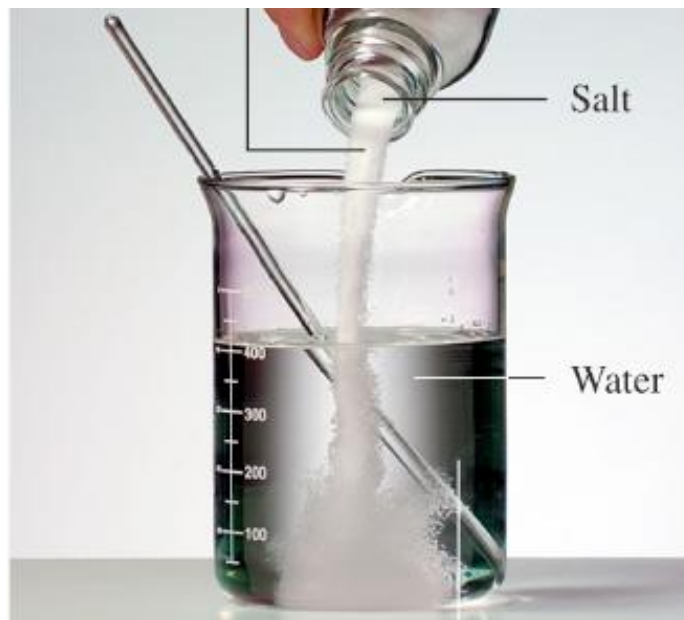


Chapter 8 Solutions

Disampaikan oleh : Dr. Sri Handayani
2013

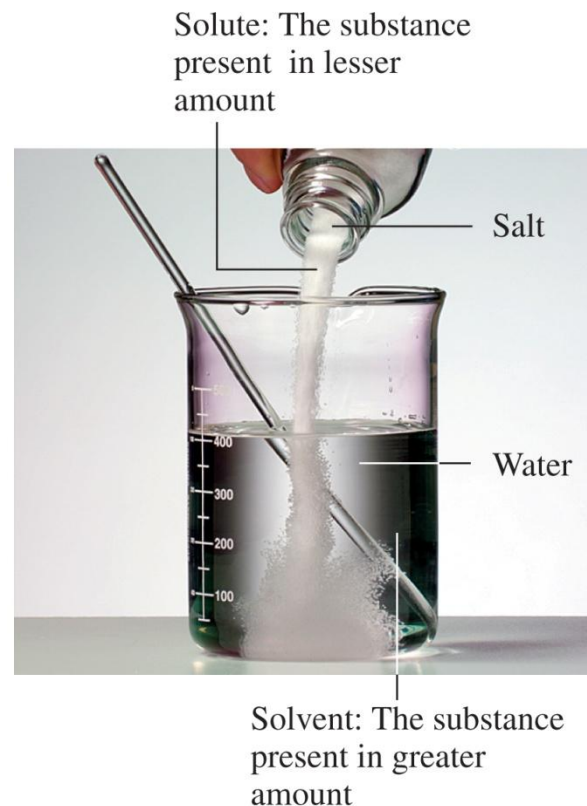
8.1 Solutions



Solutions: Solute and Solvent

Solutions

- are homogeneous mixtures of two or more substances
- consist of a solvent and one or more solutes

