

# 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** ( $\Delta H$ ). 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 <sub>rxn</sub> )		Reaction	Change in Energy (kJ/mol <sub>rxn</sub> )
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 Pogil Answers

**Peder Voetmann Christiansen**



## **Bond Energy Pogil Answers:**

A Simple Semiempirical Approximation for Bond Energy Francisco Elias Jorge, Mario Giambiagi, Myriam Segre de Giambiagi, 1985      **Energy and Bonding** Michael Hudson (chimiste), 1969      Chemistry Richard S. Moog, John J. Farrell, 2014-01-13 Chemistry A Guided Approach 6th Edition follows the underlying principles developed by years of research on how readers learn and draws on testing by those using the POGIL methodology This text follows inquiry based learning and correspondingly emphasizes the underlying concepts and the reasoning behind the concepts This text offers an approach that follows modern cognitive learning principles by having readers learn how to create knowledge based on experimental data and how to test that knowledge      *Kit Bond's Position Paper No. 4* Christopher S. Bond, Missouri Transition Government, 1980      **Energy Expression for the Chemical Bond Between Atoms in Hydrides and Oxides**, 2008      **S.C.F. Calculations of Bond Properties and Potential Energy Surfaces**, 1971      Phase Co-ordinate Bond Graph Analysis of Multiport Energy Systems, 1974      **Phase co-ordinate bond graph analysis of multiport energy systems** Mohammed Ridzuan Bin Haji Mohammed Salleh, 1974      **Energy Bond Graphs** Peder Voetmann Christiansen, 2005

## Decoding **Bond Energy Pogil Answers**: Revealing the Captivating Potential of Verbal Expression

In a time characterized by interconnectedness and an insatiable thirst for knowledge, the captivating potential of verbal expression has emerged as a formidable force. Its ability to evoke sentiments, stimulate introspection, and incite profound transformations is genuinely awe-inspiring. Within the pages of "**Bond Energy Pogil Answers**," a mesmerizing literary creation penned with a celebrated wordsmith, readers embark on an enlightening odyssey, unraveling the intricate significance of language and its enduring affect our lives. In this appraisal, we shall explore the book is central themes, evaluate its distinctive writing style, and gauge its pervasive influence on the hearts and minds of its readership.

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