

## Answer on Question#45485-Chemistry, Physical Chemistry

### Question:

Sugar dissolves less readily in water as compared to NaCl. Why?

### Solution:

The sugar dissolves slower in water than the salt as it consists of molecules move slower. The dissolution rate depends on how fast molecules may come off from the crystal and how fast the molecules move in solution.

First, consider the chemical composition of the sugar.

The chemical formula of sugar is  $C_{12}H_{22}O_{11}$ . As seen, each molecule consists of 45 atoms. The mass of this molecule is 342 amu ( $12 \times 12 + 22 \times 1 + 11 \times 16$ ). As we know the mass is a measure of inertia (the more the object weighs the more power you need to spend to move the object)

Now, consider the chemical composition of the salt.

Chemical formula of salt is NaCl. The salt consists of sodium ions and chlorine ions, which can move separately. Mass of sodium ion is 23 amu. Mass of sodium ion is 23 amu, mass of chlorine ion is 35 amu. These ions are lighter and smaller in size than molecules of sugar and accordingly can move faster.

In physics, the measure of the ability of molecules to move in solution is the diffusion coefficient. The diffusion coefficient of NaCl is about three times larger than the diffusion coefficient of sugar.

It should be noted that the ability of molecules to move is influenced by other factors besides molecular weight and molecular size (e.g., the shape of the molecules, the intermolecular forces). These factors are difficult to take into account.

It should also be remembered that although the sugar dissolves more slowly than the salt, however the solubility of sugar in water is more than the solubility of the salt. The solubility of sugar is about 487 g in 100g of water (100°C) The solubility of NaCl is about 39g in 100g of water (100°C).

**Answer:** The sugar consists of the molecules move slower than the ions of NaCl.