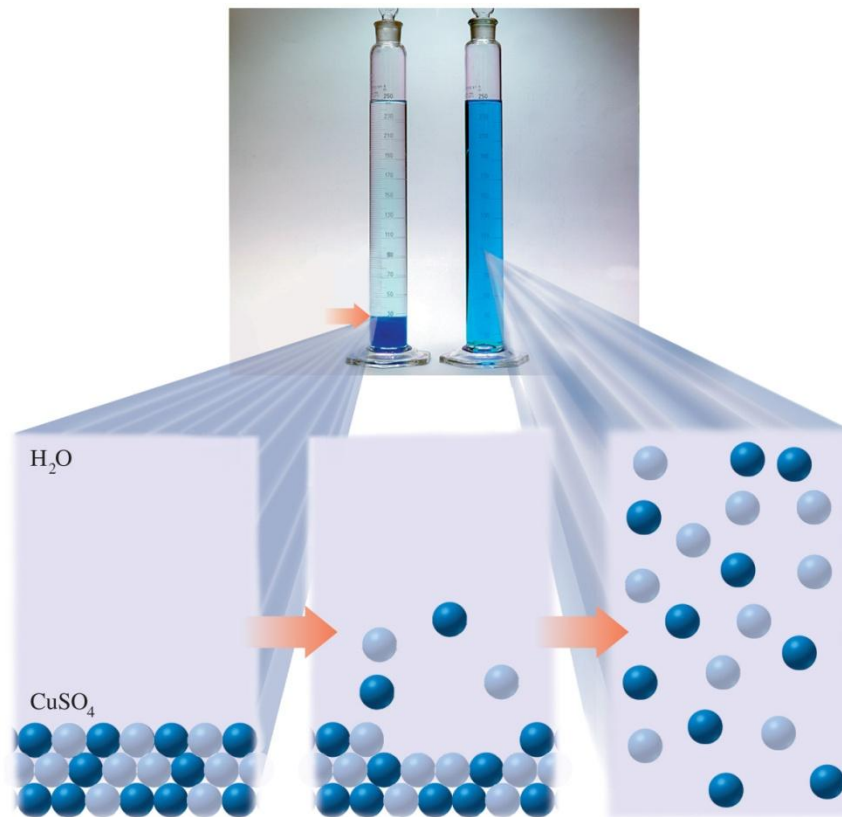


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Nature of Solutes in Solutions

Solutes

- spread evenly throughout the solution
- cannot be separated by filtration
- can be separated by evaporation
- are not visible but can give a color to the solution



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Examples of Solutions

- The solute and solvent in a solution can be a solid, liquid, and/or a gas.

TABLE 8.1 Some Examples of Solutions

Type	Example	Primary Solute	Solvent
Gas Solutions			
Gas in a gas	Air	Oxygen (gas)	Nitrogen (gas)
Liquid Solutions			
Gas in a liquid	Soda water	Carbon dioxide (gas)	Water (liquid)
	Household ammonia	Ammonia (gas)	Water (liquid)
Liquid in a liquid	Vinegar	Acetic acid (liquid)	Water (liquid)
Solid in a liquid	Seawater	Sodium chloride (solid)	Water (liquid)
	Tincture of iodine	Iodine (solid)	Ethanol (liquid)
Solid Solutions			
Liquid in a solid	Dental amalgam	Mercury (liquid)	Silver (solid)
Solid in a solid	Brass	Zinc (solid)	Copper (solid)
	Steel	Carbon (solid)	Iron (solid)

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Learning Check

Identify the solute in each of the following solutions:

- A. 2 g sugar (1) and 100 mL water (2)
- B. 60.0 mL of ethyl alcohol (1) and 30.0 mL of methyl alcohol (2)
- C. 55.0 mL water (1) and 1.50 g NaCl (2)
- D. Air: 200 mL O₂ (1) and 800 mL N₂ (2)

Solution

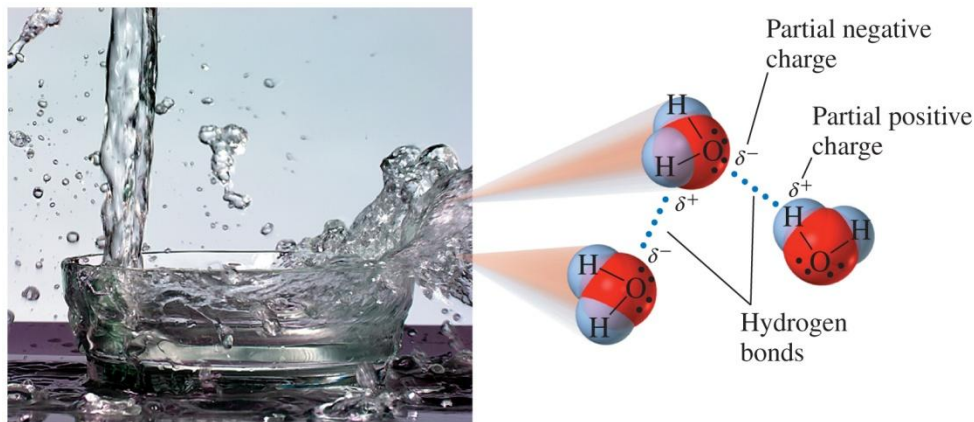
Identify the solute in each of the following solutions:

