



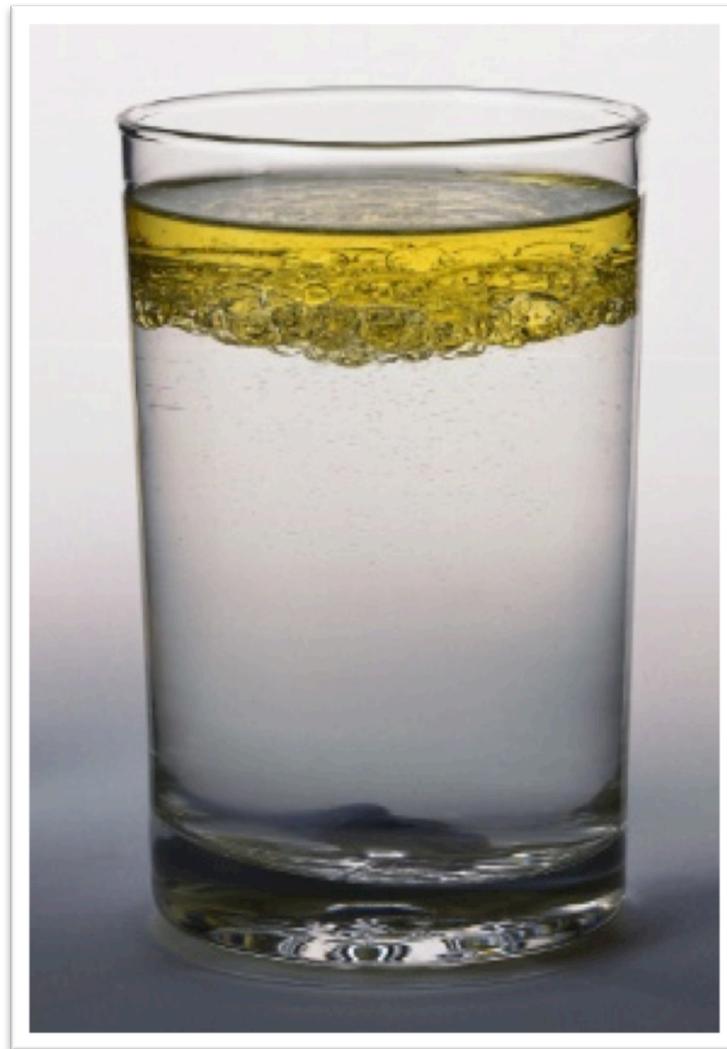
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- The SPO Virtual Classrooms offer many educational resources, including practice test questions, review questions, lecture PowerPoints, video tutorials, sample assignments and course syllabi. New materials are continually being developed, so check back frequently, or follow us on Facebook (Science Prof Online) or Twitter (ScienceProfSPO) for updates.
- Many SPO PowerPoints are available in a variety of formats, such as fully editable PowerPoint files, as well as uneditable versions in smaller file sizes, such as PowerPoint Shows and Portable Document Format (.pdf), for ease of printing.
- Images used on this resource, and on the SPO website are, wherever possible, credited and linked to their source. Any words underlined and appearing in blue are links that can be clicked on for more information. PowerPoints must be viewed in *slide show mode* to use the hyperlinks directly.
- Several helpful links to fun and interactive learning tools are included throughout the PPT and on the Smart Links slide, near the end of each presentation. You must be in *slide show mode* to utilize hyperlinks and animations.
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Chemical Solute, Solvents & Solubility



Solutions are *homogeneous mixtures* in which one substance is dissolved in another.

Solutions have two parts:

solute & **solvent**

Q: Which is the substance that is dissolved?

So the substance that **does the dissolving** is called the... ?

Homogeneous means that the the solute and the solvent are evenly distributed.

A **heterogeneous** mixture is made of different substances that remain physically separate.

