CHEM 1515.901
Exam I
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Name _____

TA's Name _____

Please sign your name below to give permission to post, by the last 4 digits of your student I.D. number, your course scores on homework, laboratories and exams. If you do not give me permission by signing I will not post any of your scores.

_____
(signature)

INSTRUCTIONS:

1. This examination consists of a total of 8 different pages. The last three pages include a periodic table, a table of vapor pressures for water, a solubility table and a table of thermodynamic values. All work should be done in this booklet.

2. PRINT your name, TA's name and your lab section number now in the space at the top of this sheet. DO NOT SEPARATE THESE PAGES.

3. Answer all questions that you can and whenever called for show your work clearly. Your method of solving problems should pattern the approach used in lecture. You do not have to show your work for the multiple choice or short answer questions.

4. No credit will be awarded if your work is not shown in problems 1b, 1d, 1e, 5b, 5d-f and 7.

5. Point values are shown next to the problem number.

6. Budget your time for each of the questions. Some problems may have a low point value yet be very challenging. If you do not recognize the solution to a question quickly, skip it, and return to the question after completing the easier problems.

7. Look through the exam before beginning; plan your work; then begin.

8. Relax and do well.

	Page 2	Page 3	Page 4	Page 5	TOTAL
SCORES	_____	_____	_____	_____	_____
	(32)	(22)	(30)	(16)	(100)

1. Tungsten can be obtained commercially by the reduction of tungsten(VI) oxide by dihydrogen to form tungsten metal and water vapor. The following thermodynamic data is known;

	Tungsten(VI) oxide*(s)*	Water*(g)*
ΔH_f° (kJ·mol^{-1})	–840.3	–241.8
ΔG_f° (kJ·mol^{-1})	–763.4	–228.4

(4) a) Write the balanced chemical equation for the reaction described above.

(12) b) Calculate ΔH° and ΔG° for this reaction.

(4) c) Is this reaction spontaneous st 25 $^\circ$C? (Briefly explain how you arrived at your answer.)

(4) d) At what temperature will this reaction be spontaneous?

(8) e) If S° for tungsten metal is 33 J·mol^{-1}·K^{-1}. Calculate the ΔS_f° for tungsten(VI) oxide.

(12) 2. In each of the following groups, pick the member which has the given property. Explain your answer.

a) highest boiling point; CO_2, CSe_2, CS_2

b) lowest boiling point; HF, HCl, HBr

c) lowest vapor pressure at 25 ˚C; H_2SO_4, NH_3, $CH_3CH_2CH_2CH_3$

(10) 4. Identify the interparticle attractive forces present in the solids of the following substances. If more than one interparticle force, indicate which is the most important.

a) $CHCl_3$

b) $BaSO_4$

c) CH_3OH

d) $C_{diamond}$

(2) 5a. Write the chemical equation which describes the vaporization of trichloromethane, $CHCl_3$.

(4) b) Calculate ΔH°_{rxn} (ΔH°_{vap}) for this phase change.

(4) c) Is the process decribed in the chemical equation in part a) endothermic, or exothermic? Briefly explain, using a molecular level description, why the phase change from liquid to vapor is endothermic or exothermic.

(8) d) Calculate the *normal* boiling point for trichloromethane if the equilibrium vapor pressure at 15.0 ˚C is 122 mmHg

(6) e) Calculate the entropy change, ΔS°, for the phase change.

(6) f) A 1.00 gram sample of trichloromethane is placed into an evacuated 1.00 L container at 75.0 ˚C. The container is then cooled to 15.0 ˚C. Describe the phase(s) present at 15.0 ˚C.