

IMF Practice Questions

CW/HW

Name: _____ Date: _____ Per _____

- ___ 1. Order the intermolecular forces (dipole-dipole, London Dispersion, ionic, and hydrogen-bonding) from weakest to strongest .
- A) dipole-dipole, London Dispersion, ionic, and hydrogen-bonding
 - B) London Dispersion, dipole-dipole, hydrogen-bonding, ionic
 - C) hydrogen-bonding, dipole-dipole, London Dispersion, and ionic
 - D) dipole-dipole, ionic, London Dispersion, and hydrogen-bonding
 - E) London Dispersion, ionic, dipole-dipole, and hydrogen-bonding
- ___ 2. Hydrogen bonds account for which of the following observation?
- A) Hydrogen naturally exists as a diatomic molecule.
 - B) Hydrogen is easily combustible with oxygen.
 - C) Water molecules are bent or "V-shaped".
 - D) Air is more dense than hydrogen gas.
 - E) For its molar mass, water has a high boiling point.
- ___ 3. Which of the following would you expect to have the highest boiling point?
- A) F_2
 - B) Cl_2
 - C) Br_2
 - D) I_2
 - E) All of the above have the same boiling point.
- ___ 4. Which of the following is most likely to be a solid at room temperature?
- A) Na_2S
 - B) HF
 - C) NH_3
 - D) N_2
 - E) H_2O
- ___ 5. Which of the following should have the lowest boiling point?
- A) Na_2S
 - B) HF
 - C) NH_3
 - D) N_2
 - E) H_2O
- ___ 6. On a relative basis, the weaker the intermolecular forces in a substance,
- A) the greater its heat of vaporization.
 - B) the more it deviates from ideal gas behavior.
 - C) the greater its vapor pressure at a particular temperature.
 - D) the higher its melting point.
 - E) none of these

- ___ 7. Which of the species below would you expect to show the least hydrogen bonding?
- A) NH_3
 - B) H_2O
 - C) HF
 - D) CH_4
 - E) all the same
- ___ 8. The molecules in a sample of solid SO_2 are attracted to each other by a combination of
- A) London forces and H-bonding.
 - B) H-bonding and ionic bonding.
 - C) covalent bonding and dipole-dipole interactions.
 - D) London forces and dipole-dipole interactions.
 - E) none of these
- ___ 9. Which of the following is the correct order of boiling points for KNO_3 , CH_3OH , C_2H_6 , Ne ?
- A) $\text{Ne} < \text{CH}_3\text{OH} < \text{C}_2\text{H}_6 < \text{KNO}_3$
 - B) $\text{KNO}_3 < \text{CH}_3\text{OH} < \text{C}_2\text{H}_6 < \text{Ne}$
 - C) $\text{Ne} < \text{C}_2\text{H}_6 < \text{KNO}_3 < \text{CH}_3\text{OH}$
 - D) $\text{Ne} < \text{C}_2\text{H}_6 < \text{CH}_3\text{OH} < \text{KNO}_3$
 - E) $\text{C}_2\text{H}_6 < \text{Ne} < \text{CH}_3\text{OH} < \text{KNO}_3$
- ___ 10. Which of the following statements about liquids is true?
- A) Droplet formation occurs because of the higher stability associated with increased surface area.
 - B) Substances that can form hydrogen bonds will display lower melting points than predicted from periodic trends.
 - C) London dispersion forces arise from a distortion of the electron clouds within a molecule or atom.
 - D) Liquid rise within a capillary tube because of the small size lowers the effective atmospheric pressure over the surface of the liquid.
 - E) The boiling point of a solution is dependent solely on the atmospheric pressure over the solution.
- ___ 11. Which statement regarding water is true?
- A) Energy must be given off in order to break down the crystal lattice of ice to a liquid.
 - B) Hydrogen bonds are stronger than covalent bonds.
 - C) Liquid water is less dense than solid water.
 - D) Only covalent bonds are broken when ice melts.
 - E) All of the statements (a-d) are false.
- ___ 12. In which of the following groups of substances would dispersion forces be the only *significant* factors in determining boiling points?
- I. Cl_2 II. HF III. Ne IV. KNO_2 V. CCl_4
- A) I, III, V
 - B) I, II, III
 - C) II, IV
 - D) II, V
 - E) III, IV, V