- A. sugar (1)
- B. methyl alcohol (2)
- C. NaCl (2)
- D. O₂ (1)

Water

Water

- is the most common solvent
- is a polar molecule
- forms hydrogen bonds between the hydrogen atom in one molecule and the oxygen atom in a different water molecule



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Combinations of Solutes and Solvents in Solutions

TABLE 8.3 Possible Combinations of Solutes and Solvents

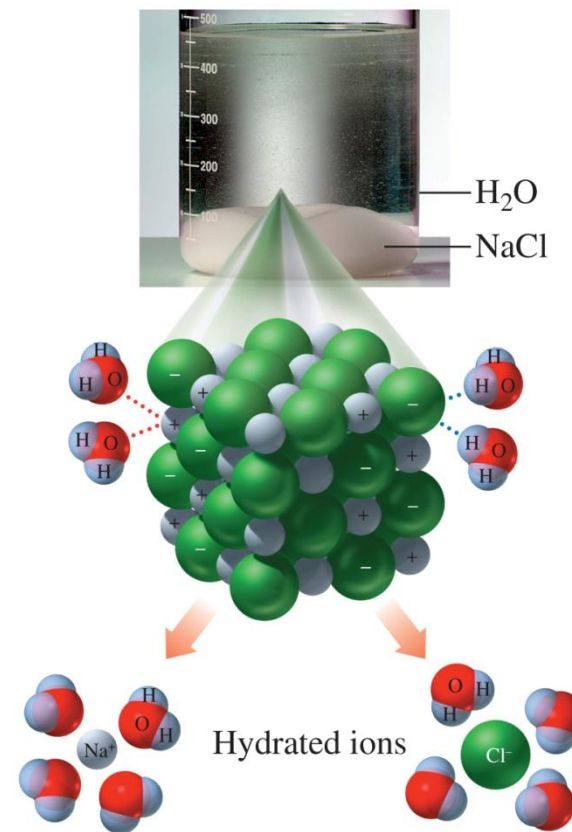
Solutions Will Form		Solutions Will Not Form	
Solute	Solvent	Solute	Solvent
Polar	Polar	Polar	Nonpolar
Nonpolar	Nonpolar	Nonpolar	Polar

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Formation of a Solution

Na⁺ and Cl⁻ ions

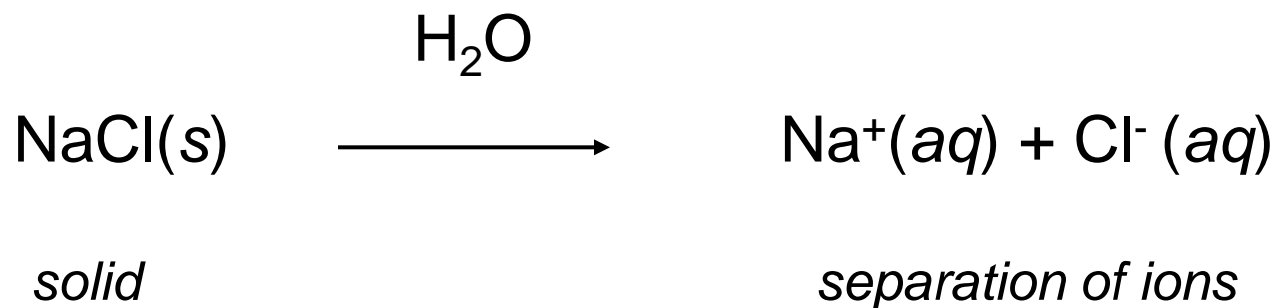
- on the surface of a NaCl crystal are attracted to polar water molecules
- are hydrated in solution by many H₂O molecules surrounding each ion



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Equations for Solution Formation

When NaCl(s) dissolves in water, the reaction can be written as



Learning Check

Solid LiCl is added to water. It dissolves because:

- A. The Li^+ ions are attracted to the
 - 1) oxygen atom (δ^-) of water.
 - 2) hydrogen atom (δ^+) of water.

- B. The Cl^- ions are attracted to the
 - 1) oxygen atom (δ^-) of water.
 - 2) hydrogen atom (δ^+) of water.

