

9 • Bonding & Molecular Structure

BOND ENERGIES

Table 9.9 • Some Average Single- and Multiple-Bond Energies (kJ/mol)

	H	C	N	O	F	Si	P	S	Cl	Br	I
H	436	413	391	463	565	318	322	347	432	366	299
C		346	305	358	485			272	339	285	213
N			163	201	283				192		
O				146		452	335		218	201	201
F					155	565	490	284	253	249	278
Si						222		293	381	310	234
P							201		326		184
S								226	255		
Cl									242	216	208
Br										193	175
I											151

Multiple Bonds

N=N	418	C=C	602
N≡N	945	C≡C	835
C=N	615	C=O	732
C≡N	887	C≡O	1072
O=O (in O ₂)	498		

Table 6.2 • Standard Enthalpies of Formation (kJ/mol)

C ₂ H ₆ (g)	ethane	-84.7
H ₂ O(g)	water vapor	-241.8
CO ₂ (g)	carbon dioxide	-393.5

- Write the balanced chemical equation for the complete combustion of ethane, C₂H₆(g).
- Draw structural formulas (shortcut Lewis structures) for each of the species.
- Calculate the energy needed to break the bonds in the reactants. _____
Calculate the energy released as the bonds in the products are formed. _____
- What is the $\Delta H_{\text{combustion}}$ based on bond energies? _____
- On the back of this page, calculate the $\Delta H_{\text{combustion}}$ using Hess's Law and the thermochemical data from Chapter 6.