

# 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

**Wenbin Ji**



## **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    *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    Phase Co-ordinate Bond Graph Analysis of Multiport Energy Systems, 1974    *Energy Bond Graphs* Peder Voetmann Christiansen, 2005    **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    Phase co-ordinate bond graph analysis of multiport energy systems Mohammed Ridzuan Bin Haji Mohammed Salleh, 1974    S.C.F. Calculations of Bond Properties and Potential Energy Surfaces, 1971    *Energy Bond Graphs* Peder Voetmann Christiansen, Roskilde Universitetscenter. Institut for Studiet af Matematik og Fysik samt deres Funktioner i Undervisning, Forskning og Anvendelser, 2005

## Reviewing **Bond Energy Pogil Answers**: Unlocking the Spellbinding Force of Linguistics

In a fast-paced world fueled by information and interconnectivity, the spellbinding force of linguistics has acquired newfound prominence. Its capacity to evoke emotions, stimulate contemplation, and stimulate metamorphosis is actually astonishing. Within the pages of "**Bond Energy Pogil Answers**," an enthralling opus penned by a very acclaimed wordsmith, readers attempt an immersive expedition to unravel the intricate significance of language and its indelible imprint on our lives. Throughout this assessment, we shall delve to the book is central motifs, appraise its distinctive narrative style, and gauge its overarching influence on the minds of its readers.

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