**Honors Chemistry II** Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Unit 4 Review

Things you need to have a thorough understanding of (all topics covered in Honors Chemistry and in this class so far are fair game):

* Types of Covalent Bonds
* Nonpolar Covalent Bonds
* Polar Covalent Bonds
* Coordinate Covalent Bonds - Lewis
* Acids and Lewis Bases
* Lewis Structures
* Resonance
* Hybridization
* Molecular Geometry
* Energy Effects on Molecules
* Isomerism
* Functional Groups
* Interactions of Functional Groups
* Classification of Molecules
* Intermolecular Interactions
* Dipole moments
* Types of Compounds
* Properties of Metallic, Molecular,
* Macromolecular and Ionic Compounds

The following three questions refer to the following diatomic species.

(A) Li2 (B) B2 (C) N2

(D) O2 (E) F2

1. Has the largest bond–dissociation energy
2. Has a bond order of 2
3. Contains 1 sigma *(σ)* and 2 pi (π) bonds

X CH3–CH2–CH2–CH2–CH3

Y CH3–CH2–CH2–CH2–OH

Z HO–CH2–CH2–CH2–OH

1. Based on concepts of polarity and hydrogen bonding, which of the following sequences correctly lists the compounds above in the order of their increasing solubility in water?

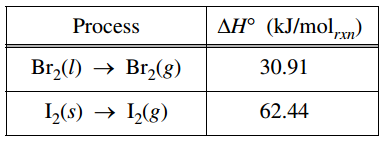
(A) Z < Y < X (B) Y < Z < X

(C) Y < X < Z (D) X < Z < Y

(E) X < Y < Z

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Your responses to these questions will be scored on the basis of the accuracy and relevance of the information cited. Explanations should be clear and well organized. Examples and equations may be included in your responses where appropriate. Specific answers are preferable to broad, diffuse responses.



At 298 K and 1 atm, the standard state of Br2 is a liquid, whereas the standard state of I2 is a solid. The enthalpy changes for the formation of Br2(g) and I2(g) from these elemental forms at 298 K and 1 atm are given in the table above.

(a) Explain why ΔH° for the formation of I2(g) from I2(s) is larger than ΔH° for the formation of Br2(g) from Br2(l). In your explanation identify the type of particle interactions involved and a reason for the difference in magnitude of those interactions.

(b) Predict which of the two processes shown in the table has the greater change in entropy. Justify your prediction.

(c) I2(s) and Br2(l) can react to form the compound IBr(l). Predict which would have the greater molar enthalpy of vaporization, IBr(l) or Br2(l). Justify your prediction.

An experiment is performed to compare the solubilities of I2(s) in different solvents, water and hexane (C6H14). A student adds 2 mL of H2O and 2 mL of C6H14 to a test tube. Because H2O and C6H14 are immiscible, two layers are observed in the test tube. The student drops a small, purple crystal of I2(s) into the test tube, which is then corked and inverted several times. The C6H14 layer becomes light purple, while the H2O layer remains virtually colorless.

(d) Explain why the hexane layer is light purple while the water layer is virtually colorless. Your explanation should reference the relative strengths of interactions between molecules of I2 and the solvents H2O and C6H14, and the reasons for the differences.

The student then adds a small crystal of KI(s) to the test tube. The test tube is corked and inverted several times. The I− ion reacts with I2 to form the I3− ion, a linear species.

(i) In the box below, draw the complete Lewis electron-dot diagram for the I3− ion.

(ii) In which layer, water or hexane, would the concentration of I3− be higher? Explain.

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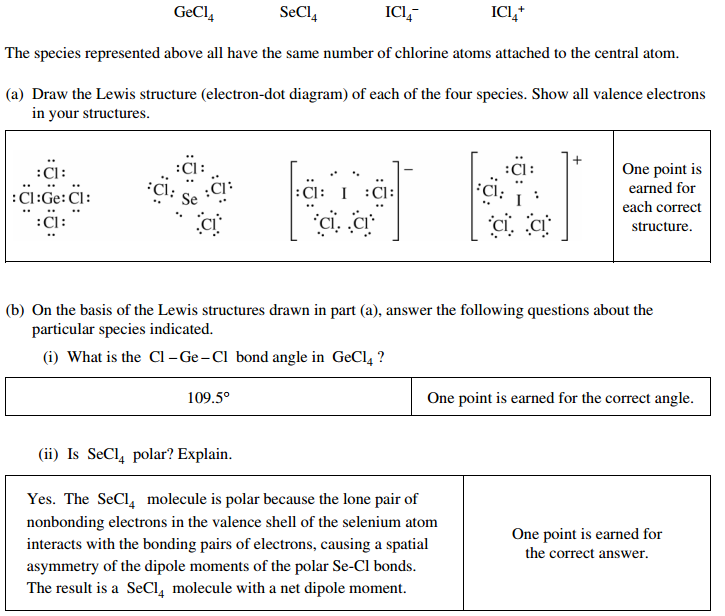
The species represented below all have the same number of chlorine atoms attached to the central atom.

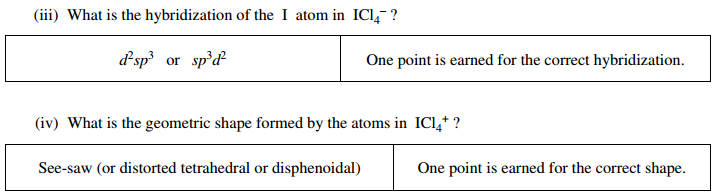
GeCl4 SeCl4 ICl4- ICl4+

1. Draw the Lewis structure (electron-dot diagram) of each of the four species. Show all valence electrons in your structures.
2. On the basis of the Lewis structures drawn in part (a), answer the following questions about the particular species indicated.
   1. What is the Cl-Ge-Cl bond angle in GeCl4?
   2. Is SeCl4 polar? Explain.
   3. What is the hybridization of the I atom in ICl4- ?
   4. What is the geometric shape formed by the atoms in ICl4+ ?

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