

Bond Energy

What makes a reaction endothermic or exothermic?

Why?

Chemical reactions can be a lot like playing with Legos®—you must take apart part of your last creation before you can replace it with something new. For many chemical reactions, we have to first break bonds in the reactants before we can put the atoms back into a new arrangement to form the products. Both of these processes involve changes in energy. The net energy change for a reaction is called the **heat of reaction** or the **change in enthalpy** (ΔH). In this activity we will look at one way energy changes can be approximated for chemical reactions.

Model 1 – Breaking and Forming Bonds

	Reaction	Change in Energy (kJ/mol _{rxn})		Reaction	Change in Energy (kJ/mol _{rxn})
A)	$\text{PCl}_3(\text{g}) \rightarrow \text{P}(\text{g}) + 3\text{Cl}(\text{g})$	+ 966.7 <i>broken</i>	E)	$\text{P}(\text{g}) + 3\text{Cl}(\text{g}) \rightarrow \text{PCl}_3(\text{g})$	- 966.7 <i>formed</i>
B)	$\text{PCl}_5(\text{g}) \rightarrow \text{P}(\text{g}) + 5\text{Cl}(\text{g})$	+ 1,297.9 <i>broken</i>	F)	$\text{P}(\text{g}) + 5\text{Cl}(\text{g}) \rightarrow \text{PCl}_5(\text{g})$	- 1,297.9 <i>formed</i>
C)	$\text{PF}_3(\text{g}) \rightarrow \text{P}(\text{g}) + 3\text{F}(\text{g})$	+ 1,470.4 <i>broken</i>	G)	$\text{P}(\text{g}) + 3\text{F}(\text{g}) \rightarrow \text{PF}_3(\text{g})$	- 1,470.4 <i>formed</i>
D)	$\text{PF}_5(\text{g}) \rightarrow \text{P}(\text{g}) + 5\text{F}(\text{g})$	+ 2,305.4 <i>broken</i>	H)	$\text{P}(\text{g}) + 5\text{F}(\text{g}) \rightarrow \text{PF}_5(\text{g})$	- 2,305.4 <i>formed</i>

- Identify four reactions in Model 1 where bonds are being broken. Write "broken" in the Change in Energy box in the table for each reaction you identify.
- Identify four reactions in Model 1 where bonds are being formed. Write "formed" in the Change in Energy box in the table for each reaction you identify.
- Circle the correct word to complete each sentence below.
 - When bonds are (broken/formed) there is a positive energy change.
 - Breaking bonds is (endothermic/exothermic).
 - When bonds are (broken/formed) there is a negative energy change.
 - Forming bonds is (endothermic/exothermic).
- Find two reactions in Model 1 that are exact opposites of each other, that is, one reaction is the reverse of the other reaction.

- How do the changes in energy for the reverse reactions compare?

The changes in energy for these reactions are the same, but opposite in sign.

- Explain your answer to part a considering what you learned from Questions 1–3 about bond breaking and bond formation.

If a given amount of energy is required to break a bond, then the same amount of energy will be released when the bond is formed.

Bond Energy The Activity Series Answer Key

Charles H. Corwin



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maintain and generate motivation for the subject of chemistry **Foundations of College Chemistry** Morris Hein,Susan Arena,Cary Willard,2023 Foundations of College Chemistry 16th edition presents chemistry as a modern vital subject and is designed to make introductory chemistry accessible to all beginning students It is intended for students who have never taken a chemistry course or those who had a significant interruption in their studies but plan to continue with the general

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Chemistry John McMurry,1998 *Chemistry* James E. Brady,Fred Senese,2004-02-04 Publisher Description *Human Biology: Breathing* Craig H. Heller,1999 *Index to Educational Overhead Transparencies* National Information Center for Educational Media,1980 *Physical Science* Verne Hobson Booth,1967 *Chemistry and Life* John William Hill,Dorothy M. Feigl,1983 Chemistry Alfred Benjamin Garrett,William Thomas Lippincott,Frank Henry Verhoek,1968 **Mechanical Engineering, Materials and Energy** Grace Chang,2011-12-22 Selected peer reviewed papers from the 2011 International Conference on Mechanical Engineering Materials and Energy ICMEME 2011 October 19 21 2011 Dalian China The Incarnate Lord Lionel Spencer Thornton,1928 The Electrician ,1914 **Biology** Cecie Starr,2000

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Table of Contents **Bond Energy The Activity Series Answer Key**

1. Understanding the eBook **Bond Energy The Activity Series Answer Key**
 - The Rise of Digital Reading **Bond Energy The Activity Series Answer Key**
 - Advantages of eBooks Over Traditional Books
2. Identifying **Bond Energy The Activity Series Answer Key**
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an **Bond Energy The Activity Series Answer Key**
 - User-Friendly Interface
4. Exploring eBook Recommendations from **Bond Energy The Activity Series Answer Key**
 - Personalized Recommendations
 - **Bond Energy The Activity Series Answer Key** User Reviews and Ratings
 - **Bond Energy The Activity Series Answer Key** and Bestseller Lists

5. Accessing Bond Energy The Activity Series Answer Key Free and Paid eBooks
 - Bond Energy The Activity Series Answer Key Public Domain eBooks
 - Bond Energy The Activity Series Answer Key eBook Subscription Services
 - Bond Energy The Activity Series Answer Key Budget-Friendly Options
6. Navigating Bond Energy The Activity Series Answer Key eBook Formats
 - ePub, PDF, MOBI, and More
 - Bond Energy The Activity Series Answer Key Compatibility with Devices
 - Bond Energy The Activity Series Answer Key Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Bond Energy The Activity Series Answer Key
 - Highlighting and Note-Taking Bond Energy The Activity Series Answer Key
 - Interactive Elements Bond Energy The Activity Series Answer Key
8. Staying Engaged with Bond Energy The Activity Series Answer Key
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Bond Energy The Activity Series Answer Key
9. Balancing eBooks and Physical Books Bond Energy The Activity Series Answer Key
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Bond Energy The Activity Series Answer Key
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Bond Energy The Activity Series Answer Key
 - Setting Reading Goals Bond Energy The Activity Series Answer Key
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Bond Energy The Activity Series Answer Key
 - Fact-Checking eBook Content of Bond Energy The Activity Series Answer Key
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
- Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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