CHEMISTRY 111 NAME: **ANSWERS**
SECTION 2
February 25, 2003

Q1. Which of the following forces are responsible for holding NF_3 in the liquid state? Circle all that apply.

Ion-ion	Ion-dipole
Dipole-dipole	H-bonding
Diple-Induced dipole	**Induced dipole-Induced dipole**

Q2. The solute-solvent interactions when N_2 dissolves in water are primarily of the type:
Circle the best correct answer.

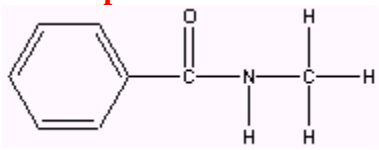
dipole-dipole
ion-dipole
ion-ion
dipole-induced dipole
None of the Above

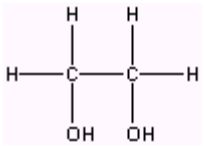
Q3. Which of the following is expected to have the highest boiling point?

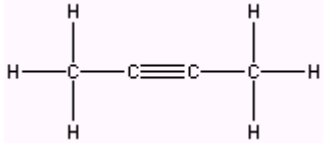
$CH_3CH_2CH_2CH_3$	CH_4
CH_3OH	**$CH_3CH_2CH_2CH_2CH_2OH$**

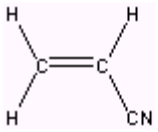
Q4. For which of the following compounds would hydrogen bonding be expected to play an important role in holding the molecules in the liquid state. Circle all that apply.

Ans: Top Two

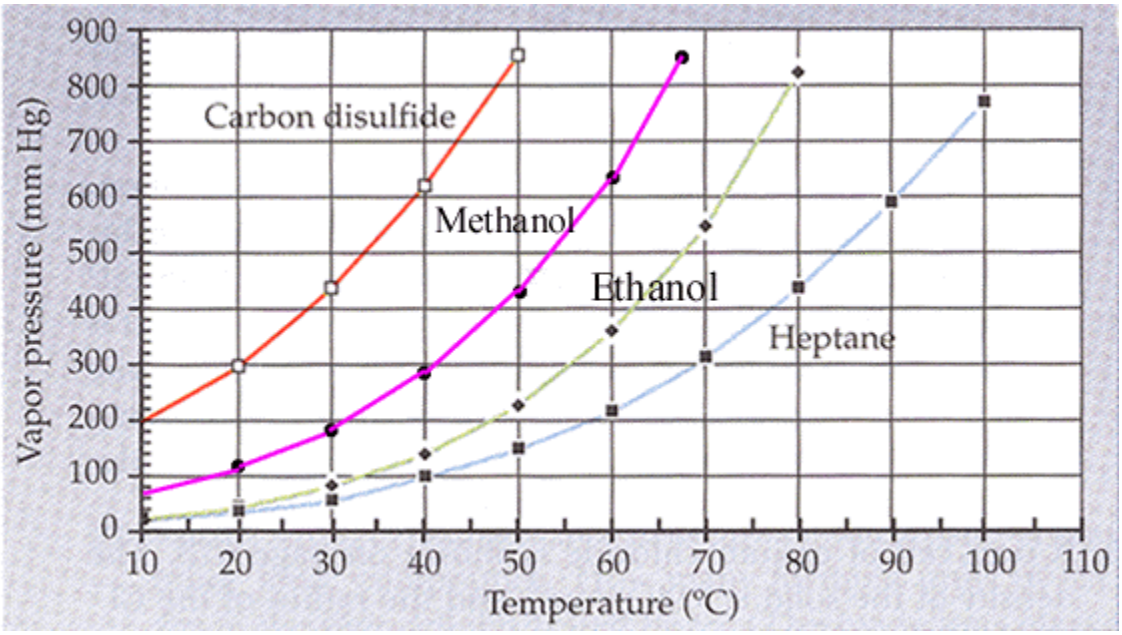








None of the Above



Q5. a. From the plot of vapor pressures vs temperature above, estimate the boiling point of methanol when the external pressure is 182 mm Hg.

30 °C

b. From the plot of vapor pressures vs temperature above, estimate the normal boiling point of carbon disulfide.

47 °C

c. From the plot of vapor pressures vs temperature above, estimate the boiling point of carbon disulfide when the external pressure is 615 mm Hg.

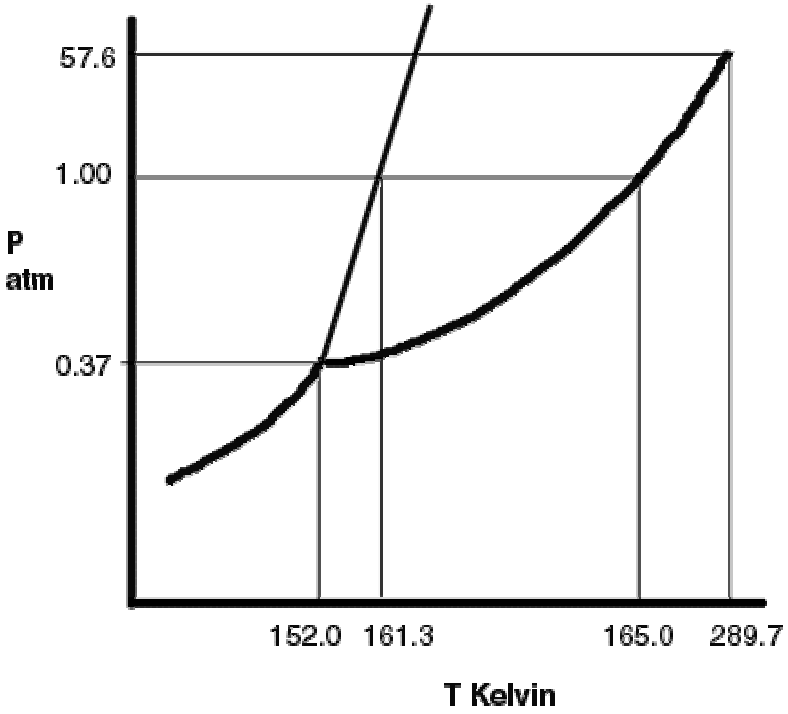
40 °C

d. Which of the compounds depicted has the strongest intermolecular forces? **Heptane**

e. Draw a new curve on the graph for a compound with weaker intermolecular forces than any of the compounds depicted.

