7.2 What Dissolves?

Name: _____

Like Dissolves Like

- a solute will dissolve in a solvent if both contain similar types of intermolecular forces of a similar magnitude

What are the forces involved in solutions?

- The forces between molecules are called intermolecular forces (between molecules)
- There are 2 types:

    - London forces (non polar molecules).
        - Allows non-polar molecules to exist as liquids/solids bc there is a force of attraction
        - Induced dipole will induce more dipoles in surrounding molecules.
        - Dipoles disperse throughout the sample which causes molecules to attract each other = dispersion force, or London dispersion force
        - Strength of London forces increase as size of molecules increase

    - Dipole-dipole forces (polar molecules)
        - (positive pole of one molecule is next to and attracts negative pole of adjacent molecule)
        - Network of dipole- dipole = high melting / boiling pts -> more energy needed to overcome attraction
        - The more polar the molecules are = stronger dipole – dipole force

What is the difference between the two?

- London forces are formed by inducing a dipole
- London forces exist between particles of all substances
- London forces have a temporary attraction between molecules
- Dipole-dipole forces are a result of molecules having a permanent dipole
- Molecules with dipoles have atoms with a difference in electronegativity between the two atoms

Note: polar substances generally have higher boiling points than non-polar substances

What is a hydrogen bond? (Special type of dipole – dipole force)

- a bond between polar molecules –b/n hydrogen atom of one molecule with N, O, or F of another molecule
- The hydrogen bond is present in molecules containing a H-N, H-O, or H-F bond
- The H-N, H-O, or H-F bonds are very polar bc of the large /\ En

In summary:

1. Hydrogen bonds are present when molecules contain H-F, O-H, or N-H bonds.
2. When a permanent dipole is present, dipole-dipole forces and London forces are present
3. When a permanent dipole is not present, **only** London forces are present (non – polar molecules)
4. Londn forces are the weakest type of bonding force

Why does "like dissolve like"? (solute only dissolves in solvent if both have similar intermolecular forces)

- Ionic solutes (e.g. NaCl) are held together by strong bonds
- Nonpolar solvents have only London forces between molecules – too weak
- Polar solvents have dipole-dipole forces between them – strong enough to dissolve ionic solids
- Ions will attract opposite ends of polar water molecule = ion – dipole force
- Ion – dipole force stronger than attraction between ions in crystal lattice -> crystal lattice breaks down

- This is also true for polar solutes
- Nonpolar solutes are only attracted by London forces
- Only nonpolar solvents have **strong** London forces

Three important steps for a substance to dissolve:

1. The particles in the solute must be separated to go into the solvent. The attraction between solute particles must be overcome or replaced.
2. The particles in the solvent must be separated to allow space for the solute particles. The attraction between solvent particles must be overcome or replaced.
3. The solute and solvent particles must interact with each other.

Using your workbook take notes on the following cases (p.373-379)

p.381: 1-4, 6a, 8, 9