

Ionic vs. Covalent Compounds

Introduction:

Ionic compounds are formed from ionic bonds. An ionic bond is one in which electrons are transferred from one atom to another. This results in one atom becoming a positive ion and one atom becoming a negative ion. Covalent compounds are formed from covalent bonds. A covalent bond is one in which electrons are shared between two atoms. This results in neither atom having a positive or negative charge. The types of bonds within a molecule influence the types of properties that the substance will have.

Ionic compounds:

Ionic compounds typically are solids at room temperature. They form a crystal lattice structure when more than one molecule is present (see Figure A). Notice that the positive charges and negative charges alternate. This results in a very strong attractive force between all atoms of the crystal. Because of the strong forces between atoms, ionic compounds tend to have very high melting points.

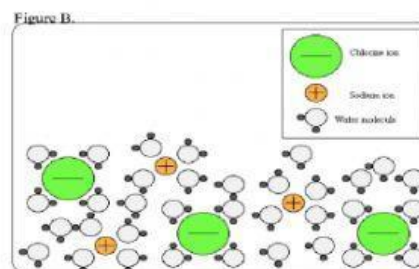
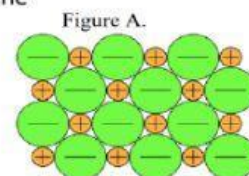
These types of compounds will tend to dissolve in water (see Figure B). When the water molecules surround an ionic crystal, the positive and negative charges of the ionic compound are able to separate and move freely throughout the water. In fact, because water is a polar molecule (more on this to come), the water is able to surround each positive and negative charge. Because the ions are free to move around in the water, this results in the solution (remember, a homogeneous mixture!) being able to conduct electricity. Electrons can travel from the positive charges to the negative charges or to the water very freely. This differs from the ionic crystal because the ions are free to move in solution.

Covalent compounds:

Covalent compounds are typically liquids or gases at room temperature, although the more complex and the larger the molecule, the greater the chance that it could exist as a solid. For example, methane, CH_4 , is a gas at room temperature, but octane, C_8H_{18} , is a liquid you use in your car. Or, even more complex, paraffin wax, $\text{C}_{25}\text{H}_{52}$, is a solid at room temperature. One thing is in common with all three: they melt easily and at fairly low temperatures. These compounds do not have positive and negative charges present, so they do not form solid crystals in the same manner. There is not a regular pattern of positive and negative charges like in an ionic compound.

Some of these molecules will dissolve in water as well, but others may not. The dissolving process is a bit different because there are no ions to be surrounded by water. However, if the molecule is polar like water, the water can surround the molecule. These types of molecules will dissolve. Some covalent molecules will not dissolve in water because they are not polar molecules (like oil or wax). Based on the density, these oil molecules float to the top and the water sinks to the bottom.

Because there are no ions to transfer electrons, covalent compounds do not conduct electricity. Pure water should not conduct electricity as a covalent compound; the only way for water to conduct electricity is for some ions to be dissolved in it!



Ionic Bonds	Both	Covalent Bonds

Directions: Write the following descriptions under ionic bonds, covalent bonds, or both based upon your reading.

- Nonmetals only -Metals & nonmetals -Share electrons -Transfer/give or take electrons
- Strong attraction between bonds -Low melting and boiling point -High melting and boiling point
- Weak bonds between molecules -Carry charge when dissolved -Dissolve in water
- Usually liquids or gases at room temperature -Solids at room temperature -NaCl -BeO
- KCl -Creates a positive ion and a negative ion -Form crystal lattice structure -Creates bonds
- Seeks to satisfy octet rule -Need to know charges -Need to know prefixes
- Does not conduct electricity -Neither atom has a positive or negative charge when they bond
- Some will dissolve in water others won't. Depends on if they are polar or not.
- C₈H₁₈ -H₂O -CH₄ -CO₂