

Dissociaon and Ionizaon

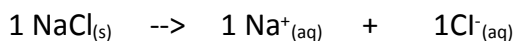
- Dissociaon - the separaon of an ionic compound into its ions when in water

<http://www.youtube.com/watch?v=EBfGcTAJF4o>

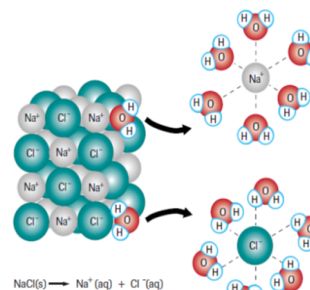
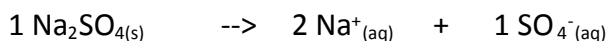


- Dissociaon equaons show the separaon of ions

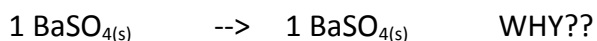
o Ex. $\text{NaCl}_{(s)}$ in water



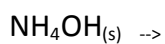
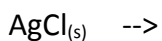
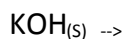
o Ex. $\text{Na}_2\text{SO}_4_{(s)}$ in water



o Ex. $\text{BaSO}_4_{(s)}$ in water



Try These:

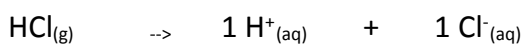


- Ionizaon - process by which a molecule is converted to an ion or ions
 - o Acids are compounds that, when placed in water, ionize to form a hydrogen ion (H^+) and a negative ion (X^-)

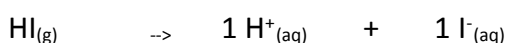
- Ionizaon equaons show the formaon of ions from a compound that is not made up of ions

Examples:

