

# Bond Energy

## Chem Worksheet 16-2

Name \_\_\_\_\_

**Bond energy** is defined as the amount of energy required to break a bond. These values are positive, indicating that bond breaking is endothermic. Bond energies are reported in kilojoules per mole (kJ/mol). The energy for breaking a hydrogen-hydrogen bond is 436 kJ/mol so when a hydrogen-hydrogen bond is formed the process releases 436 kJ/mol.

In a chemical reaction several bonds are broken and formed. For example in the reaction below a hydrogen-hydrogen bond is broken and a fluorine-fluorine bond is broken. Two hydrogen-fluorine bonds are formed. The overall energy change for this process is calculated below.



Bond energy: 436 kJ/mol

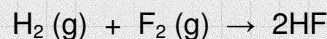


Bond Energy: 155 kJ/mol



Bond Energy: 567 kJ/mol

**example**



$$\Delta H_{\text{rxn}} = [\text{energy used for breaking bonds}] - [\text{energy formed in making bonds}]$$

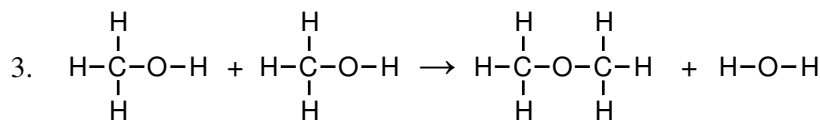
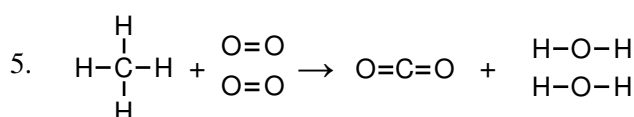
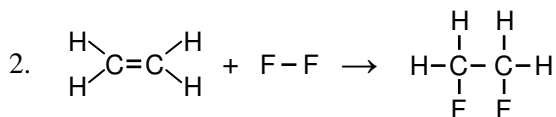
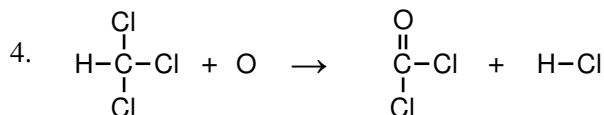
$$[436 \text{ kJ/mol} + 155 \text{ kJ/mol}] - [2(567 \text{ kJ/mol})]$$

$$= -543 \text{ kJ/mol}$$

### Average Bond Energies (kJ/mol)

H-H	436 kJ/mol	C-H	413 kJ/mol	C=C	614 kJ/mol
H-Cl	431 kJ/mol	C-C	348 kJ/mol	C≡C	839 kJ/mol
H-F	567 kJ/mol	C-N	293 kJ/mol	C=O	799 kJ/mol
N-H	391 kJ/mol	C-O	358 kJ/mol	O=O	495 kJ/mol
N-O	201 kJ/mol	C-F	485 kJ/mol	C≡O	1072 kJ/mol
O-H	463 kJ/mol	C-Cl	328 kJ/mol	C=N	615 kJ/mol
O-O	146 kJ/mol	C-S	259 kJ/mol	N=N	418 kJ/mol
F-F	155 kJ/mol	Cl-Cl	242 kJ/mol	N≡N	941 kJ/mol
				C≡N	891 kJ/mol

Estimate the enthalpy change ( $\Delta H_{\text{rxn}}$ ) of the following reactions using the bond energies above.



Draw Lewis structures for reactants and products. Estimate the enthalpy change ( $\Delta H_{\text{rxn}}$ ) for the reactions using bond energies.

