Name_____ ID Number_____

BROOKLYN COLLEGE OF CUNY
Chemistry 1.2 Final Examination: Fall 2000

Directions: Circle the best choice. 3 points each. 60 points total for this part.

1. An aqueous sample freezes at -2.00 ˚C. For water k_f = 1.86 ˚C/m and k_b = 0.52 ˚C/m The boiling point of the solution is…..
1. 102.08 2. 100.15 3. 100.20 4. 100.56 5. none of these

2. The extent to which a solute dissolves in a particular solvent depends on which of the following factors?
1. the chemical structures of the solvent and solute particles
2. the interactions between the solvent and solute particles
3. the temperature at which the solution is formed
4. all of the above
5. none of the above.

3. How many grams of calcium bromide ($CaBr_2$, MW = 200.) must be used to prepare 500. mL of 0.400 M $CaBr_2$ solution?
a. 20.0 g b. 40.0 g c. 60.0 g d. 80.0 g

4.Which of the following 0.10 M aqueous solutions would have the lowest freezing point? a. KBr b. Na_2SO_4 c. $NaNO_3$ d. $MgSO_4$

5. Which molecule is T-shaped? a. OF_2 b. IBr_3 c. PCl_2Br d. IBr_4^-

6. The molar mass of hemoglobin is 68,000 g/mol. Calculate the osmotic pressure produced from 2.20 g hemoglobin in 100.
mL water at 20°C. [R = 0.0821 L atm/(mol K)]
a. 5.29×10^{-3} atm b. 7.78×10^{-3} atm c. 5.29×10^{-4} atm d. 7.78×10^{-4} atm

7. Which of the following has the highest boiling point?
a. CH_3CH_2OH b. $CH_3CH_2CH_2OH$ c. $CH_3CH_2CH_2CH_3$ d. $CH_3CH_2OCH_3CH_2$

8. What do the following species have in common?
CS_2 CO_2 CH_2O
a. All are gases are room temperature. b. All contain pi (p) bonding.
c. All are isoelectronic with each other. d. All have no dipole moment.

9. How many lone pairs are found in the *entire* molecule PBr_5?
a. none b. 5 c. 15 d. 20

10. A molecule has the following properties: The molecule contains two different halogens. The molecule has no dipole moment. The molecule does not form hydrogen bonds. What molecule could it be?
a. OF_2 b. IBr_3 c. PCl_2Br d. IBr_4^-

11. Pi bonding can be found in which of the following?
a. ethyne (C_2H_2) b. ozone c. hydrogen peroxide d. both a & b e. all three molecules

12. Linear geometry best describes which of the following molecules? a. ethyne (C_2H_2) b. ozone c. hydrogen peroxide d. All of the above molecules are linear.

An experiment is performed in which 1.0 J of heat is added to 10. g ethanol (C_2H_5OH). The same amount of heat is added to 10. g benzene (C_6H_6) and the following temperature changes are observed:

Substance	Δ T
ethanol	+0.041 K
benzene	+0.057 K

13. Which compound has the larger specific heat?
a. ethanol b. benzene c. They have the same specific heat.
d. It cannot be determined from the information given.

14. Which has the larger molar heat capacity?
a. ethanol b. benzene c. They have the same molar heat capacity.
d. It cannot be determined from the information given.

15. What is the shape of a molecule of XeF_4 ? a. tetrahedral b. square planar
c. octahedral d. T-shaped

16. The higher boiling point of ethanol (C_2H_5OH) over pentane (C_5H_{12}) is predominantly due to
a. intertwining of molecules in pentane. b. higher molecular weight of pentane.
c. van der Waals repulsion in ethanol. d. hydrogen bonding in ethanol.

17. The predominant intermolecular force between Xe atoms is the
a. nuclear force. b. dipole-dipole force. c. hydrogen bonding force.
d. dispersion (London) force.

18. Which of the following has the lowest boiling point?
a. F_2 b. Cl_2 c. Br_2 d. I_2

19. Which of the following substances, A-C, are ionic crystalline solids?

Substance	Appearance	Melting Point	Electrical Conductivity	Solubility in water
A	soft, yellow	145°C	none	insoluble
B	brittle, white	750°C	only if dissolved in water or melted	soluble
C	lustrous, ductile	1725°C	high	insoluble

a) A only b) B only c) C only d) A & C e) B & C

20. Which of the substances above are covalent solids? (same choices as 21.) ___Ans.
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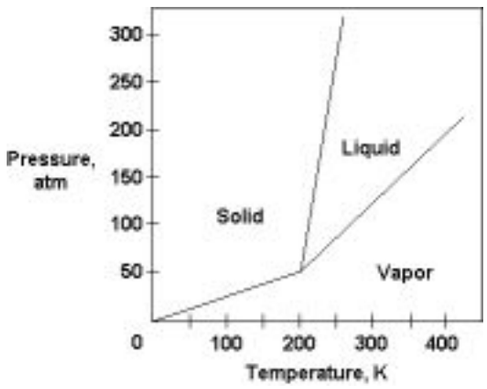
Part II



1. Base your answers on the above phase diagram for substance "X." (20 pts.)

a. What is the triple point of X? (List the temperature and pressure.)

b List the critical temperature and critical pressure?

c. At 100 atm list all phase changes that will occur when X is heated from 100 K to 300 K.

d. What will occur when X is heated from 100 K to 300 K at 30 atm?

e. What will occur at 300 K if the pressure is increased from 50 atm to 150 atm?

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2. A solution contains 180 g of glucose (mol. mass = 180) dissolved in 180 g of H_2O at 100˚ C. The vapor pressure of water at that temperature is 1.00 atm and glucose is non-volatile. Please show all formulas used and all work. (20 pts.)

   a. What is the mole fraction of glucose?

   b. What is the vapor pressure of the solution?

   c. What is the molality?

   d. What is the boiling point of the solution? (k_b = 0.52 ˚C)