Question#46595 – Chemistry – Inorganic Chemistry

Question:

The dipole moment of HBr is 2.602 × 〖10〗 ^(-30) C m and its bond length is 141 pm. Calculate its percentage ionic character.

Answer:

For a given bond, the percent ionic character is given simply by

$$I = \frac{100\mu_{obs}}{\mu_{ionic}}$$

Where μ_{obs} is actual or calculated dipole moment and μ_{ionic} is a dipole moment if the bond would be 100% ionic. Simple formula for calculating the percent of ionic character (if μ expressed in D and bond length r expressed in pm):

$$I = \frac{10^4 \mu_{obs}}{4.8032r}$$

Where 4.8032 esu·Å is a fundamental charge.

To calculate dipole moment in D, we can divide $2.620 \cdot 10^{-30}$ C·m to $3.34 \cdot 10^{-30}$ C·m/D:

$$\mu_{obs} = \frac{2.602 \cdot 10^{-30} C \cdot m}{3.34 \cdot 10^{-30} \frac{C \cdot m}{D}} = 0.78D$$

Now using formula above:

$$I = \frac{10^4 \mu_{obs}}{4.8032r} = \frac{10^4 \times 0.78}{4.8032 \times 141} = 11.6\%$$