

## AP Chemistry POGIL: Bond Energy

**Driving Question:** 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> )
<b>A</b>	$\text{PCl}_{5(g)} \rightarrow \text{P}_{(g)} + 3\text{Cl}_{(g)}$	+ 966.7 <i>Broken</i>		<b>E</b>	$\text{P}_{(g)} + 3\text{Cl}_{(g)} \rightarrow \text{PCl}_{5(g)}$	- 966.7 <i>Formed</i>
<b>B</b>	$\text{PCl}_{5(g)} \rightarrow \text{P}_{(g)} + 5\text{Cl}_{(g)}$	+ 1297.9 <i>Broken</i>		<b>F</b>	$\text{P}_{(g)} + 5\text{Cl}_{(g)} \rightarrow \text{PCl}_{5(g)}$	- 1297.9 <i>Formed</i>
<b>C</b>	$\text{PF}_{5(g)} \rightarrow \text{P}_{(g)} + 3\text{F}_{(g)}$	+ 1470.4 <i>Broken</i>		<b>G</b>	$\text{P}_{(g)} + 3\text{F}_{(g)} \rightarrow \text{PF}_{5(g)}$	- 1470.4 <i>Formed</i>
<b>D</b>	$\text{PF}_{5(g)} \rightarrow \text{P}_{(g)} + 5\text{F}_{(g)}$	+ 2305.4 <i>Broken</i>		<b>H</b>	$\text{P}_{(g)} + 5\text{F}_{(g)} \rightarrow \text{PF}_{5(g)}$	- 2305.4 <i>Formed</i>

- 1). **Identify** four reactions in Model 1 where bonds are being **broken**. Write “broken” in the Change in Energy box **below the numerical value** in the table for each reaction you identify.
- 2). **Identify** four reactions in Model 1 where bonds are being **formed**. Write “formed” in the Change in Energy box **below the numerical value** in the table for each reaction you identify.

# Batteries Pogil Answers

**L Reisser**



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