Name: _____

Intermolecular Forces

Background

Compounds interact with each other differently depending on their polarity. These interactions are called intermolecular forces (IMFs), and physical properties of compounds can be inferred by the type of IMFs. In this activity, you will have the opportunity to "feel" the strength of different intermolecular forces with the help of a computer simulation, and then you will consider what that means about some of the compounds' physical properties. Remember, the IMFs are hydrogen bonds, dipole-dipole interactions, induced dipole attraction, and London dispersion forces.

Procedure

1. Visit the simulation Comparing Attractive Forces (http://bit.ly/10zvRMY).
2. From the dropdown menu "select a pair of molecules" choose "pull apart Br_2 and Br_2."
3. Predict how difficult it will be to pull apart the two molecules in the data table.
4. Using the green star, move one Br_2 away from the other. Comment on how easy or difficult this was in the data table.
5. From the dropdown menu, choose "pull apart H_2 and H_2."
6. Predict how difficult it will be to pull apart the two molecules in the data table.
7. Using the green star, move one H_2 away from the other. Comment on how easy or difficult this was in the data table.
8. From the dropdown menu, choose "pull apart HBr and HBr."
9. Predict how difficult it will be to pull apart the two molecules in the data table.
10. Using the green star, move one HBr away from the other. Comment on how easy or difficult this was in the data table.
11. From the dropdown menu, choose "pull apart Br_2 and HBr."
12. Predict how difficult it will be to pull apart the two molecules in the data table.
13. Using the green star, move Br_2 away from HBr. Comment on how easy or difficult this was in the data table.
14. In the last two columns, determine whether the molecules are polar or nonpolar and identify the type of intermolecular forces the molecules exhibit.

Data

Molecules	Predict	Actual	Polar/nonpolar?	IMF
Br_2 & Br_2				
H_2 & H_2				
HBr & HBr				
Br_2 & HBr				

Analysis

1. Explain why you classified the intermolecular forces the way you did for each pair of molecules taking into account polarity.
    a. Br_2 & Br_2

    b. H_2 & H_2

c. HBr & HBr

d. Br_2 & HBr

2. If you had samples of HBr(aq) and Br_2(l) in real life and you mixed them together, would you expect them to mix or separate into two layers? Explain.

3. If HF was used in the simulation instead of HBr, how easy or difficult would it be to separate the molecules? What kind of polarity and IMFs would the molecules experience? Complete the following data table with your predictions:

Molecules	Predict	Polar/nonpolar	IMF
Br_2 & Br_2			
HF & HF			
Br_2 & HF			

Explain your IMF classifications, taking into account polarity.

4. How would you expect HF's boiling point to compare to HBr? Explain. Use the Molecular Workbench simulation Boiling Point (http://bit.ly/1xEty5j) to help you.

5. If F_2 was used in the simulation instead of Br_2, how easy or difficult would it be to separate the molecules? What kind of polarity and IMFs would the molecules experience? Complete the following data table with your predictions:

Molecules	Predict	Polar/nonpolar	IMF
F_2 & F_2			
HBr & HBr			
F_2 & HBr			

Explain your IMF classifications, taking into account polarity.

6. How would you expect F_2's boiling point to compare to Br_2? Explain.

7. How would you expect HBr's boiling point to compare to Br_2? Explain.

8. Consider the familiar compound water (H_2O). How would water's boiling point compare to HBr and HF? Explain.

9. Look up the boiling points of H_2O, Br_2, F_2, HBr, and HF. Were your predictions correct? Explain.

10. Of the two original compounds you investigated in the simulation (HBr and Br_2), which would be soluble in water? Explain.

11. Rank the vapor pressures of water, HBr, and HF from lowest to highest. Explain.

Conclusion

When considering physical properties, are IMFs the only factor to consider? Explain.