Day 3.6 Warm-Up

1. A 2 mol sample of $CO_2(g)$ and a 2 mol sample of $SO_2(g)$ are placed separately in two 8 L rigid containers at 25°C.

Question	Circle Correct Answer			Explanation
Greatest Pressure?	$CO_2(g)$	$SO_2(g)$	Same for both gases	
Greatest average kinetic energy?	$CO_2(g)$	$SO_2(g)$	Same for both gases	
Greatest particle speed?	$CO_2(g)$	$SO_2(g)$	Same for both gases	
Greatest density?	$CO_2(g)$	$SO_2(g)$	Same for both gases	
Fastest to effuse if there was a pinhole opening in each container?	$CO_2(g)$	$SO_2(g)$	Same for both gases	

2. CCl_4 is a liquid whereas CI_4 is a solid when both are at 25°C.
    a. Which substance has a higher melting point? Justify your answer.

    b. Students were asked to explain the difference in state of matter of the two substances at 25°C. Their responses are below. Which student is correct?

    Student A's response: More energy is needed to break the bond in CI_4 than in CCl_4 because the C-I bond is stronger than the C-Cl bond.

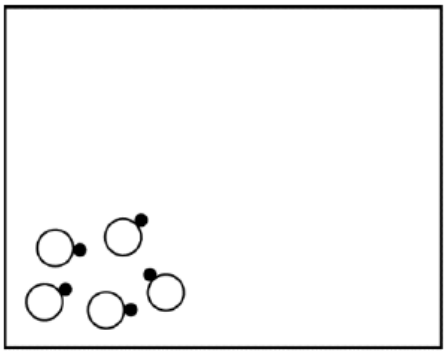
    Student B's response: More energy is needed to break the attraction between CI_4 molecules than those between CCl_4 molecules. The dipole moment of the CCl_4 molecule is larger than that of the CI_4 molecule because Cl is more electronegative than I.

    Student C's response: More energy is needed to break the attraction between CI_4 molecules than those between CCl_4 molecules. The London dispersion forces are stronger in CCl_4 than in CI_4 because Cl is more electronegative than I.

    Student D's response: More energy is needed to break the attraction between CI_4 molecules than those between CCl_4 molecules. The London dispersion forces are stronger in CI_4 than in CCl_4 because CI_4 has a more polarizable electron cloud than CCl_4.

Review Exercises

1. A representation of five molecules of HBr in the liquid state is shown in box 1 below. In box 2, draw a representation of the five molecules of HBr after complete vaporization has occurred.



Box 1

Box 2

Molecule	Boiling Point of Compound (K)	Dipole Moment (debyes)	Polarizability (10^{-24} cm^3)
HCl	188	1.05	2.63
HBr	207	0.80	3.61
HI	238	0.38	5.44

2. The boiling points, dipole moments, and polarizabilities of three hydrogen halides are given in the table above.
   (a) What can be inferred from the boiling point data?

   (b) What can be inferred from the dipole moment data?

   (c) What can be inferred from the polarizability data?

   (d) Based on the data in the table, what type of intermolecular force among the molecules HCl(l), HBr(l), and HI(l) is able to account for the trend in boiling points? Justify your answer.

   (e) Equimolar amounts of HCl(l), HBr(l), and HI(l) are placed into separate, previously evacuated identical 5 L containers at 100 K. Which liquid would have the greatest vapor pressure at 100 K? Justify your answer.

   (f) Based on the data in the table, a student predicts that the boiling point of HF should be 170 K. The accepted boiling point of HF is 293 K. Explain why the student's prediction is wrong in terms of the types and strengths of the intermolecular forces among HF molecules.