

### 13.2

What rule do we use to explain dissolving? What does it mean?	Like dissolves like rule. This means that polar and ionic compounds dissolve in polar solvents whereas non-polar compounds dissolve in non-polar solvents.
What are the two factors that determine if one substance will dissolve in another?	1) Attractive forces between molecules, 2) a tendency for randomness.
Give examples of nature's tendency for randomness.	The diffusion of gasses (e.g. perfume in a room, or the mixing of two gasses), the diffusion of liquid in liquid (e.g. a drop of food colouring in water).
Why does alcohol easily dissolve in water?	Because the attraction of water (polar) to alcohol (polar) is about the same as the attraction of water to water.
Why does benzene not dissolve in water?	Because the attraction of water (polar) to benzene (non-polar) is very different from the attraction of water to water. Think about it this way: whenever two or more molecules of water bump into each other, they will be attracted (both have partial charges). Any benzene molecules in the area will not be attracted to the water, and therefore will be pushed out of the way.
Why does benzene (non-polar) dissolve in CCl <sub>4</sub> (non-polar)?	Both have weak attractive forces, thus they can easily leave their own kind to mix with each other. The drive for randomness wins out over any differences in attractive forces.
Why do ionic compounds dissolve in water and other polar solvents?	The partial charges of the water molecules attract positive and negative ions. The water molecules surround (or hydrate) the ions (fig. 13.8)
Distinguish between hydration and solvation.	Solvation is when solvent molecules surround solute ions, allowing the ions to dissolve. Hydration is the special case of solvation where the solvent is water.

### 10.3

Distinguish between intermolecular and intramolecular (with respect to location and strength).	Intermolecular forces are weak and between molecules. Intramolecular forces/bonds are strong and between atoms in a molecule.
What are the four types of intermolecular attractions?	Ionic, dipole-dipole forces, London forces, and hydrogen bonding.
What causes ionic attractions?	The attraction of a negative ion to a positive ion.
What causes dipole-dipole attractions?	The attraction of a dipole (i.e. partial charge) in one molecule to a dipole in another.
What evidence suggests that non-polar molecules such as Cl <sub>2</sub> or CH <sub>4</sub> have intermolecular forces? What are these forces called?	The evidence is that if the temperature is low enough, the attraction between molecules results in the formation of liquids or solids. These attractive forces are known as London forces (after Fritz London).
Explain the formation of London forces. What two terms are associated with this idea?	As electrons orbit an atom, by chance they will not always be equally spread around the nucleus, creating short-lived areas of partial charge (called an <u>instantaneous dipole</u> ). If an instantaneous dipole of one atom interacts with the instantaneous dipole of another atom in the correct way, the atoms will be attracted to one another. Alternatively, an instantaneous dipole in one atom may induce a dipole in another atom (similar to charged rod brought close to a pith ball). This <u>induced dipole</u> will also result in an attraction between atoms. The attraction continues as the electrons in opposite atoms move synchronously (fig 10.3).
In what kind of compounds do London forces exist?	They exist in all compounds. But their effect is dwarfed in compounds that also have strong dipole-dipole attractions or ionic attractions.
Which two factors influence the strength of London forces and why?	The size of the electron cloud (i.e. atomic radius) and the length of the molecule. Large electron clouds are more easily deformed than small ones, thus large atoms form stronger attractions (fig 10.4). Longer molecules have more sites for London force interactions and thus experience greater attractive forces.
How do physical properties change when attractive forces are high?	With high attractive forces, substances easily stick together forming liquids or solids. Thus, the greater the attractive force the higher the melting and boiling point of the substance.
What elements combine with hydrogen to permit hydrogen bonding?	N, O, and F.
How is hydrogen bonding related to dipole-dipole forces?	Hydrogen bonding is a type of dipole-dipole attraction. However, it is very strong because the high ENs of N, O, and F result in large dipoles.
Are hydrogen bonds intermolecular or intramolecular?	This is a type of intermolecular bond (bond between molecules). Do not get confused by the name; hydrogen bonding does not refer to the bonds between H and N, O, and F. It refers to the resulting dipoles that lead to strong intermolecular forces.
Why is hydrogen bonding so important?	First, it is important in biological systems. Second, it significantly effects the melting and boiling point of water and other compounds.
Explain the observation that H <sub>2</sub> O, HF, and NH <sub>3</sub> have higher than expected boiling points (fig. 10.16)	Hydrogen bonding explains this. Hydrogen bonding exists in compounds of hydrogen and N, O, and F, but not their period 3, 4, and 5 counterparts.
How is an ionic compound defined?	An ionic compound will completely ionize in solution allowing electricity to be conducted. Note that this <i>is</i> consistent with the idea that ionic compounds do not have 100% ionic character. In compounds, electrons are still shared to some degree, but in solution they are not.
How were ionic, polar-covalent, and non-polar covalent compounds symbolized in class?	Ionic - +/- , Polar-covalent - $\delta^{+/-}$ , non-polar covalent - $\delta^0$