

Name: _____ Period: _____ Date: _____

AP Chemistry 30 – Lab Activity 4: Intermolecular Forces

Learning Objectives

1. Explore the role of intermolecular forces in physical properties and common phenomena
2. Identify how polarity of molecules dictates strength of intermolecular forces

Instructions

1. Go <http://haydukscience.weebly.com/uploads/2/0/9/7/20974360/imfs.jnlp> and download the Java file onto your computer.
2. Open the file. Answer the questions below using the program. Write your answers on a separate piece of paper. Hand in one copy per student.

Questions

1. Draw the representations of a non-polar molecule and a polar molecule. Why are they different?
2. Click on "click to activate".
 - a. What type of attractions occur between non-polar molecules? What causes these attractions?
 - b. What is the *average* charge on non-polar molecules over time? Are these forces stronger or weaker than the forces between polar molecules?
 - c. What type of attractions occur between polar molecules? What causes these attractions?
3. Back in the program, play with the molecules in "Seeing Intermolecular Attractions". In your answers, write the correct responses to, "Which of the following form intermolecular attractions?"
4. Click on Page 2. Try pulling apart each pair of molecules. You may need to increase the "steering strength" to see this well.
 - a. Write the three pairs of molecules in order of how difficult they are to separate, from weakest to strongest.
 - b. Which type of intermolecular attraction is strongest? For which type of molecules does this attraction occur?
5. Click on Page 3. In "Intermolecular Attractions and Boiling Point", heat both liquids. Which liquid vaporizes first? Does this make sense based on what you saw when you pulled the molecules apart?
6. In "Intermolecular Attractions and Solubility", shake up the oil and water. Watch as they settle, and explain why they settle the way they do.
7. Click on Page 4. Use the information on the page to identify which substance will have the highest boiling point of the three alcohols listed at the bottom of the page. Explain your answer.
8. Click on Page 5. Try pulling apart the different shapes of molecules. Try the two questions on the page. In your answers, explain how size and shape make a difference in the strength of intermolecular forces between molecules.
9. Click on Page 6. What are hydrogen bonds?
10. Answer these summary questions. You may want to look at Page 10 to see the multiple choice options.
 - a. List the three types of attractive forces you explored in this activity, from weakest to strongest.

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- b. Which three forces affect the strength of intermolecular attractions?
- c. If you have two substances with molecules that are similar size and shape, but A experiences London dispersion forces and B experiences dipole-dipole attraction, which one would you expect to have a higher boiling point? Explain why.
- d. You have two substances, both of which have the same boiling point. The first substance is made from molecules that are small (just a few atoms bonded together), and the second substance is made from molecules that are larger (many atoms bonded together). How can it be possible for two such different molecules to yield substances with the same boiling point? Describe the kinds of intermolecular attractions that must be involved and any other properties of the molecules that could cause this result.