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Precipitation Reaction

What you need to understand here, is that precipitation and salt solubility go hand in hand but they are NOT the same concept.

During this experiment, precipitation will be referring to when a *new* salt complex is formed and comes out of solution.

- When the initial salt does not dissolve in the solvent- it is *not* thought of as a precipitate.

[http://www.youtube.com/watch?feature=player_embedded&v=us9Ls118R9c]

- As seen in the reaction in the video, the initial salts, KI (aq) and $HgCl_2$ (aq) *are* soluble in water, meaning they completely dissolved when you add each respective salt by itself into water.
- Remember, when the salt dissolved- for example KI, the K+ and I- ions are no longer in the rigid lattice form but are separated from each other by being surrounded by water. Hence you have "free" floating ions in solution.
- Therefore, if you added the two salts together- the free floating ions react to one another, and in this case, some of the Hg+ ions reacted with the I- ions to create a salt of HgI that precipitated out (becoming the precipitate). K+ ions can react with either Cl- or I- in solution (both products are soluble!)
- Not *all* the Hg+ ions will react with I- ions. You would have $HgCl_2$ also in solution mixture, but since it is solule- it will *not* precipitate out.

One important key note to remember is that, even if you just are dissolving one salt, you can get that salt to precipitate out of solution if you exceed the ion concentration threshold.

Here is an example to explain the concept of precipitation when the salt concentration exceeds the saturation level.

[http://www.youtube.com/watch?feature=player_embedded&v=JlppDrtzZXE]

- The sodium acetate hydrated salt has a solubility value of 50.4g/100g H_2O.
    - Meaning, you can dissolve 50.4g of the salt in 100g of water and have all the salt dissolve. If you dissolve perfectly 50.4g, the solution is saturated.
        - As seen in the video, if you add even a grain of salt to the saturated solution, it exceeds the saturation level (ionic concentration threshold) and you see the salt precipitate out.

- Remember: this is a precipitation because the initial salt dissolved in water. If it didn't dissolve in water in the first place, the salt sitting on the bottom of the flask would not be considered the precipitate.

Summary of key points to fully understand what is going on in lab.

- salt consists of an anion (negatively charged) and a cation (positively) charged.

- Salt dissolving depends on the polarity of the solvent

- a polar solvent, such as water, has partial charges on the molecule (that's why it is polar).
    - the partially negative charge from the oxygen will attract to the cation
    - the partially positive chage from the hydrogen will attract to the anion.
        - because of the partial charges, the water will form a shell (see diagram above) around the ions (essentially separating them apart- which is what dissolving is all about).

- a non-polar solvent, such as hexane, does *not* have any overall partia charge to it. So there is nothing attracting the ions of the salt (so it will remain a solid and will *not* dissolve).

- You have to distinguish the difference between precipitation and salt solubility. The concepts work together but they are *not* the same thing!

- if the salt is not soluble in a solvent (not dissolved)- the remaining undissolved salt is *not* the precipitate.

- precipitation (in this experiment's case) is thought as: when two *different* ions combine together and create a *new* salt (different than that of the original salts used).

- Simply put: if you have salt AB and salt CD, both have to dissolve in the solvent (hence getting free floating A+, B-, C+ and D- ions. The ions can then interact and create new salts:AC and BD (and also combine to make the original salts).
    - If salt AD has a low solubility- the water can "retain" a very small amount before the ionic conctration is over the solubility threshold and you start seeing the salt precipitating out.

- If salt BC has a higher solubility- the water can "retain" a larger amount. It would take a higher concentration to go over the solubility threshold for the salt to start precipitating out.

Now let's move onto learning about the experiments being done in lab!