Solutions



Solubility

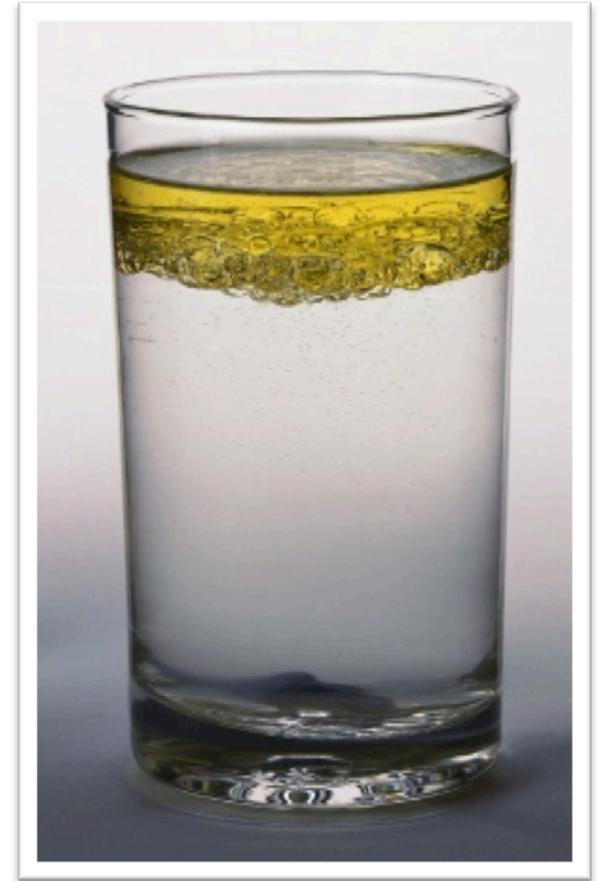
(mixability)

A measure of how much of a given substance will dissolve in a liquid.

Relates to whether the molecules involved are **polar** or **non-polar**.

A substance that does not dissolve is **insoluble**. *Example: Oil is insoluble in water.*

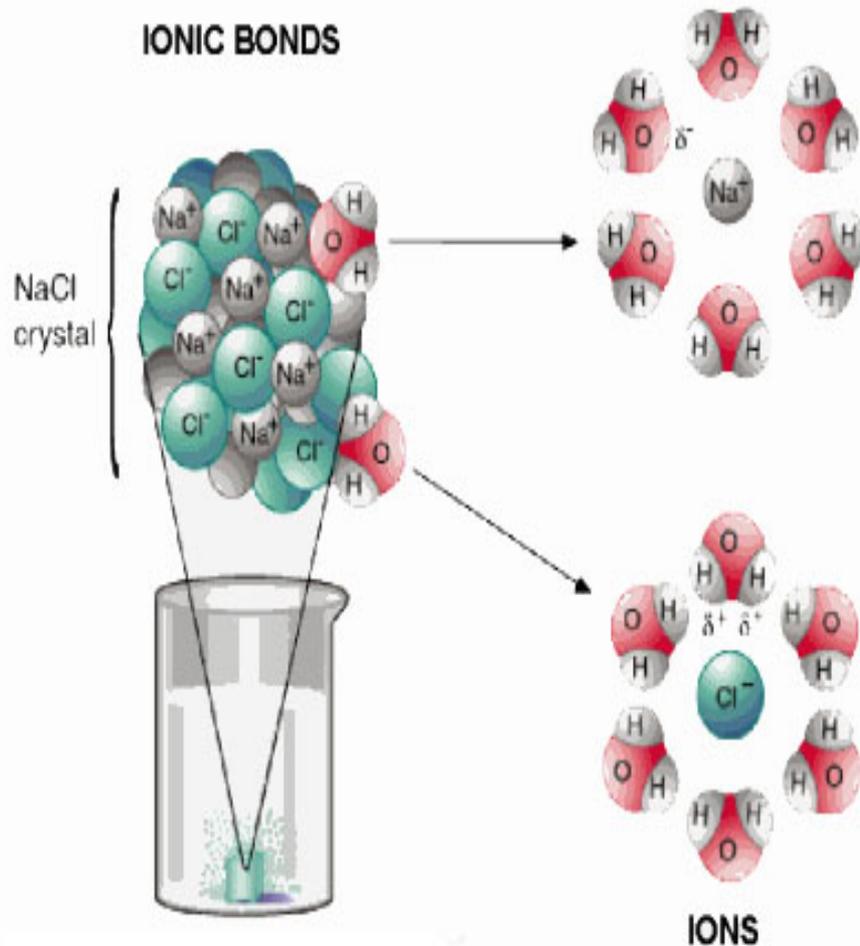
A substance that does dissolve is called **soluble**. *Example: Sugar is soluble in water.*



What determines solubility?

**Like Dissolves
Like Rule**

Substances with
charges (full or partial)
like to mix with
one another.

