Section 9A – Covalent Bonds

TABLE 8.4 Average Bond Enthalpies (kJ/mol)

Single Bonds

C—H	413	N—H	391	O—H	463	F—F	155
C—C	348	N—N	163	O—O	146		
C—N	293	N—O	201	O—F	190	Cl—F	253
C—O	358	N—F	272	O—Cl	203	Cl—Cl	242
C—F	485	N—Cl	200	O—I	234		
C—Cl	328	N—Br	243			Br—F	237
C—Br	276			S—H	339	Br—Cl	218
C—I	240	H—H	436	S—F	327	Br—Br	193
C—S	259	H—F	567	S—Cl	253		
		H—Cl	431	S—Br	218	I—Cl	208
Si—H	323	H—Br	366	S—S	266	I—Br	175
Si—Si	226	H—I	299			I—I	151
Si—C	301						
Si—O	368						
Si—Cl	464						

Multiple Bonds

C=C	614	N=N	418	O_2	495
C≡C	839	N≡N	941		
C=N	615	N=O	607	S=O	523
C≡N	891			S=S	418
C=O	799				
C≡O	1072				

Practice

1) Describe what a covalent bond is and how electronegativity of the atoms involved affects the covalent bond.

2) Classify each of the following bonds as ionic, nonpolar, or polar:

Bond	Type	Bond	Type
C–C		O–O	
Mg–O		Fe–Cl	
B–F		N–H	
P–O		O–H	
C–H		Al–N	
Li–I			

3) In each pair of molecules, circle the molecule that will have the ***longest*** bond length:

a) C−Cl C−F b) H−O H−S

c) H−H Br−Br d) Si=O Si−O

e) Si=O C=O

4) Define a single, double, and triple covalent bond. Site differences between the three types of bonds in terms of bond length, bond enthalpy, and bond strength.

Discussion

One of the best ways to describe an idea in chemistry is through the use of analogy. We have been discussing the idea of electronegativity and how the different values for atoms affect the type of bond between two atoms. You need to write *at least* a paragraph about an analogy for electronegativity that you have come up with. The analogy must described within the paragraph or two. The written work should not be more that a page long.

During the following day in class we will break into groups and you will be responsible for describing your analogy to your peers within the group. Afterwards, your group will select the analogy you all think is the best description of electronegativity. Your group will then be responsible for describing electronegativity to the rest of the class using the analogy you have selected.

Lab

We have talked about two different types of bonds, ionic and covalent. Using the following methods, you will determine how the type of bonding affects different properties of the compounds. Each of the test you will be doing is a physical test, we will not be looking at the chemical properties of the substances yet. There are no pre-lab questions, but you should be able to distinguish the difference between an ionic bond and a covalent bond, if you are having difficulty with this, please see me so that we can clear up any problems you are having.

Materials

• 24−microwell plate • calcium chloride • Bunsen burner • citric acid

• conductivity tester • ethanol • ring stand • phenyl salicylate

• potassium iodide • sodium chloride • sucrose • tin can lid • pipets

WARNING: ethanol is flammable, keep away from flame

Procedure

1. List some observations of the chemicals you have.

2. Place the tin can lid over the ring on the ring stand and light the Bunsen burner. Position the lid so the hottest part of the flame is heating the lid. Turn off the gas and allow the lid to cool. While cooling collect the needed chemicals and create a chart that includes physical characteristics, relative melting point, solubility in H_2O and CH_3CH_2OH, and conductivity.

3. Place of few crystals of each solid on the lid. Be sure to evenly space the piles and do not allow crystals of different compounds to mix.

4. Light the Bunsen burner and heat the lid with the crystals on it. Note which substance melts first, second, etc.

5. After 2 (two) minutes, stop heating the lid and any compounds that did not melt, place an *n* next to it in your data chart.

6. In the 24−well plate, add a few crystals of each solid in the first and second row. Be sure to note which crystals are in which well.

7. In the first row add 10 (ten) drops of distilled water. DO NOT stir, allow the compound to dissolve on its own.

8. In the second row add 10 (ten) drops of ethanol. DO NOT stir, allow the compound to dissolve on its own.

9. Test the conductivity of each solution, be sure to rinse of the conductivity tester after each test.

10. Rinse the contents of the plate down the drain.

Analysis

1. Group the substances into two groups according the properties you have tested.

2. Find the formulas of each of the compounds tested.

3. List properties of each group and determine what type of bonding occurs in each group.

4. What type of bonding do you believe is stronger and why?

Conclusion

Write a paragraph or two summary of the difference between the compounds you have worked with. The paragraph(s) should sum up what occurred in the experiment and state what exactly was determined about the compounds studied.