It should start higher and go up faster than the others.

Q6. Refer to the following phase diagram (not to scale!) for xenon:



a. A sample of xenon at a pressure of 0.370 atm and a temperature of 137 K is compressed at constant temperature to a pressure of 63.5 atm. Which of the following are true? Circle all that apply.

No phase change will occur.

The final state of the substance is a solid.

The sample is initially a gas.

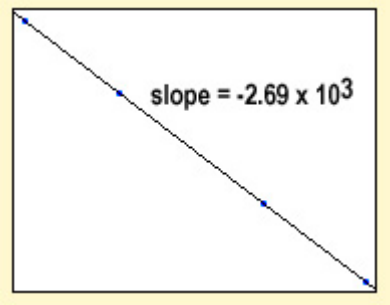
The liquid initially present will vaporize.

The sample is initially a solid.

b. Add an arrow to the diagram that shows a vaporization occurring without an increase in temperature.

Q7.

A plot to determine the enthalpy of vaporization of C_4H_{10} is depicted on the right.



4. Label the X axis: **1/T**
5. Label the Y axis: **ln P**
6. What is the enthalpy of vaporization in $kJ.mol^{-1}$.

22.4 kJ/mol

Q8. Consider the depiction of a surfactant molecule. The long part is a hydrophobic hydrocarbon chain and the "head group" is polar. Sketch how these would form a micelle when dissolved in CCl_4 instead of water.
You can use a cruder version of each surfactant molecule.

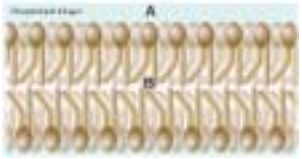
ans: Sketch should show them in a circle with polar head groups pointing in and the tails pointing out.

Q9. Which of the following would be expected to dissolve extensively in water? Circle all that apply.

NH_3 CCl_4 I_2 **CH_3OH**

Q10. Consider the image of a lipid bilayer below. Would a nonpolar fatty molecule reside in the area labeled A or the one labeled B?

B



Q11. When two strands of DNA come together to form a double helix in water:

a. What happens to the total number of
H-bonds in the total system: increase decrease **remain same**

b. What is the primary driving force leading to formation of the double helix:

increase in entropy of water molecules

Q12.
Match the following aqueous solutions with the appropriate letter from the column on the right.

☐	1. **0.28** m **KCH_3COO**	---- A. Lowest freezing point
☐	2. **0.20** m **$(NH_4)_2SO_4$**	---- B. Second lowest freezing point
☐	3. **0.18** m **$MgBr_2$**	---- C. Third lowest freezing point
☐	4. **0.50** m **Glucose** (nonelectrolyte)	---- D. Highest freezing point

ANS: 1-B 2-A 3-C 4-D

Q13. Compare pure water and a 1.0 m aqueous solution of NaCl.

Which has:	a. higher vapor pressure	**water**	or	the solution
	b. higher boiling point	water	or	**the solution**
	c. higher melting point	**water**	or	the solution

Q14. For the gas phase decomposition of hydrogen iodide at 700K
$2\ HI = H_2 + I_2$
the following data have been obtained:

[HI], M	1.82	0.714	0.444	0.322
t, s	0	710	1420	2130

3. The average rate of disappearance of HI over the time period from t=710 s to t=1420 s is:

$3.8 \times 10^{-4}\ M.s^{-1}$

4. The average rate of appearance of I_2 over the same time period is:

$1.9 \times 10^{-4}\ M.s^{-1}$

Q15 The reaction of nitrogen dioxide with carbon monoxide
$NO_2 + CO = NO + CO_2$
is second order in NO_2 and zero order in CO.

3. Write the rate law for this reaction: **$RATE = K[NO_2]^2$**

4. Doubling the initial concentration of CO would: (check 1)

Increase the Rate of the reaction. _____
Decrease the Rate of the reaction. _____
Have no effect on the Rate of the reaction. _____

Q16 The reaction of mercury(II) chloride with oxalate ion is found to have the following rate law:

$$Rate = k[HgCl_2][C_2O_4^{2-}]^2$$

In one experiment to determine this rate law, the rate of the reaction was found to be $1.95 \times 10^{-4}\ M.s^{-1}$ when $[HgCl_2] = 0.0710$ M and $[C_2O_4^{2-}] = 0.491$ M. What is the value of the rate constant for this reaction. [Show Work]

$K = Rate/\{(0.0710)(0.491)^2\} = 0.0114\ M^{-2}s^{-1}$

Q17 The following initial rate data are for the reduction of nitric oxide with hydrogen:
$2\ NO + 2\ H_2 \rightarrow N_2 + 2\ H_2O$

Exp	$[NO]_0$, M	$[H_2]_0$, M	Initial Rate, Ms^{-1}
1	0.440	0.365	0.0975
2	0.880	0.365	0.390
3	0.440	0.730	0.195

4. The order of the reaction with respect to NO is: **2**

5. The order of the reaction with respect to H_2 is: **1**

6. The overall order of the reaction is: **3**