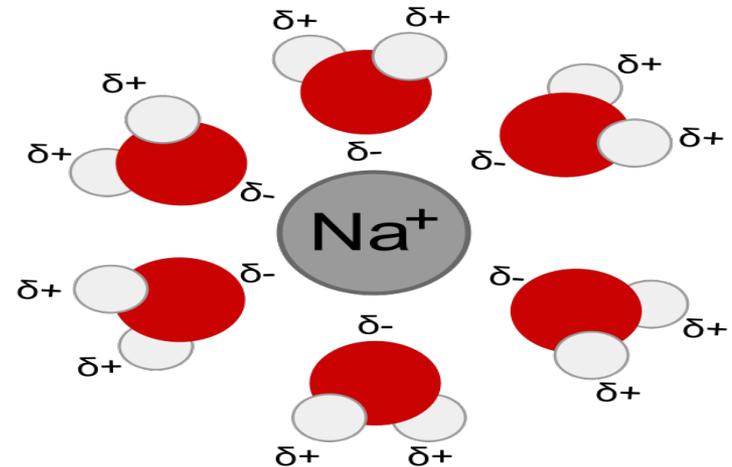


Water is considered the “Universal Solvent”

Water dissolves more substances than any other liquid.

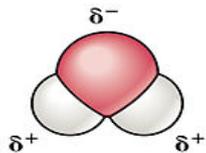
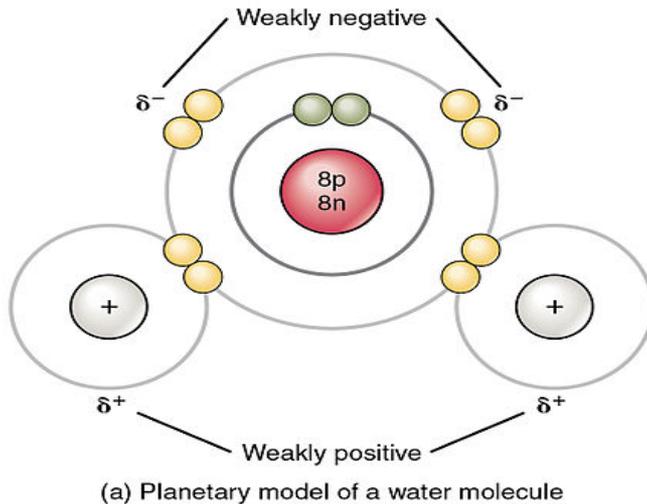
The water molecule's polarity makes it such an excellent solvent.

The polarity allows water to become attracted to many other charged (ions) or partially charged (polar) molecules.

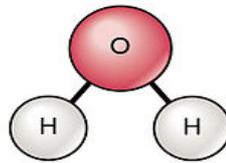


Polar vs. Non-Polar Covalent Bonds

Polar molecules unequally share electrons between atoms, so have a slight positive charge at one end and a slight negative charge at the other.

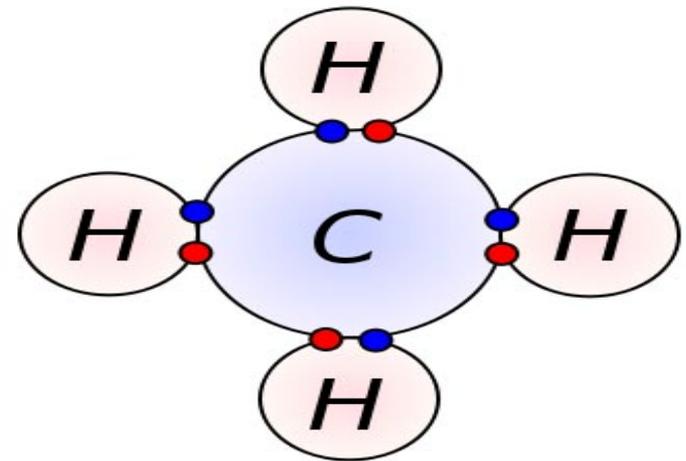


(b) Three-dimensional model of a water molecule



(c) Structural formula for water molecule

Non-polar molecules have electrons equally shared between their atoms.



