Comparing Bond Types

Each of the three compounds SeO_2, CaH_2, and Cs_3Sb consist of two types of atoms whose difference in electronegativity is approximately the same. Yet only one of these compounds conducts electricity in the solid state, only one has a high melting point and dissolves in water to give a solution that conducts electricity, and only one has a relatively low melting point.

First, match the properties described above (e.g. conducts electricity in the solid state) to one of the following types of bonding: covalent, ionic, or metallic. Be sure to explain your reasoning for each assignment.

covalent → relatively low melting point

ionic → high melting point and dissolves in water to give solution that conducts electricity

metallic → solid conducts electricity

Second, based solely on the relative position of the atoms in the periodic table, match these three compounds to their expected type of bonding. Be sure to explain your reasoning.

SeO_2 → covalent; two non-metals

CaH_2 → ionic; metal and non-metal

Cs_3Sb → two metals

Next, using the bond triangle, verify that your assignments of compounds and bonding types are correct. The electronegativities of the elements are Se: 2.55, Ca: 1.0, Cs: 0.7, O: 3.5, H: 2.1, Sb: 1.9.

SeO_2 has ΔEN of 1.19 and an $\overline{EN}$ of 3.015

CaH_2 has ΔEN of 1.27 and an $\overline{EN}$ of 1.665

Cs_3Sb has ΔEN of 1.32 and an $\overline{EN}$ of 1.32

For a similar ΔEN, the smaller the $\overline{EN}$ the more metallic-like the bonding, and the larger the $\overline{EN}$ the more covalent-like the bonding; ionic bonding has a more intermediate value for $\overline{EN}$.