Name: ____________________

1. Draw Lewis structures for each. Indicate any polarity using δ^+ and δ^-.

Indicate the strongest intermolecular force (IMF) present. Choose from:

- hydrogen bonding,
- dipole-dipole forces,
- or London dispersion forces (also known as van der Walls forces).

a) O_2

b) SO_2

c) H_2O

d) HF (g), hydrogen fluoride gas (not an acid)

e) HCl (g)

f) NH_3, ammonia

g) CO_2

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2. Circle the chemical species in each pair that you would expect to have the higher boiling point. Provide a brief explanation (1 sentence max.) using IMF concepts.

a) HF vs. F_2

Why: ________________________________

b) NO vs. O_2

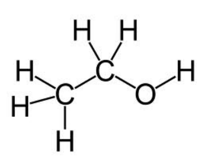
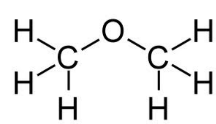
Why: ________________________________

c) Cl_2 vs. F_2

Why: ________________________________

d) C_2H_6 vs. CH_4

Why: ________________________________

e)  vs. 

Why: ________________________________

3. What is responsible for the <u>high boiling point</u> of HF (19.7 °C) relative to HCl (-84.8 °C) and HBr (-66.4 °C)?

a. hydrogen bonding
b. dipole/induced dipole force
c. induced dipole/induced dipole force
d. covalent bonding
e. dipole-dipole force

4. Which one of the following molecules has the <u>lowest</u> boiling point?

a. CH_4 b. $CHCl_3$ c. CH_2Cl_2 d. CH_3Cl e. CCl_4

5. Which of the following boils at the <u>lowest</u> temperature?

a. C_4H_{10} b. C_5H_{12} c. C_6H_{14} d. C_7H_{16} e. C_8H_{18}

6. Arrange Cl_2, ICl, and Br_2 in order from <u>lowest to highest</u> boiling point.

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7. Calculate the heat, in Joules, required for the following. Indicate as exothermic or endothermic.

a. heating 25.0 g of water from 20.0 °C to 60.0 °C (c_p = 4.184 J/°C g for water)

b. heating 25.0 g water from 60.0 °C to 100.0 °C

c. boiling 25.0 g of water at 100 °C into steam (ΔH_{vap} = 2260 kJ/mol)

d. condensing 25.0 g of steam at 100 °C into water

e. heating 25.0 g of water from 20.0 °C to 100 °C <u>and</u> boiling into steam

f. heating 25.0 g copper from 60.0 °C to 100.0 °C (c_p = 0.385 J/°C g for copper)

g. cooling 25.0 g copper from 20.0 °C to -20.0 °C