

### IMF's and Boiling Point

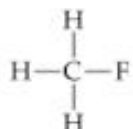
- 1) What is the relationship between IMF strength, boiling point and vapor pressure? Why?
- 2) Rank by increasing boiling point and explain why:



- 3) The 3D skeletal structure of neopentane (above) is provided above. Is this molecule polar or nonpolar? Will it have a relatively high boiling point or low boiling point?



Formaldehyde



Fluoromethane



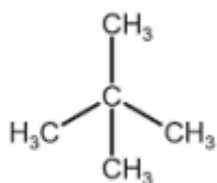
Hydrogen peroxide

- 4) From the list above, at room temperature, one of these molecules are a liquid and the rest are gas. Which one is liquid and why?

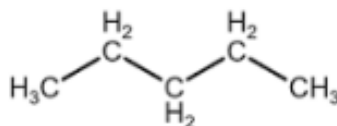
Name	Structural Formula	Molar Mass (g/mol)
Acetone	$\begin{array}{ccccc} & H & & O & & H \\ &   & &    & &   \\ H & -C & - & C & - & C-H \\ &   & & & &   \\ & H & & & & H \end{array}$	58.1
1-propanol	$\begin{array}{ccccc} H & H & H & & \\   &   &   & & \\ H-C & -C & -C & -O & -H \\   &   &   & & \\ H & H & H & & \end{array}$	60.1
Butane	$\begin{array}{ccccccc} H & H & H & H & & \\   &   &   &   & & \\ H-C & -C & -C & -C & -H \\   &   &   &   & & \\ H & H & H & H & & \end{array}$	58.1

The table above shows the structural formulas and molar masses for three different compounds. Which of the following is a list of the compounds in order of increasing boiling points?

- (A) Butane < 1-propanol < acetone
- (B) Butane < acetone < 1-propanol
- (C) 1-propanol < acetone < butane
- (D) Acetone = butane < 1-propanol

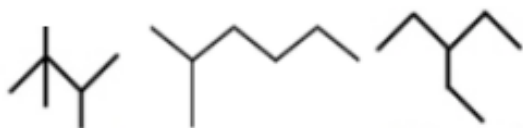


neopentane



*n*-pentane

- 5) Neopentane and *n*-pentane have the same molar mass. Which will have a higher vapor pressure?
- 6) Dimethyl Ether and Ethanol are constitutional isomers (they have the same molecular formula,  $C_2H_6O$ ). What will account for Ethanol's higher boiling point?
- 7) Which of the following constitutional isomers of heptane would have the greatest viscosity?



- 8) The boiling points of Fluorine, Chlorine, Bromine, and Iodine increase in that order. Which of the following statements is a valid reasoning for this observation?
- A) The surface area of these molecules increases causing a decrease in electronegativity
  - B) The chemical reactivity becomes increasingly more unstable down a group for halogens
  - C) The dipole-dipole forces increase strengthening the interactions
  - D) The molar masses of these molecules are increasing
  - E) The electron cloud of these elements is increasing in polarizability
- 9) The intermolecular force(s) responsible for the fact that  $CH_4$  has the lowest boiling point in the set  $CH_4$ ,  $SiH_4$ ,  $GeH_4$ ,  $SnH_4$  is/are \_\_\_\_\_.
- A) mainly hydrogen bonding but also dipole-dipole interactions
  - B) hydrogen bonding
  - C) mainly London-dispersion forces but also dipole-dipole interactions
  - D) dipole-dipole interactions
  - E) London dispersion forces

### Phases

- 1) A phase diagram for Jamesonnum is shown below.
- a) Label each area of the graph with correct areas, phase boundaries and points.
- b) What is the normal boiling point for Jamesonnum?
- c) What is melting point at 1 atm?
- d) What is the phase at 1 atm and 50 degrees C?
- e) Draw a line segment showing sublimation and constant pressure of 0.5 atm
- f) Draw line segments showing condensation under constant temperature of 140 C and then freezing under constant pressure

