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Water: The Neutral Substance

Water is a polar molecule. It is composed of hydrogen and oxygen. Hydrogen has an electronegativity of 2.2, while oxygen has an electronegativity of 3.5. This means that the shared electrons between hydrogen and oxygen are displaced toward the oxygen. As a result, the hydrogen end of the bond has a slight positive charge and the oxygen end of the bond has a slight negative charge. These charges are distributed asymmetrically around the water molecule, giving it a positive and a negative pole. This causes a strong attraction between water molecules. The attraction is especially strong because the hydrogen, with its slight positive charge, is attracted to the oxygen, with its slight negative charge. As a result, the positive end of one water molecule forms a strong bond with the negative end of another water molecule. This type of bond is known as a hydrogen bond. It is strong enough to pull a proton or hydrogen from one water molecule and attach it to the oxygen of another. In this way, ions form in water from pure water. The concentration of these ions is low.



Answer the questions below based on the information above and on your knowledge of chemistry.

1. Draw a diagram in the space below based on the drawing above showing the result when one hydrogen (proton) is pulled off one water molecule and attached to another.

a. What are the formulas of the ions formed?
b. Write an equation showing the formation of the ions from two molecules of water.
2. The hydronium ion (H_3O^+) and the hydroxide ion (OH^-) are formed by the reaction between water molecules. What would you have the reaction between hydronium and hydroxide ions? Write an equation showing the reaction.
3. How does the reaction between water molecules compare to the reaction between hydronium and hydroxide ions?

4. Pure water is actually a mixture of water molecules, hydronium ions, and hydroxide ions:
a. How does the concentration of hydroxide ions compare to the concentration of the hydronium ions in pure water? Explain.
b. How does the concentration of ions compare to the concentration of molecules in pure water?

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