Final Packet Instructions: Do your best and don’t be anxious. Read the question, re-read the question, write down all given or valuable information, and write down what you want to find.

1. How many following are not true?
   I. Intermolecular forces are the forces that bind atoms together to create molecules
   II. Intermolecular forces are significantly stronger than intramolecular forces
   III. Intermolecular forces affect physical properties such as boiling point, freezing point, etc
   IV. Intermolecular forces are responsible for why oil and water do not mix

   1) Zero  2) One  3) Two  4) Three  5) Four

2. Which solution will mix the best?

   1) Methane (CH₄) in methanol (CH₃OH)
   2) Ethylene glycol HOCH₂CH₂OH in chloroform (CHCl₃)
   3) Toluene (C₇H₈) in Hexane (CH₃CH₂CH₂CH₂CH₂CH₃)
   4) Diethyl ether (CH₃CH₂OCH₂CH₃) in water
   5) Petroleum in water

3. The vapor pressure of water is 1.0 atm at 373 K, and the enthalpy of vaporization is 40.7 kJ/mol. What is the vapor pressure of water if the temperature is raised to 383 K?

   1) 1.41 atm
   2) 0.70 atm
   3) 1.0 atm
   4) 14.1 atm
   5) 7.00 atm
4. Which of the following statements is true?

1) A saturated solution is not at equilibrium and additional solute will not dissolve
2) A supersaturated solution is relatively unstable because it contains less solvent
3) A unsaturated solution is not stable because it contains too much solution and not enough solute
4) At equilibrium, the concentration of a solution remains constant and the undissolved solute is in equilibrium with dissolved solute
5) None of the Above are True

5. The partial pressure of carbon dioxide gas inside a bottle of cola is 4 atm at 258 °C. What is the solubility of CO₂? The Henry’s law constant for CO₂ in water is 3.33*10⁻² mol/L?atm at 258 °C.

1) 0.05 mol/L
2) 4.0 mol/L
3) 0.1 mol/L
4) 0.01 mol/L
5) None of the Above

6. Which of the following is false?

1) Molarity is affected by temperature while molality is not
2) In dilute aqueous solutions, molality is approximately equal to molarity
3) Molarity is the preferred method of concentration when investigating physical properties
4) Concentration is an intensive property
5) All of the above are true

7. In Pennsylvania and other northern states, salt is put on the ice to prevent black ice on the roads. Why does the ice melt when salt (NaCl) touches it?

1) The energy in salt heats up the ice
2) The melting point of ice increases due to the colligative properties of NaCl
3) The freezing point of the ice decreases due to the colligative properties
4) The ionic – dipole bonds increase the bond energy which results in heat
5) None of the Above
8. A man adds 1.00 kg of ethylene glycol (C₂H₆O₂) antifreeze to 4,450 g of water in his car’s radiator on a winter day. What is the freezing point of the solution now? Important data: K_f = 1.86 °C/m

1) 6.73°C  2) 2.75°C  3) – 6.73°C  4) – 2.75°C  5) – 10.5°C

9. Biochemists have discovered more than 400 mutant varieties of hemoglobin, the blood protein that binds O₂ and carries it to the body’s cells. A physician dissolves 21.5 mg of one variety in water to make 1.50 mL of solution at 5.08 °C. She measures an osmotic pressure of 3.61 torr. What is the molar mass of the protein?

1) 3.12×10⁷ g/mol  2) 3.12 g/mol  3) 6.89×10⁴ g/mol  4) 2.08×10⁻⁴ g/mol  5) 800 g/mol

10. Which member in each pair has the highest vapor pressure at a given temperature?
A: C₂H₆ or C₄H₁₀  B: CH₃CH₂OH or CH₃CH₂F  C: NH₃ or PH₃

1) C₂H₆, CH₃CH₂OH, NH₃  2) C₂H₆, CH₃CH₂F, PH₃  3) C₄H₁₀, CH₃CH₂F, PH₃  4) C₂H₆, CH₃CH₂F, NH₃  5) C₄H₁₀, CH₃CH₂OH, NH₃

11. Nickel crystallizes in a face-centered cubic structure with an edge length a = 352.4 pm. Based on this information, calculate the approximate density of nickel.

1) 8.9  2) 2.4  3) 9.3  4) 8.7  5) 7.6

12. Copper adopts a face centered cubic cell, and the edge length of the unit cell is 361.5 pm. What is the atomic radius of copper?

1) 127.8 pm  2) 255.6 pm  3) 511.2 pm  4) 383.4 pm  5) None of the above
13. Which of the following is true?

1) Ion – Dipole forces are not as strong as ion – induced dipole
2) Hydrogen bonding is the principal force in polar solutions
3) Dispersion forces only contribute to solubility in nonpolar solutions
4) Ion – Dipole forces in aqueous solutions result in ions clustering around water. These are called hydration shells
5) All of the above are true

14. Which of the following is not true?

1) 0.12 \( m \) \( \text{Na}_2\text{SO}_4 \) has a higher boiling point than 0.12 \( m \) \( \text{KBr} \)
2) 0.10 \( m \) \( \text{CaCl}_2 \) has a lower freezing point than 0.20 \( m \) \( \text{HOCH}_2\text{CH}_2\text{OH} \)
3) According to the phase diagram, the solid has a lower density than the liquid.
4) According to the phase diagram, the temperature corresponding to Point E is the normal boiling point.
5) All of the following are true.

15. A sample of rubbing alcohol contains 142 g of isopropyl alcohol (C3H7OH) and 58.0 g of water. What are the mole fractions of alcohol and water respectively?

1) 0.423, 0.423
2) 0.500, 0.500
3) 0.577, 0.423
4) 0.423, 0.577
5) None of the Above

16. Hydrogen peroxide is a powerful oxidizing agent; it is used in concentrated solution in rocket fuel and in dilute solution in hair bleach. An aqueous solution of H2O2 is 30.0\% by mass and has a density of 1.11 g/mL. What is the molality of the solution?

1) 9.79 m
2) 12.6 m
3) 3.88 m
4) 1.26 m
5) None of the Above
17. Find the vapor pressure lowering, DP, when 10.0 mL of glycerol (C\textsubscript{3}H\textsubscript{8}O\textsubscript{3}) is added to 500. mL of water at 50.8°C. At this temperature, the vapor pressure of pure water is 92.5 torr and its density is 0.988 g/mL. The density of glycerol is 1.26 g/mL.

1) 0.562 torr 
2) 0.00498 torr 
3) 27.4 torr 
4) 0.461 torr 
5) 760 torr 

GOOD LUCK and SMILE ON THE EXAM!!!

-Teaching Center