- Electron from hydrogen
- Electron from carbon

Video:

[Polar & Non-Polar Molecules](#)

from Crash Course Biology

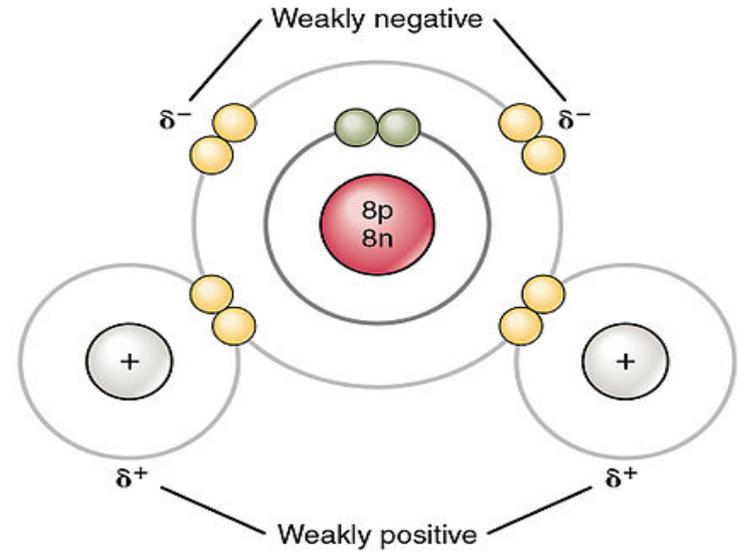
Water is a good solvent for many other **polar solutes**.

Polar Covalent Molecules include:

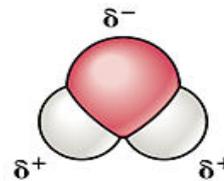
- Ammonia NH_3
- Glucose $\text{C}_6\text{H}_{12}\text{O}_6$
- Urea $(\text{NH}_2)_2\text{CO}$

*High ratio of O's and N's tend to make a molecule polar.

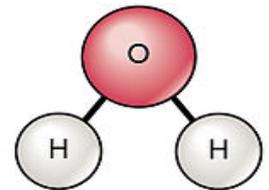
For example, **blood** is a water based solution.



(a) Planetary model of a water molecule



(b) Three-dimensional model of a water molecule



(c) Structural formula for water molecule

Water is also a good solvent for ionic compounds.

(a.k.a. salts & electrolytes)

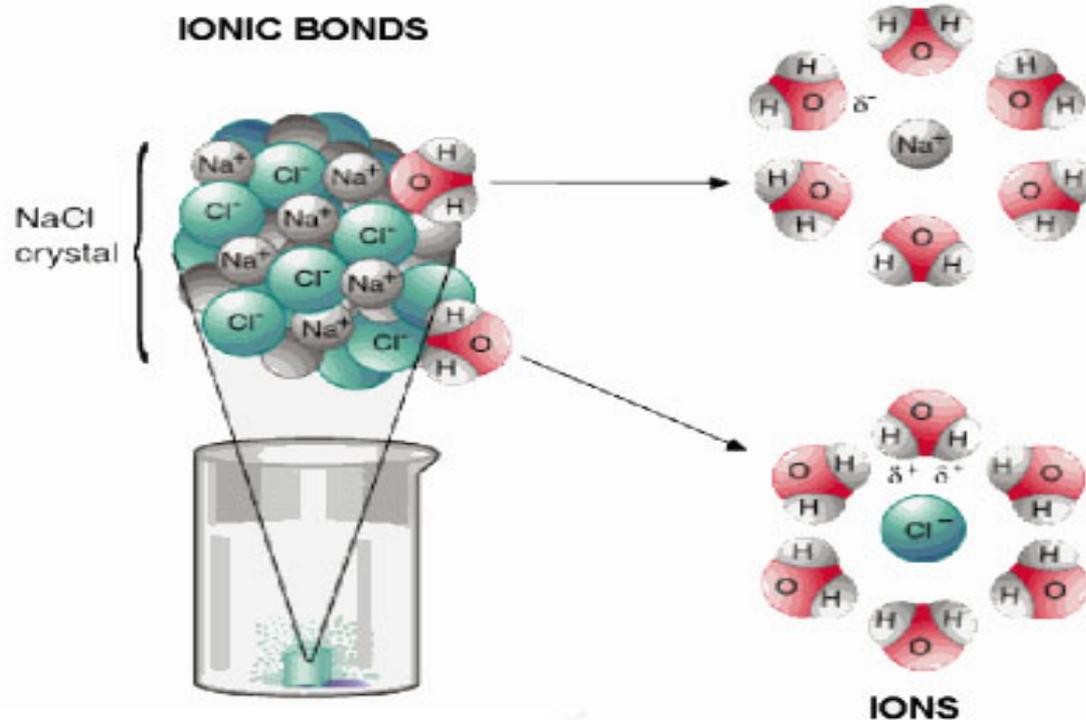


The partial and full charges attract each other.

Salts **dissociate**
into their ions in
water.

