Answer on Question #59740-Physics- Electromagnetism

A typical polar molecule has a dipole moment of the order of magnitude 1.6 × 10 −29 Cm. Calculate the energy required to reverse its direction to be opposite to an electric field of intensity 10 6 V / m

Solution

The potential energy of dipole moment is

$$U = -pE\cos\theta.$$

At the initial state $\theta = 0$:

$$U_i = -pE\cos 0 = -pE.$$

At the final state $\theta = \pi$:

$$U_f = -pE\cos\pi = pE.$$

The requires energy is

$$W = U_f - U_i = pE - (-pE) = 2pE = 2 \cdot 1.6 \cdot 10^{-29} \cdot 10^{6} = 3.2 \cdot 10^{-23} J.$$