Ice Encyclopedia Article

Ice

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Ice

Ice is frozen **water**, or in other words, water in solid state. Ice is a transparent, colorless substance with some special properties; it floats in water, ice expands when water freezes, and its **melting** point decreases with increasing pressure. Water is the only substance that exists in all three phases as gas, liquid, and solid under normal circumstances on Earth.

Water, and thus ice molecules, consist of one **oxygen** and two hydrogen atoms. Water is a polar molecule, with a slight negative charge on the oxygen side, and a slight positive charge on the hydrogen side, which makes it possible to interact with other polar molecules or ions. Thus, a loose chemical connection called a hydrogen bond forms between the water molecules, where each water molecule can bind to other water molecules, forming a complex network. These hydrogen bonds are the main reason for the special properties of water and ice.

Water in the solid state forms a highly ordered hexagonal (six-sided) crystal lattice structure, because it is the most stable arrangement of the water molecules. Although the individual molecules can vibrate, they cannot move fast enough to leave the crystal structure, since the opposite electrical polarities hold them together. This lattice crystal can be visualized as layers of hexagonal rings of the oxygen atoms stacked on each other. Ice has eleven known crystal forms, depending on pressure, **temperature**, or how quickly the ice forms. Ice cannot form from liquid water at the **freezing** point, unless there are seeds for the crystal, which dissipate the energy of the colliding water molecules, keeping them locked in the lattice structure. If no seeds are present, spontaneous crystal nucleation begins only if the water is supercooled below the freezing point.

Ice is present in nature in many places and in many forms: **icebergs**, ice sheets, **glaciers**, snow, freezing rain, sleet, ice **crystals**, icicles, hail, rime, graupel, and ice **fog**. Ice plays an important role in **erosion** (water fills the cracks of **rock**, freezes, expands, and breaks the rock), and in atmospheric

Ice forming on water. Robert J. Huffman. Field Mark Publications. ***Reproduced by permission.***

energy transport (when water vapor changes into liquid or ice, latent heat is released). The way ice forms in bodies of water (not from the bottom up, but from the top down) protects many organisms in the water from very cold and fast temperature fluctuations.