

Subject → Thermodynamics
Topic → Bond Energy

Class → B.Sc. Part-I subsidiary

Subject → Chemistry

Chapter → Thermochemistry

Author → Dr. Amarendra Kumar

Name → Dr. Amarendra Kumar,

Dept. of Chemistry,

Jain College, Aravali

Bond Energy

The average amount of energy required to break or dissociate one mole of bonds of that type present in the compound is called Bond energy or Bond enthalpy.

Bond energy is expressed in Kcal mol^{-1} or kJ mol^{-1} .

e.g. Bond energy of N-H bond is 433 KJ mol^{-1} or $103.58 \text{ Kcal mol}^{-1}$.

| Bond | Bond energy |
|------|-----------------------------|
| C-C | 243 KJ mol^{-1} |
| O=O | $499.0 \text{ KJ mol}^{-1}$ |
| C-H | $414.0 \text{ KJ mol}^{-1}$ |

For diatomic molecules (like H_2, HCl), the bond energy is equal to the dissociation energy of the molecules but for all polyatomic molecule like CH_4 the bond dissociation energy are different.

Bond energy is a measure of strength of the bond. In other words, bond energy is the force with which the atoms are bonded together.

Bond energy depends upon

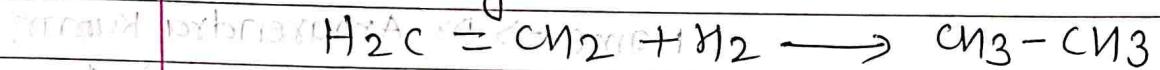
- (i) Size of the atom
- (ii) Electronegativity
- (iii) Bond length

Applications of Bond Energies

1. Determination of enthalpies of Reactions \Rightarrow

The bond energies is used for determining enthalpies of reactions.

e.g.



In this reacⁿ. the four C-H bonds of C_2H_4 remain unaffected. A double bond breaks in ethylene and an H-H bond breaks in H_2 . In turn, one C-C bond and two C-H bonds are formed in C_2H_6 . Thus

$$\Delta H = -\Delta H_{\text{C=C}} - 2\Delta H_{\text{C-H}} + \Delta H_{\text{C-C}} + \Delta H_{\text{H-H}}$$

Substituting the bond energies values, we get

$$\begin{aligned} \text{For } \Delta H &= -(347.3 + 832.4) + (615.0 + 435.1) \\ &= -129.6 \text{ kJ} \end{aligned}$$

This value is quite close to the experimental value of -133 kJ .

2. Determination of enthalpies of formation of Compounds

3. Determination of resonance energy.

When a bond is broken, the bond energy is positive because heat is absorbed. It is written with a minus sign when a bond is formed and heat is evolved. ~~heat absorbed to break a bond~~

~~heat absorbed to form a bond~~

~~heat added to break a bond~~

~~heat released from a bond~~