

PRINT NAME _____

SIGN NAME _____

CIRCLE your recitation section in the list below.

A: W 8:00 NS 130	B: F 1:00 HM 210
C: T 9:00 NS 108	D: W 9:00 NS 317
E: Th 9:00 HM 210	F: F 12:00 NS 128

SCORED GRADE: _____

All answers should be with the correct significant figures.

Atomic weights are provided in the Periodic Table. These values must be used. The Periodic Table will not be collected. It may be used as scratch paper or as cover paper. Do not turn it in.

Be certain your answers are clear. If an answer is not clear, it can be considered wrong.

Problems marked with ** in the margin are from the assigned homework. These total 31 points.

Place your name in the space provided at the top of each question page. This helps to identify the pages if they are accidentally separated during grading and processing.

Work promptly. Use your time effectively.

SOME THINGS WHICH MAY OR MAY NOT BE USEFUL

$$T(\text{K}) = T(^{\circ}\text{C}) + 273$$

$$R = 0.08206 \text{ L}\cdot\text{atm}/(\text{mol}\cdot\text{K})$$

Heat and Heat Capacity

$$q = \Delta T \times \text{mass} \times c$$

Freezing point depression

$$\Delta T_f = K_f \times m$$

Osmotic pressure

$$\Pi = M \times R \times T$$

Gas solubility

$$[\text{A}(\text{aq})] = k_H \times P$$

****KEEP YOUR WORK AND ANSWERS COVERED.****

1. (30 pts) Indicate whether each statement is true (T) or false (F). Be certain T or F is clearly indicated.

_____ A system with more options for the distribution of energy has more entropy.

_____ For every pure substance, $\Delta H_{\text{cond}}^{\circ} = -\Delta H_{\text{vap}}^{\circ}$.

_____ Decreasing the pressure on a liquid will increase its boiling point.

_____ Water can sublime below 0 °C.

_____ CO₂ is more polarizable than SO₂.

_____ Each carbon atom in diamond is sp^3 hybridized and bonded to four other carbon atoms.

_____ All $\Delta H_{\text{soln}}^{\circ}$ values for gas phase solutes are negative.

_____ Helium is insoluble in water.

_____ All salts increase in solubility in water as temperature increases.

_____ A solution of 0.1 m glucose (C₆H₁₂O₆) will have a higher equilibrium vapor pressure than a solution of 0.05 m sucrose (C₁₂H₂₂O₁₁).

- ** 2. (4 pts) Your 2 L bottle of carbonated water has gone flat. If the solution in the bottle at equilibrium at 25 °C contains [CO₂(aq)] = 0.0016 M, then calculate (and circle) the pressure (in atm) of the CO₂(g) in the gas space. For CO₂, $k_{\text{H}} = 0.034 \text{ M/atm}$.

0.011 0.016 0.022 0.027 0.036 0.039

0.041 0.047 0.050 0.054 0.062 0.067

3. (5 pts) $\Delta H_{\text{sub}}^{\circ}$ for I₂ at 25 °C is 62.24 kJ. Circle the number of kJ required to sublime 36.0 g I₂.

6.01 6.82 7.34 7.91 8.13 8.83

9.51 9.72 10.8 15.9 20.6 23.3

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- ** 4. (6 pts) Consider the (pure) compounds below.



Which compound(s) have hydrogen bonding? _____

Which one compound has the weakest dispersion? _____

Which one compound has the strongest dispersion? _____

5. (6 pts) Consider a solution of 1.490 M magnesium sulfate, which has a density of 1.165 g/mL. Circle the mole% of the solute.

2.13%

2.37%

2.65%

2.72%

3.08%

3.20%

3.69%

3.73%

4.15%

4.39%

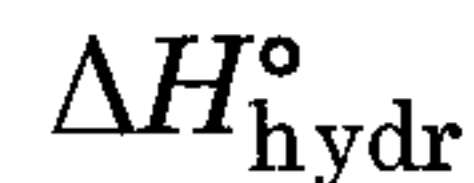
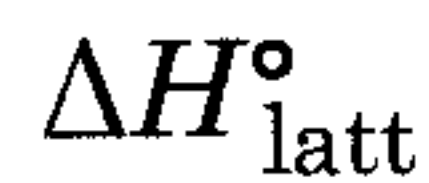
4.45%

4.71%

- ** 6. (9 pts) Which intermolecular forces are operating for each of the following (pure) compounds?



7. (9 pts) Consider the following enthalpy terms.



Which term represents the energy required to separate the molecules of a liquid? _____

Which term represents the change in energy upon dissolving a liquid into water? _____

How many of the terms are ALWAYS negative (exothermic)? _____

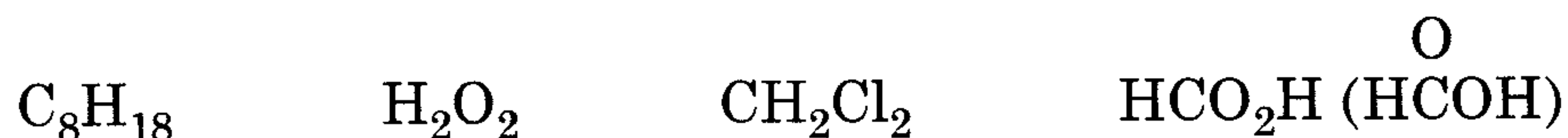
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8. (6 pts) For each compound below in water, list the primary intermolecular forces which are operating between the compound and the water.

CS₂ _____

PH₃ _____

- ** 9. (6 pts) Consider the following compounds, all of which are liquids by themselves.



Two are miscible in water. Which are they? _____

One is soluble but not miscible. Which is it? _____

One is insoluble and immiscible. Which is it? _____

- ** 10. (6 pts) A solution is composed of 5.11 g disulfur dichloride in 50.0 g carbon tetrachloride. What is the molality of the disulfur dichloride in this solution?

0.503 0.563 0.582 0.620 0.637 0.699

0.735 0.757 0.782 0.811 0.846 0.877

11. (5 pts) The structure of calcium fluoride is based on an fcc lattice of calcium ions. How many cations and anions are in one unit cell?

cations _____ anions _____

12. (2 pts) What is the strongest IF in (pure) Cl₃PS? _____

(2 pts) Comparing Br⁻ and I⁻, which one has the greater charge density? _____

(2 pts) Comparing SiF₄ and CF₄, which one has the lower EVP at 25 °C? _____

(2 pts) Comparing SiO₂, NO₂ and SO₂, one is a solid at 25 °C. Which one is the solid? _____