BOND DISSOCIATION ENERGY

The energy required to break one mole of a specific type of bond in a gaseous molecule is referred to as bond dissociation energy. In the case of diatomic molecules, this value is synonymous with bond energy. However, for polyatomic molecules containing more than one similar bond, the term "bond dissociation energy" does not remain consistent for successive bonds of the same type.

To illustrate, consider the dissociation of water:

$$H - OH(g) \rightarrow H(g) + OH(g) \qquad \Delta H_1 = 498 kJ/mol$$

$$O - H(g) \rightarrow H(g) + O(g) \qquad \Delta H_2 = 430 kJ/mol$$

In the given example, the bond dissociation energy for O–H bonds in the first and second dissociation events is not identical. Consequently, the bond enthalpy is not equal to the bond dissociation energy for such cases. In such instances, the bond enthalpy is expressed as the average of the bond dissociation energies for various similar bonds.

Therefore, the bond energy or bond enthalpy of the O – H bond is calculated as:

$$\Delta H_{O-H} = \frac{498 + 430}{2} = 464 kJ/mol$$

The overall enthalpy change (ΔH) for the reaction can be determined using the bond energies of reactants and products:

$$\Delta H = [\text{sum of bond energies of reactants}] - [\text{sum of bond energies of products}]$$