

# Introduction to Physical Science

Solutions  
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## Basic Properties of Solutions

- Definition of a solution:
  - Homogeneous mixture of two or more substances
- Solvent vs. Solute
  - Solvent - component present in a much greater concentration
  - Solute - component present in lesser concentration

## Solution Examples

- Sucrose (sugar)
  -
- Sucrose molecules are solutes - spread through out the solution
- Potassium dichromate ( )
  -
- Dissociates in water - solutes are both potassium and dichromate ions

## Properties & Types of Solutions

- A solution can be a solid, liquid or gas.
- Properties
  - Homogeneous
  - Physical state of solution is the same as that of the solvent
  - Components are dispersed on a molecular scale
  - Solvent will not settle out
  - Concentrations can be varied continuously

Different Types of Solutions

Solution	Solute	Solvent
air	O <sub>2</sub> (g)	N <sub>2</sub> (g)
soft drinks <sup>1</sup>	CO <sub>2</sub> (g)	H <sub>2</sub> O(l)
hydrogen in palladium	H <sub>2</sub> (g)	Pd(s)
rubbing alcohol	H <sub>2</sub> O(l)	C <sub>3</sub> H <sub>7</sub> O(l) (2-propanol)
saltwater	NaCl(s)	H <sub>2</sub> O(l)
brass	Zn(s)	Cu(s)

Table 11.1

## Formation of Solutions

- Spontaneous process (no external energy source needed)
  - Decrease in internal energy
  - Increase in entropy
- Ideal solution
  - No change in energy

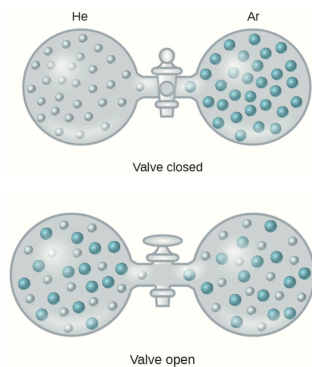


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## Electrolytes

- Definition of electrolytes
  - Substances that yield ions when dissolved in a solution
- Strong vs. Weak Electrolytes
  - Strong electrolytes - Process producing ions is essentially 100% efficient
  - Weak electrolytes - Process producing ions is much less than 100% efficient

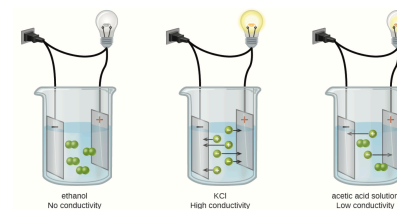


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## Ionic Electrolytes

- Polar molecule like water are attracted to ions
  - Ion-dipole attraction
  - Dissociation - a physical process
  - Nearly complete dissolution => strong electrolytes

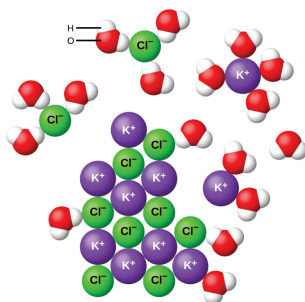


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## Covalent Electrolytes

- Water - poor conductor of electricity - very slightly ionized
  -
- Hydrochloric Acid (HCl)
  - 
  - Strong acid - strong electrolyte
  - Weak acid - weak electrolyte

## Summary

- A solution is a homogeneous mixture of two or more substances - it can be a solid, liquid or gas
- The spontaneous formation of a solution will generally cause a decrease in the internal energy and/or an increase in the entropy of the system
- Electrolytes can be strong or weak depending on the level of dissociation of the ions in solution