Solution

Solid LiCl is added to water. It dissolves because:

- A. The Li⁺ ions are attracted to the
 - 1) oxygen atom (δ^-) of water.

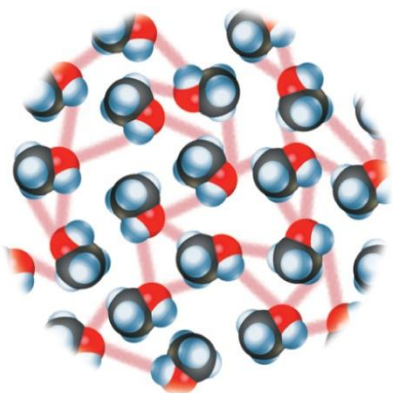
- B. The Cl⁻ ions are attracted to the
 - 2) hydrogen atom (δ^+) of water.

Like Dissolves Like

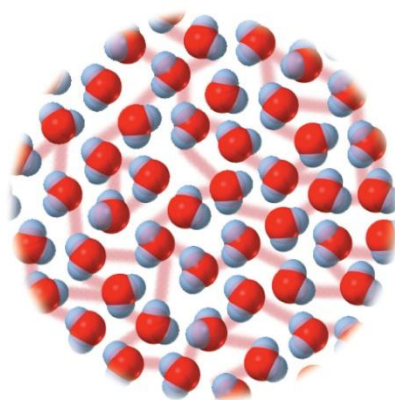
Two substances form a solution

- when there is an attraction between the particles of the solute and solvent
- when a polar solvent (such as water) dissolves polar solutes (such as sugar) and/or ionic solutes (such as NaCl)
- when a nonpolar solvent such as hexane (C_6H_{14}) dissolves nonpolar solutes such as oil or grease

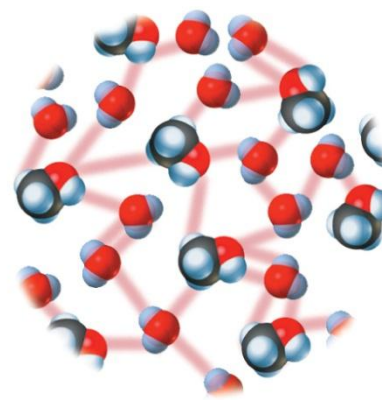
Water and a Polar Solute



Methanol (CH_3OH) solute



Water solvent



Methanol-water solution
with hydrogen bonding

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Like Dissolves Like

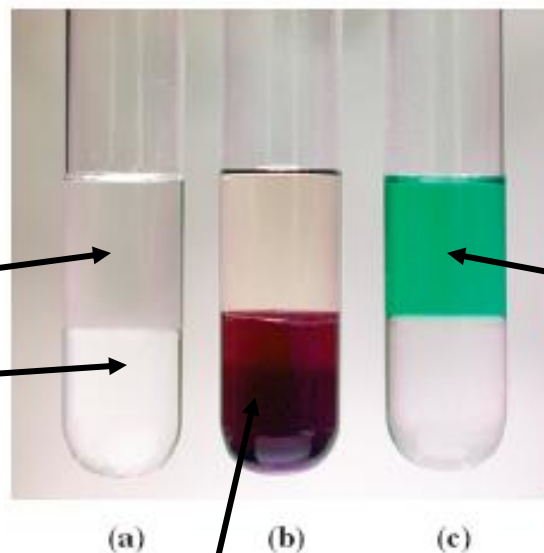
Solvents

Water (polar)

CH_2Cl_2 (nonpolar)

Solutes

$\text{Ni}(\text{NO}_3)_2$
(polar)



I_2 (nonpolar)

Learning Check

Will each of the following solutes dissolve in water?
Why or why not?

- 1) Na_2SO_4
- 2) gasoline (nonpolar)
- 3) I_2
- 4) HCl

Solution

Will each of the following solutes dissolve in water?
Why or why not?

- 1) Na_2SO_4 Yes. The solute is ionic.
- 2) gasoline No. The solute is nonpolar.
- 3) I_2 No. The solute is nonpolar.
- 4) HCl Yes. The solute is polar.

Most polar and ionic solutes dissolve in water because water is a polar solvent.