Answer on Question #48814 - Chemistry - Inorganic Chemistry

Question:

The iodine bromide molecule (IBr) has a bond length of 2.49 A° and a dipole moment of 1.21 D. Calculate the effective charges on the I and Br atoms in IBr in units of electronic charge, e. (1D = 3.34 x 10 -3° C m, electronic charge, e= 1.602×10^{-19} C)

Solution:

The dipole moment is given by $\mu = qr$, where q is the charge separated (in C) and r is the distance separating the charge. Since we're given the dipole moment (1.21 D) and the bond length (2.49 Angstrom), we solve for the charge q. Dipole moments are given in D units - recall that 1 D = 3.34×10^{-30} C m. Convert the bond length into meters:

r = 2.49 Angstrom $(\frac{1\times10^{-10}\text{m}}{1\ Angstrom})$

r = 2.49×10^{-10}m

Solve the definition of the dipole moment for the charge

$q = \frac{\mu}{r}$

q = 1.623×10^{-20} C

So, the amount of charge separated by the difference in EN is 1.623×10^{-20} Coulombs. If you need the answer in units of electronic charge e:

e = 1.60×10^{-19} C

$q = 1.623 \times 10^{-20} C(\frac{1\times\text{e}}{1.60\times10^{-19}C})$

q = 0.101 e

Answer: **Br** has a charge of **-0.101** and **I** has a charge of **+0.101**.