Name _____ Date _____ Period _____

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3.1 Intermolecular and Interparticle Forces

AP Chemistry

Name specific IMFs (LDF, dipole-dipole, hydrogen bonding, ion-dipole, dipole-induced dipole) and justify with particle-level reasons.

1. When liquid bromine, Br_2, boils, are covalent bonds broken or are intermolecular forces overcome? Explain what the $Br_2(g)$ particles look like.

2. Identify <u>all</u> of the intermolecular forces present in a pure sample of each substance.

(a) neon, Ne

(b) carbon dioxide, CO_2

(c) chloromethane, CH_3Cl

(d) ammonia, NH_3

3. Which of these substances can form hydrogen bonds between their own molecules? Explain each choice.

ethanol (CH_3CH_2OH) dimethyl ether (CH_3OCH_3) hydrazine (N_2H_4) hydrogen sulfide (H_2S)

4. Identify the intermolecular forces between the two different kinds of particles in each mixture.

(a) KBr dissolved in water

(b) I_2 dissolved in hexane, C_6H_{14} (nonpolar)

(c) N_2 gas dissolved in water

(d) acetone (CH_3COCH_3) mixed with water

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5. For each pair, circle the substance with the higher boiling point. Justify your choice in terms of the IMFs involved.

(a) Cl_2 or Br_2

(b) n-pentane (a long chain) or neopentane (compact, ball-shaped). Both are C_5H_{12}.

(c) propane, C_3H_8 (44 g/mol, nonpolar) or acetaldehyde, CH_3CHO (44 g/mol, polar)

6. Which ion, Na^+ or Mg^{2+}, has the stronger ion-dipole attraction to water molecules? Use Coulomb's law to justify your answer. (Mg^{2+} is also the smaller ion.)

7. Water, H_2O, boils at 100 °C. Hydrogen sulfide, H_2S, boils at −60 °C even though H_2S has more electrons. Explain this difference.

8. Draw one methylamine molecule, CH_3NH_2, and one water molecule showing a hydrogen bond between them. Include lone pairs and label the δ+ and δ− atoms in the hydrogen bond.

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