactions Lab Answers

5. Classify the reaction as endothermic or exothermic.

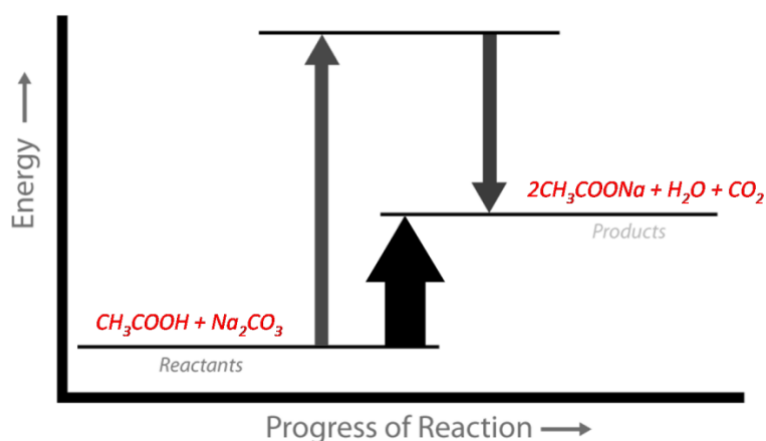
Reaction	Reactant 1	Reactant 2	Initial temperature (°C)	Final temperature (°C)	Change in Temperature (°C)	Endothermic or Exothermic?
1	Hydrochloric acid (0.5M)	Magnesium ribbon				<i>Exothermic</i>
2	Water	Ammonium nitrate				<i>Endothermic</i>
3	Sulfuric acid(0.5M)	Iron filings				<i>Exothermic</i>
4	Water	Sodium carbonate				<i>Endothermic</i>
5	Ethanoic acid (0.5M)	Sodium carbonate				<i>Endothermic</i>

### Post-lab Analysis

1. Write the balanced chemical equations for each of the five reactions from the lab.

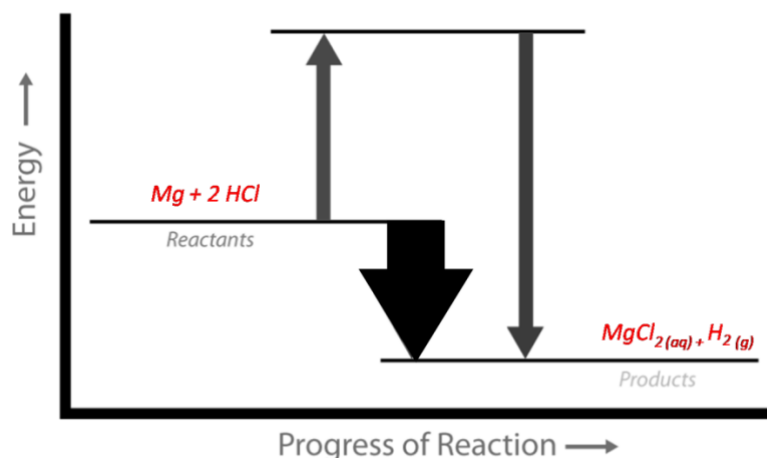


2. Draw an energy profile diagram for the reaction between ethanoic acid and sodium carbonate.



## Bond Energy and the Types of Reactions Lab Answers

3. Draw an energy profile diagram for the reaction between hydrochloric acid and magnesium ribbon.



### Questions

1. Using the terms “breaking and making bonds”, explain the net energy change for the chemical reaction between ethanoic acid and sodium carbonate.

*In the chemical reaction between ethanoic acid and sodium carbonate, more energy is used to break the bonds in the reactants, compared to forming the new bonds in the products ( $2\text{CH}_3\text{COONa} + \text{H}_2\text{O} + \text{CO}_2$ ).*

2. Using the terms “breaking and making bonds”, explain the net energy change for the chemical reaction between hydrochloric acid and magnesium.

*In the chemical reaction between hydrochloric acid and magnesium, more energy is released when the products  $\text{MgCl}_2$  and hydrogen gas are formed than energy was used to break the bonds in the reactants magnesium metal and hydrochloric acid. There is therefore a net release of energy to the surroundings and the reaction is exothermic.*

3. How might you use exothermic or endothermic processes to solve a real-world problem? Are there any instances when it would be useful to quickly make something hot or cold? Explain how it is useful to know which processes absorb or release energy.

*Exothermic reactions could be harnessed to power machines or heat homes, while endothermic reactions could be used for treating injuries or cooling.*

*By classifying reactions as exothermic or endothermic, we understand which reactions are best suited to address specific challenges.*