$\text{HCl}_{(g)}$ in water



$\text{HI}_{(g)}$ in water



Energy involved in creating a solution

- Identify any bonds that are being broken or formed in this animation

<http://www.mhhe.com/physsci/chemistry/essentialchemistry/flash/molvie1.swf>

- When bonds break, energy must be absorbed from the surroundings

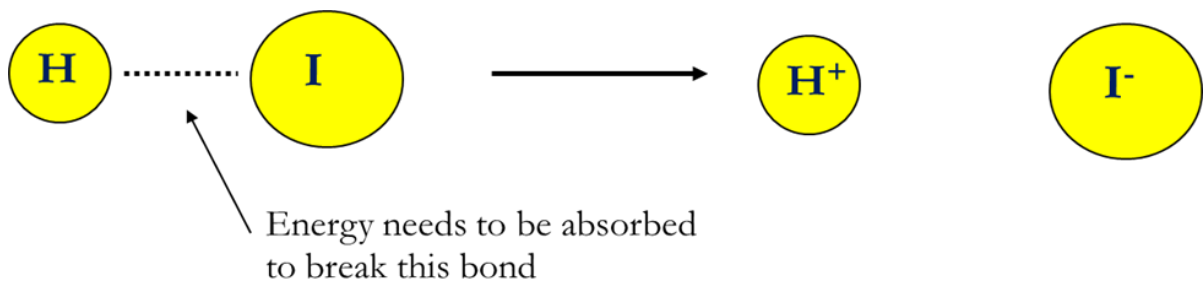
- The surroundings cool down

- When bonds form, energy is released into the surroundings

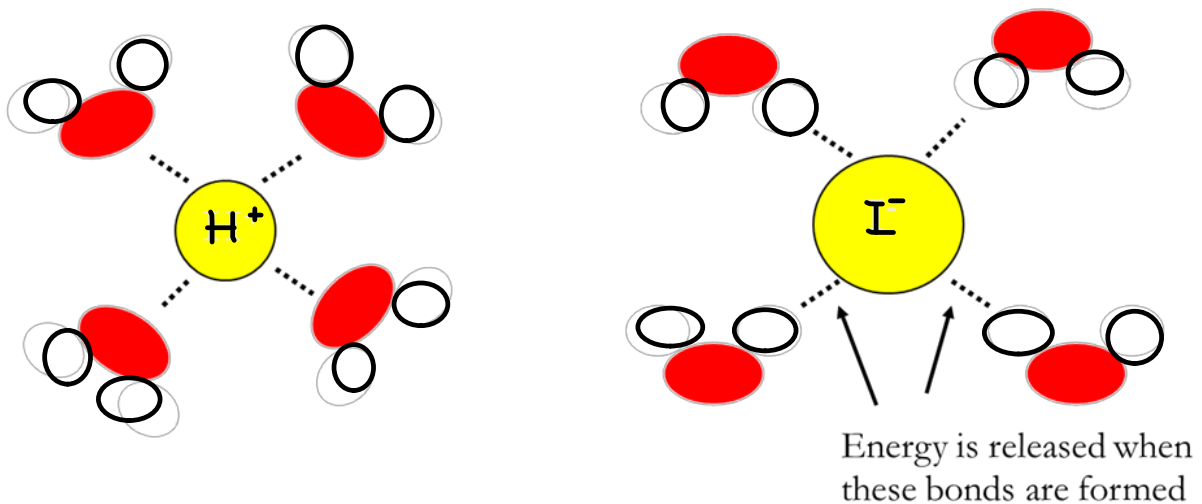
- The surroundings heat up

- Both bond breaking and forming are involved when a compound dissolves in water

1. Bonds must first break within the substance that is being dissociated or ionized



2. Energy is then released when bonds between water molecules and the separated ion form



Practice Sheet 2

1. Why are ionic compounds highly soluble in water, compared with their solubility in any other solvent?

2. For each of the following substances, write the chemical formula including pure state of matter at SATP, predict the solubility (low/high) in water, and if appropriate, write a balanced dissociation equation.

(a) silver sulfide



(b) ammonium borate



(c) copper(II) nitrate



(d) glucose, $C_6H_{12}O_6$



3. Solve the problem given below

Problem

Which of the chemicals numbered 1 to 7 is KCl(s), Ba(OH)₂(s), Zn(s), C₆H₅COOH(s), Ca₃(PO₄)₂(s), C₂₅H₅₂(s) (paraffin wax), and C₁₂H₂₂O₁₁(s)?

Design

The chemicals are tested for solubility, conductivity, and effect on litmus paper. Equal amounts of each chemical are added to equal volumes of water.

Table 6 Solubility, Conductivity, and Litmus Test Results

Chemical	Solubility in water	Conductivity of solution	Effect of solution on litmus paper	Class of substance
1	high	none	no change	molecular $C_{12}H_{22}O_{11}$
2	high	high	no change	ionic KCl
3	none	none	no change	
4	high	high	red to blue	base $Ba(OH)_2$
5	none	none	no change	
6	none	none	no change	
7	low	low	blue to red	acid C_6H_5COOH

Table 5 Electrical Conductivity

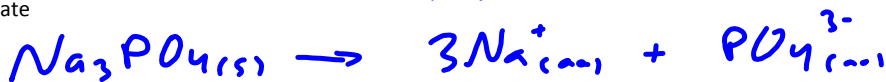
Class	Solid	Liquid	Aqueous
metal	✓	✓	-
nonmetal	X	X	-
ionic	X	✓	✓
molecular	X	X	X
acid	X	X	✓

1. Write equations to represent the dissociation of the following ionic compounds when they are placed in water:

(a) sodium fluoride



(b) sodium phosphate



(c) potassium nitrate



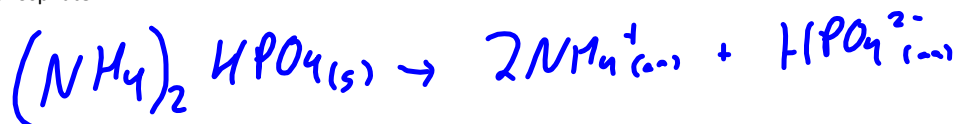
(d) cobalt(II) chloride



(e) aluminium sulphate



(f) ammonium hydrogen phosphate



2. Many substances dissolve in water because water is such a polar solvent.

(a) Are energy changes always involved when substances dissolve in water? Justify your answer.

(b) Describe a brief experimental design to test your answer to (a).

SUMMARY

Explaining Solutions

Table 4 Arrhenius' Theory of Solutions

Substance	Process	General equation
molecular	disperse as individual molecules	$\text{XY(s/l/g)} \rightarrow \text{XY(aq)}$
ionic	dissociate as individual cations and anions	$\text{MX(s)} \rightarrow \text{M}^+(\text{aq}) + \text{X}^-(\text{aq})$
base (ionic hydroxide)	dissociate as cations and hydroxide ions	$\text{MOH(s)} \rightarrow \text{M}^+(\text{aq}) + \text{OH}^-(\text{aq})$
acid	ionize to form new hydrogen ions and anions	$\text{HX(s/l/g)} \rightarrow \text{H}^+(\text{aq}) + \text{X}^-(\text{aq})$