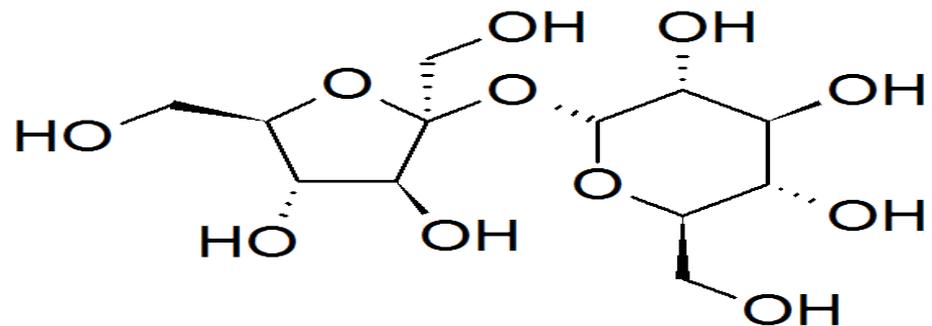
[Video](#) of dissociation of
NaCl into water.

[Video clip](#) from movie
Idiocracy:
"Brawndo Has What
Plants Crave!"



Charged molecules are **Hydrophilic**

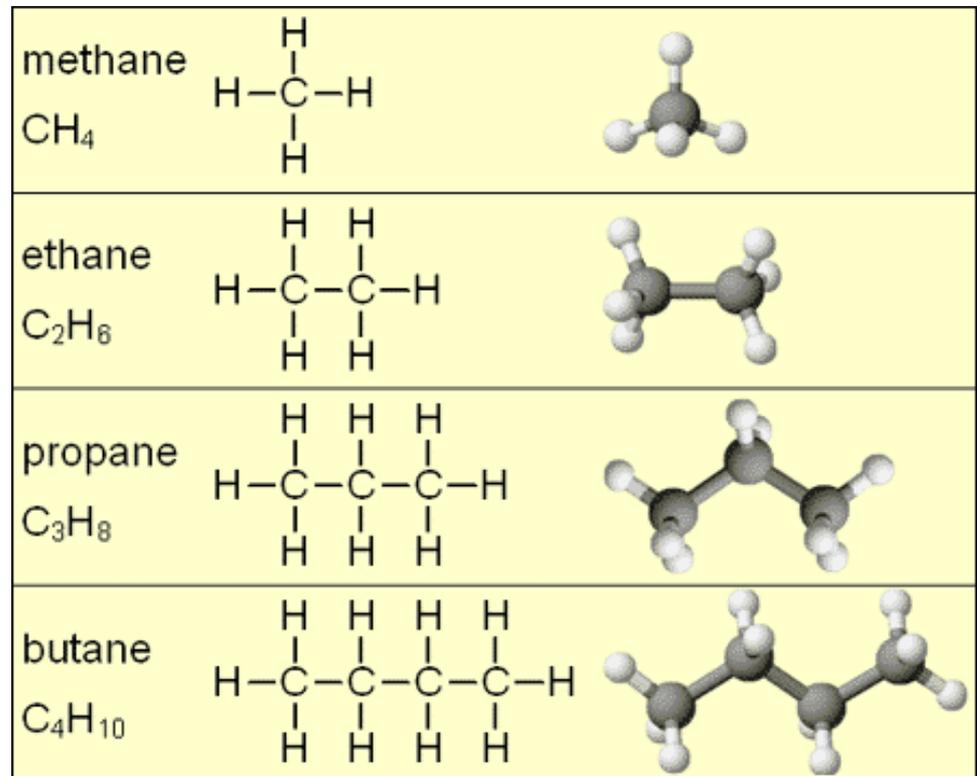
- from the Greek (hydros) "water" and (philia) "friendship"
- Water loving
- Water soluble
- **Example:** Water & sugar



Non-polar substances DO NOT carry any kind of charge

Mainly molecules
made of C's and
H's.

Example: Oily or
gasoline based
substances



What determines solubility?



**Like Dissolves
Like Rule**

Non-polar solvents
dissolve non-polar
solutes.

