

Polar and Non-Polar Substances :

Notes/W.S.-40

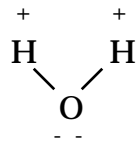
Many substances will not dissolve in water. An example is vegetable oil (a fat).

The reason for this is because of the basic differences between the structures of the water and fat molecules.

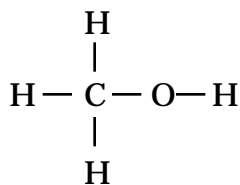
Polar and Non-Polar Substances

It turns out that molecular substances, like methanol (CH_3OH), and glucose ($\text{C}_6\text{H}_{12}\text{O}_6$), are very soluble in water. These two substances, along with water, are polar substances. Their charge is neutral, but one end of the molecule is positive and the other end is negative. Diagrams of these molecules are shown below.

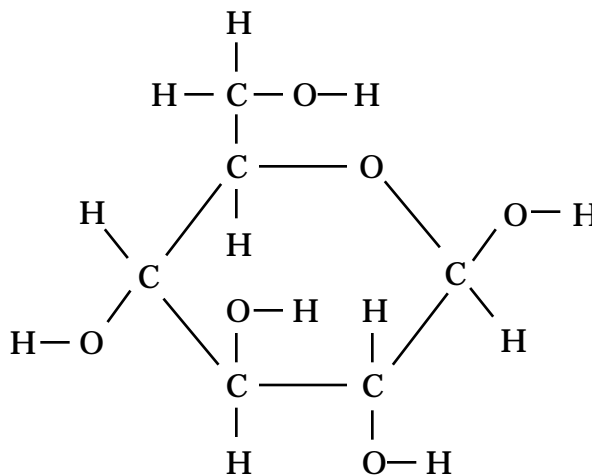
water molecule



methanol molecule



glucose molecule



Molecules with a hydroxyl group (-O-H) are generally soluble in water.

Other substances, like fats, are non-polar. They will not dissolve in water. These substances are neutral and there is no excess charge at one end of the molecule. Examples are, benzene (C_6H_6), and carbon tetra-chloride (CCl_4). Benzene will dissolve in carbon tetra-chloride.

Molecules that are hydrocarbons (mostly C and H) will dissolve in other hydrocarbons.

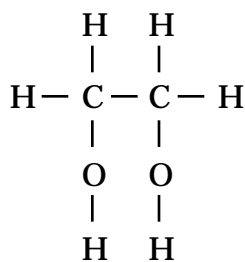
A basic rule is: Like dissolves in Like .

This means that, in general, polar substances will dissolve in other polar substances, and that non-polar substances will dissolve in other non-polar substances. Polar substances will not dissolve non-polar substances.

But there are exceptions to this rule, such as, ethanol (C_2H_5OH) will dissolve in gasoline, a hydrocarbon (C_8H_{18}).

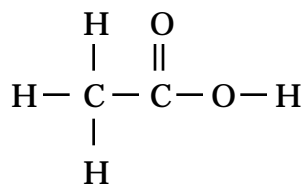
Questions:

- 1) What is a polar substance.?
- 2) Explain what the rule, "Like dissolves like" means.
- 3) Will C_7H_{16} dissolve in C_8H_{18} ? Explain.
- 4) Explain why ethylene glycol (CH_2OHCH_2OH) will dissolve in water. Draw a picture of the molecule.
- 5) Will mothballs (naphthalene, $C_{10}H_8$) dissolve in benzene?
- 6) Will acetic acid (CH_3COOH) dissolve in water? Draw a picture of the molecule.
- 7) Gasoline will dissolve butter. Explain.
- 8) Dry cleaners use the non-polar solvent, tetrachlorethene, C_2Cl_4 . Explain.
- 9) Will vitamin C dissolve in water? Why?



ethylene glycol

5) Yes. Both are non-polar substances., 6) Yes. It has a hydroxide group.,



acetic acid

7) Gasoline is an alkane (hydrocarbon)., Butter is a fat (mostly hydrocarbon). Like dissolves like., 8) This substance is like carbon tetrachloride. It is non-polar. It will dissolve fats, oils, and grease on clothing. 9) Yes. It has four hydroxyl groups., 10) Beef fat is mostly hydrocarbon., 11) benzene.