SI Chemistry
Polar Liquids

Student Outcomes: At the end of this experiment students will be able to:

1. Use the concept of electronegativity to predict which molecules are likely to be polar.
2. Discover that the presence of polar bonds in a molecule does not necessarily predict polarity in that molecule.

Materials:

glass burets
buret stands
100 ml Erlenmeyer flasks
rubber rods
wool or fur pieces
Electronegativity Table (page 166 in book)
water
acetone
methanol
ethanol
hexane
cyclohexane
ethyl acetate
isopropyl alcohol
carbon tetrachloride
Funnels

Procedure:

Part I. How will you predict the behavior of each liquid?

1. Draw Lewis Structures for each of the liquids you will test in the space provided below. You may use pages 174-178 in your text or other sources to help you.

Water:

Acetone:

Methanol:

Ethanol:

Isopropyl alcohol:

E**thyl acetate:**

Hexane:

Cyclohexane:

Carbon tetrachloride:

2. Look at the structures of the liquids you will test. Now predict if the liquid will bend in the presence of a charged rod. If you predict the liquid will bend answer **yes** in the prediction column, if you predict it will not bend answer **no** in the prediction column.

3. Explain how you made your predictions.

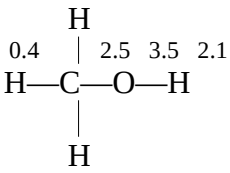
Part II: The bending of liquids by a charged rod

1. Rinse the buret with a small quantity of the liquid to be tested.
2. Fill the buret with the liquid. Place an Erlenmeyer flask under the buret to collect the liquid.
3. "Charge" a rod by rubbing it with the fur or wool piece.
4. Open the stopcock of the buret until a fine unbroken stream of the liquid flows out.
5. Place the charged rod near the stream and observe how the stream of liquid is affected.
6. Empty the flask and buret. **Save the organic compounds (all liquids except water) in the bottles provided. They will be used by the next group of students.**
7. You will test water, acetone, methanol, ethanol, isopropyl alcohol, ethyl acetate, hexane, cyclohexane and carbon tetrachloride. Carbon tetrachloride is in the fume hood because it is a very volatile liquid.
8. Enter all observations on the data table which is provided- If the liquid bends answer **yes** in the actual results column, if it does not bend answer **no** in the results column.

Part III: Analysis of Bond Polarity

1. Use the electronegativity table on page 166 to identify the most polar covalent bond or bonds in each structure.

For example: Methanol



O–H 3.5 - 2.1 = 1.4
C–O 3.5 - 2.5 = 1.0
C–H 2.5 - 2.1 = 0.4

Use the polar bond with greatest electronegativity difference, (in this case O–H = 1.4) for ranking the bond polarity in the molecules on the data table.

2. Rank the 9 liquids according to the difference in the electronegativities of the atoms forming the **most** polar bond in the molecule. Place a number 1 next to the liquid(s) with the most polar bonds, a 2 next to the liquid(s) with the next greatest bond polarity etc. **Several liquids will have the same electronegativity difference so you may have more than one liquid with a ranking of 1 for example.**

3. Do you recognize a discrepancy in your data - a liquid that should be bent by a charged rod but isn't or a liquid that should not be bent by a charged rod but is? Explain.

Submit your Lewis Structures, an explanation for your predictions, a complete data table and the answer to question 3 in Part III at the beginning of your next class. (Please see attached grading criteria)