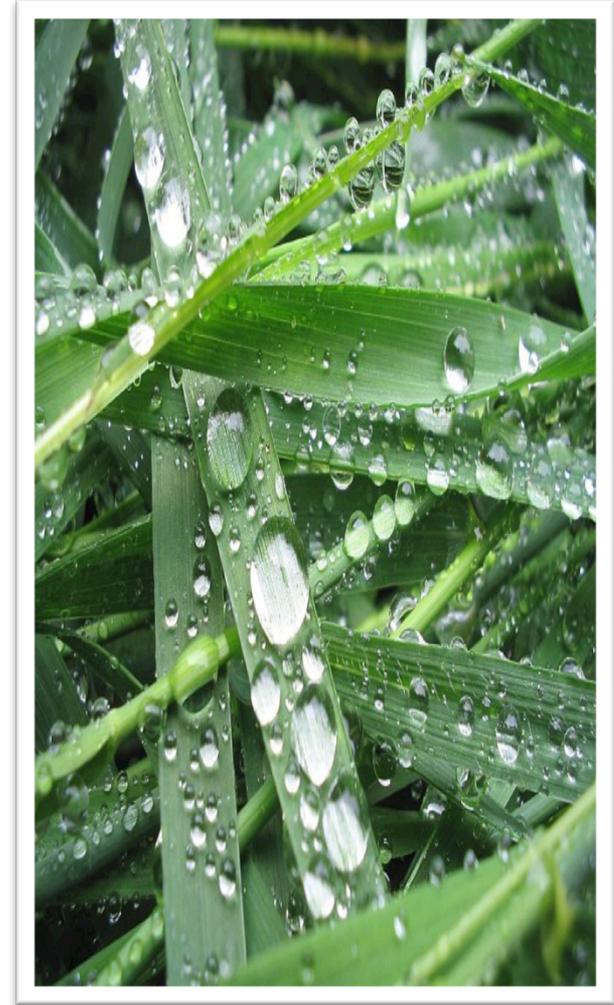
Non-polar, uncharged molecules are **Hydrophobic**

- from the Greek (hydros) “water” and (phobia) “fearing” or “hating”
- Water-fearing
- Not water soluble
- **Example:** Cholesterol is not water soluble

Non-polar solvents dissolve non-polar solutes.

Examples:

- Turpentine dissolves oil-based paints.
- Cholesterol is important component of greasy cell membranes.



Oil and Water Don't Mix

Hydrophobic
&
Hydrophilic
substances
DO NOT MIX

Examples: Salad dressing,
grease fire and water

Insoluble: Substances that
do NOT mix in each other.
Solute does not dissolve.
Line of separation.



Solubility

MOLECULE	Hydro -	Solvent examples	What elements to look for
Polar, charged	philic (likes)	water, alcohols	Hydrogen bound to elements that are electronegative in relation such as oxygens & nitrogens)
Non-polar, not charged	phobic (doesn't like)	oil-based	Carbon-hydrogen bonds

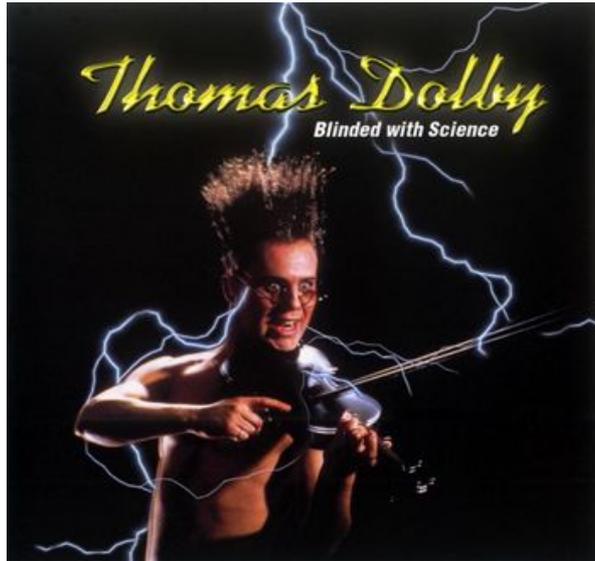
Confused?

Here are some links to fun resources that further explain **Inorganic and Covalent Compounds & Solutions:**

- [Video](#) of dissociation of NaCl into water.
- [Factors Affecting Solubility](#), animation from Tutor Vista.
- [Video clip](#) from movie **Idiocracy**: "Brawndo Has What Plants Crave!"
- [Polar & Non-polar Molecules](#) from Crash Course Chemistry #23.

Smart Links





Are you feeling blinded by science?

Do yourself a favor. Use the...

Virtual Cell Biology Classroom (VCBC)!

The VCBC is full of resources to help you succeed,
including:



- practice test questions
- review questions
- study guides and learning objectives
- PowerPoints on other topics

You can access the VCBC by going to the Science Prof Online website
www.ScienceProfOnline.com