**saIonic and Covalent (or Molecular) Compounds**

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| A compound is defined as a chemical combination of two or more elements. Covalent bonds generally occur between two or more nonmetallic elements. Ionic bonds are generally formed by the attraction between two oppositely charged ions (often a metal cation and a non metal anion)  In this experiment, you will observe several properties of some compounds and attempt to distinguish between covalent compounds and ionic compounds. Keep in mind that with any classification system, there will be some exceptions to the overall pattern. |

**MATERIALS**

* compounds A, B, C, & D
* distilled water
* 4 test tubes
* test tube rack
* microspatula
* stirring rod
* marking tape
* Bunsen burner
* Stoppers
* Test tube clamp
* match

**SAFETY**

* The compounds used in this experiment may cause skin, nasal, and eye irritation. Avoid direct contact and/or inhalation. If contact with the skin does occur, notify your teacher and flush the affected area with water.

**PROCEDURE**

1. Label four test tubes A, B, C, and D. One at a time, obtain the beakers labeled A, B, C, and D. Observe the odor and appearance of each compound and record your observations. CAUTION: Observe the odor of the sample in the beaker by wafting towards your nose. Do not directly inhale.
2. Use the microspatula to obtain PEA-SIZED samples of each compound and place them in the appropriate test tubes. Be sure to rinse and dry the microspatula after obtaining each sample to avoid contamination.

Testing Melting Point

1. Turn on your Bunsen burner, using the proper technique for igniting a Bunsen burner. Once the burner is on, heat your sample gently over the Bunsen burner. **If the substance melts, do not continue heating!**
   1. **Approximate melting points of substances can be determined rather easily. Substances with low melting points, less than 100oC, will melt readily when warmed gently in a small test tube. If the sample melts between 100oC and 300oC, it will take more than gentle warming, but will melt before the test tube imparts a yellow-orange color to the flame. Above 300oC, there will be increasing yellow-orange color of the flame up to about 500oC. After that point, round 550oC the Pyrex tube will begin to soften. We will not be measuring any melting points above 300oC!**
2. Estimate the melting temperature (either<100oC or between 100oC and 300oC). Record this in your data table.
3. Repeat with your other 3 samples.

Testing Solubility

1. Dispose of your samples from “Testing Melting Point” according to the clean up section of this lab. Clean the test tubes and dry them before step 7!
2. Use the microspatula to obtain PEA-SIZED samples of each compound and place them in the appropriate test tubes. Be sure to rinse and dry the microspatula after obtaining each sample to avoid contamination.
3. Add enough distilled water to fill the test tube halfway. Do not use tap water! Using a stopper, invert the contents of the test tube repeatedly. **Be sure to clean and dry used stopper before you use it on the next substance.**
4. Repeat with your other 3 samples.
5. Record whether solid dissolves in water in your data table.

**OBSERVATIONS**

Create a table to organize your observations.

**ANALYSIS**

a. Group the substances with similar characteristics / properties

**CONCLUSIONS AND EXTENSION**

1. Based on their component elements, state whether each compound is ionic or covalent. Explain your reasoning.

A – C6H12O6, B – NaCl, C – CaCO3, D – C12H22O11 E- oil

A – A is a covalent bond because all three have a high electronegativity

B – B is an ionic bond because Cl wants one electron and Na wants to give one.

C- C is an ionic bond because while O has a high electronegativity Ca has a low electronegativity

D-D, like a is a covalent bond

E – is a covalent bond because it has a low melting point and gives off a stronger smell

1. Based on these classifications and your data, describe the typical properties – odor, appearance, solubility in water, and melting point of covalent /molecular compounds and of ionic compounds.

Covalent: Covalent dissolve well into liquids if in a polar state and are found as gasses, liquids and solids. They tend to have a more potent smell because the atoms are less secure and therefore are more likely to break off and enter your nose. They also have a lower melting and boiling point for the same reason. As the atoms get more and more excited they are more likely to move apart at a lower temperature then an Ionic bond

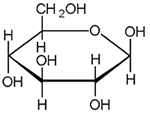
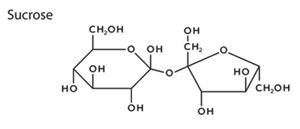
Ionic: Ionic bonds have a higher melting and boiling point because there bonds are stronger than that of a covalent bond. They do not smell for the very same reason. They are found in a more solid form. Most dissolve in liquid.

1. Was it possible to subdivide the group of covalent compounds into two categories? Research polar covalent compounds and use this information to explain your findings.

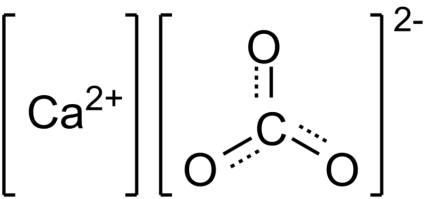
Yes you can further divide them between Polar and Non-polar covalent bonds. Polar covalent bonds have a slightly higher melting point. The biggest difference however is that in a non-polar compound the attraction between atoms is equal compared to a polar covalent bond where the difference in electronegativity is less similar. Because of this Polar molecules have on side that’s more positive and one side that’s more negative. This means the molecules join together through Dipole- Dipole forces which are stronger than non-polar who attract by London forces. While Dipole- Dipole forces attraction is constant, London forces attraction fluctuates and thus isn’t as strong.

1. Draw diagrams to show the formation of the ionic substances tested in this experiment. Draw diagrams of the sugars used in the experiment. Contrast these two diagrams.

C6H12O6  C12H22O11

NaCl CaCO3

http://library.thinkquest.org/C0110275/images/nacl.gif 

In a Covalent Compound model all the atoms are combined together and none of them are either positive or negative. In an Ionic model the exact opposite is occurring.

1. Describe ionic and covalent bonds in terms of electronegativities of the bonding atoms.

In a polar covalent bond the electronegativities of the two atoms are similar but not a close as in a non-polar covalent bond. In ionic compounds the electronegativity is very different this is why one atom can take electrons while the other gives.

1. Explain, with detailed **diagrams**, what is happening at the **molecular/ionic** level when a substance melts.

See other page

1. Explain, with detailed **diagrams**, what is happening at the **molecular/ionic** level when a substance dissolves.

See other page

1. By making reference to the explanations in the above questions, explain your observations in this experiment by making reference to forces of attraction involved with ionic and covalent / molecular compounds.

Because covalent compounds bonds are not as strong compared to ionic bonds they are more likely to separate. This means they will dissolve in liquid better, have a lower melting point and boiling point and have a more potent smell.

1. Using the patterns established in this experiment and the information in your notes, predict the properties – odor, appearance, solubility in water, and *high/low melting point* – of **carbon** **disulfide** (CS2) and methane (CH4). Explain how you reached these conclusions.

Because CS2 is a non-polar covalent bond (their electronegativity is almost the same) I predict, based on our groups previous findings, that it has a low melting and boiling point, it will smell and it will dissolve well into water.

CH4 is a polar covalent bond and will have similar traits though its melting point will be slightly higher than CS2. Its bond, using Dipole- Dipole force, will be stronger than that of a non-polar covalent bond.