- ___ 13. The elements of group 5A, the nitrogen family, form compounds with hydrogen having the boiling points listed below:
SbH₃ -17°C, AsH₃ -55°C, PH₃ -87°C, NH₃ -33°C
The first three elements illustrate a trend where the boiling point decreases as the mass decreases; however, ammonia (NH₃) does not follow the trend because of
- A) dipole-dipole attraction.
 - B) metallic bonding.
 - C) hydrogen bonding.
 - D) London dispersion forces.
 - E) ionic bonding.
- ___ 14. Which substance involves no bonding forces except London dispersion forces?
- A) NaCl(l)
 - B) HF(l)
 - C) N₂(s)
 - D) H₂O(l)
 - E) K(s)
- ___ 15. On the basis of your knowledge of bonding in liquids and solids, arrange the following substances in order of highest to lowest melting temperature: NaCl, Na, Cl₂, SiO₂
- A) Cl₂, Na, NaCl, SiO₂
 - B) Na, NaCl, Cl₂, SiO₂
 - C) SiO₂, NaCl, Na, Cl₂
 - D) NaCl, SiO₂, Na, Cl₂
 - E) SiO₂, Na, NaCl, Cl₂
- ___ 16. Which of the following substances would you expect to have the lowest boiling point?
- A) diamond
 - B) methane, CH₄
 - C) sodium nitrate, NaNO₃
 - D) glycerine, C₃H₅(OH)₃
 - E) copper
- ___ 17. What is responsible for capillary action, a property of liquids?
- A) surface tension
 - B) cohesive forces
 - C) adhesive forces
 - D) viscosity
 - E) two of these
- ___ 18. When a nonpolar liquid displays a convex meniscus, which of the following explains this behavior?
- A) It has a low surface tension, and therefore clings to the glass.
 - B) The cohesive forces are stronger than the adhesive forces toward the glass.
 - C) The adhesive forces toward the glass are stronger than the cohesive forces.
 - D) The liquid's viscosity is low.
 - E) none of these

19. Which best explains the following trend?

Element	b.p. (K)
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He	4
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Ne	25
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Ar	95
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Kr	125
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Xe	170
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- A) London dispersion forces
- B) dipole-dipole interaction
- C) hydrogen bonding
- D) Le Chatelier's principle
- E) none of these

20. Which of the following has the highest boiling point?

- A) chalk (calcium carbonate)
- B) ice (water)
- C) window cleaner (ammonia)
- D) motor oil (hydrocarbon chains)
- E) helium gas inside a party balloon

21. Which of the following compounds has the highest viscosity?

- A) $\text{CCl}_4(\text{l})$
- B) $\text{N}_2(\text{g})$
- C) $\text{H}_2\text{O}(\text{l})$
- D) $\text{CH}_3-(\text{CH}_2)_{25}-\text{CH}_3(\text{l})$
- E) $\text{HCl}(\text{g})$

22. Hydrogen bonding is a type of London dispersion force.

- A) True
- B) False

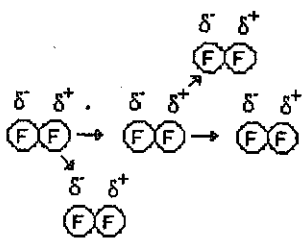
23. Intermolecular forces are weaker than intramolecular bonds.

- A) True
- B) False

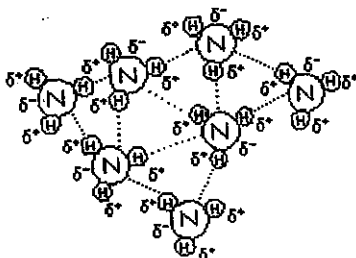
Use the following to answer questions 24-26:

Consider the representations below to answer the next three questions.

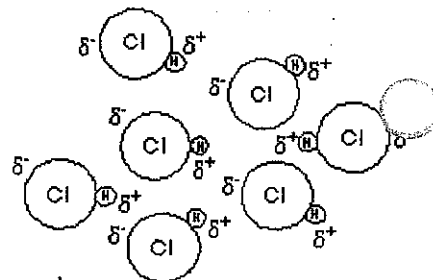
(I)



(II)



(III)



- ___ 24. How many of the following statements are correct concerning drawing I?
- I. Each molecule induces a dipole onto the next molecule in close proximity.
 - II. The phenomenon shown is relatively weak and short-lived.
 - III. C_8H_{18} contains this type of interaction.
 - IV. The forces that exist in this phenomenon are London dispersion forces.
- A) 0
B) 1
C) 2
D) 3
E) 4
- ___ 25. Which of the following statements are incorrect concerning drawing III?
- A) Electrostatic interactions exist between the molecules.
 - B) The molecules find the best compromise between attraction and repulsion.
 - C) These molecules exhibit ionic bonding.
 - D) OCS exhibits this type of interaction.
 - E) Two of the above statements are incorrect.
- ___ 26. Which drawing *best* represents the interactions between HF?
- A) I
 - B) II
 - C) III
 - D) I, II
 - E) All of the above
- ___ 27. Methane (CH_4) exhibits stronger hydrogen bond interactions than ammonia (NH_3).
- A) True
 - B) False
- ___ 28. Liquids with large intermolecular forces tend to have high surface tension.
- A) True
 - B) False
29. The particularly strong dipole-dipole interaction between hydrogen and nitrogen is known as a _____.
30. The relatively weak forces that exist among noble gas atoms are _____.

31. The resistance of a liquid to an increase in its surface area is the _____ of the liquid.
32. The meniscus of mercury curves downward at the edges. Explain using the concepts of cohesion and adhesion.
33. If you have 10.0 moles of BH_3 and 5.0 moles of HF , which amount exhibits the most hydrogen bonding? Explain.
34. Make a sketch to show the hydrogen bonding between two acetic acid molecules ($\text{HC}_2\text{H}_3\text{O}_2$).