NAME _____

CHEMISTRY 102 FALL 2008

EXAM 1 FORM D SECTION 502 DR. KEENEY-KENNICUTT

Directions: (1) Put your name on PART 1 and your name and signature on PART 2 of the exam where indicated.
(2) Sign the Aggie Code on PART 2 of this exam.
(3) Each multiple choice question is actually 2 questions on your scanning sheet. If you are sure of an answer, **put the same answer down for both questions** for 5 pts. If you cannot decide between two answers, put your best answer down for the first (odd) question and the other answer down for the second (even) question. If you get the first one correct you'll get 3 pts; if you get the second one correct you'll get 2 pts. If there is an ambiguous multiple choice question, use the last page to explain your answer.
(4) Do NOT write on the envelope.
(5) When finished, put everything in the envelope and wait to be excused. At the table, take everything out of the envelope. You can pick up the multiple choice part with the answers outside my office after 3pm.
(6) There are a total of 33 questions (19 actual questions).

PART 1

1&2. Which of the following pairs of liquids are NOT miscible?

(a) CHOOH / CCl_4
(b) CCl_4 / $CHCl_3$
(c) CH_3CH_2OH / H_2O
(d) CH_3CH_2OH / CH_3OH
(e) C_6H_6 / CCl_4

3&4. For a solution of Na_3PO_4, the ideal van't Hoff factor, i_{ideal}, would be:

(a) 2 (b) 3 (c) 4 (d) 6 (e) 8

5&6. Which statement(s) list(s) the substance with the lower entropy first and the higher entropy second?

(1) 1 mole of N_2 in a 20 L container < 1 mole of N_2 in a 10 L container
(2) $H_2O(s)$ at 0^oC < $H_2O(\ell)$ at 0^oC
(3) CHOOH < CH_3COOH

(a) 2 only (b) 1, 2 only (c) 1 only (d) 2,3 only (e) 1, 2, 3

7&8. Which of the following statements is FALSE?

(a) $\Delta S_{universe} = \Delta S_{surroundings} + \Delta S_{system}$

(b) A reaction is spontaneous if $\Delta S_{surroundings}$ increases.

(c) Hess' Law allows you to calculate the entropy involved in a reaction.

(d) Exothermic processes are those with $\Delta H < 0$.

(e) If a reaction is endothermic, heat is being absorbed.

9&10. Which of the following compounds has $\Delta H^{o}_{f\,298} = 0$?

(a) Fe(g) (b) Hg(s) (c) N(g) (d) Ne(g) (e) $I_2(g)$

11&12. The best representation for the reaction whose heat of reaction is equal to the standard molar enthalpy of formation for $CaCO_3(s)$ is:

(a) $CaCO_3(s) \rightarrow Ca(s) + C(graphite,s) + 3/2\ O_2(g)$

(b) $Ca^{2+}(aq) + CO_3^{2-}(aq) \rightarrow CaCO_3(s)$

(c) $Ca(s) + C(graphite,s) + 3/2\ O_2(g) \rightarrow CaCO_3(s)$

(d) $2Ca(s) + 2\ C(diamond,s) + 3O_2(g) \rightarrow 2CaCO_3(s)$

(e) $CaCO_3(s) \rightarrow Ca^{2+}(aq) + CO_3^{2-}(aq)$

13&14. Here is a listing of the molal boiling point constants (K_b values) for 3 solvents. If 0.10 mol of a soluble, nonelectrolyte were dissolved in 100 g of each solvent, what will be the order of increasing boiling point elevations of the resulting solutions?

(1)	Ethanol	1.22 ^{o}C/m
(2)	Chloroform	3.67 ^{o}C/m
(3)	Benzene	2.53 ^{o}C/m

(a) (1) < (2) < (3) (b) (2) < (1) < (3) (c) (3) < (2) < (1)

(d) (3) < (1) < (2) (e) (1) < (3) < (2)

15&16. Which of the following statements is FALSE about osmotic pressure?

(a) Osmotic pressure can be measured in torr or atmospheres.

(b) It results from the flow of solute across a semi-permeable membrane.

(c) When a semi-permeable membrane separates 2 solutions of different concentrations, solvent flows through the membrane to try to equalize the concentrations.

(d) It is a colligative property.

(e) It depends on the number of particles (ions, molecules or a mixture of both) in the solution.

17&18. What mass of water must be used to dissolve 40.0 grams of ethanol, C_2H_5OH to prepare a 0.100 molal solution of ethanol?

(a) 8.68 kg (b) 3.76 kg (c) 4.00 kg (d) 7.18 kg (e) 6.35 kg

19&20. If 4.27 grams of sucrose, $C_{12}H_{22}O_{11}$ are dissolved in 16.2 grams of water, what will be the boiling point of the resulting solution? K_b for water = 0.512 $^oC/m$?

(a) 101.64^oC (b) 100.39^oC (c) 99.626^oC (d) 100.73^oC (e) 101.42^oC

21&22. What is the enthalpy change of the reaction below at 298 K and 1 atm pressure?

	$CO_2(g)$	+	$2H_2S(g)$	$\rightarrow$	$CS_2(\ell)$	+	$2H_2O(\ell)$
$\Delta H^\circ_{f\,298}$ (kJ/mol)	−394.0		−20.2		+89.5		−286.0

(a) +144 kJ (b) +227 kJ (c) −461.7 kJ (d) −48.1 kJ (e) −311.6 kJ

23&24. When 20.0 grams of an unknown nonelectrolyte are dissolved in 500. grams of benzene, C_6H_6, the freezing point of the resulting solution is 3.77°C. Pure benzene freezes at 5.48°C and its K_f value is 5.12 °C/m. What is the molecular weight of the compound?

(a) 120. g/mol (b) 80.0 g/mol (c) 100. g/mol (d) 140. g/mol (e) 160. g/mol

25&26. What is the molarity of a 5.52 m aqueous solution of $CaCl_2$ if the density of the solution is 1.37 g/mL? (Assume that you have 1kg = 1000 g of water.)

(a) 5.10 M (b) 5.34 M (c) 5.58 M (d) 3.15 M (e) 4.69 M

27&28. Consider the following reaction: $2\ K(s) + 2\ H_2O(\ell) \rightarrow H_2(g) + 2\ KOH(aq)$ $\Delta H = -391$ kJ/mol rxn

How much heat is evolved if 25.0 g of potassium metal react with excess water?

(a) −83.5 kJ (b) 53.2 kJ (c) 724 kJ

(d) 255 kJ (e) 125 kJ

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PART 2

Please read and sign: "On my honor, as an Aggie, I have neither given nor received unauthorized aid on this exam." _____

(12 pts) **29.** Give the name or formula to the following compounds:

(a) sodium nitride

(b) iron(II) hydrogen carbonate

(c) $(NH_4)_2SO_4$

(d) $Ca(NO_2)_2$

(e) ethane

(f) CCl_4

30. Consider this reaction at 25°C:

	$2SO_2(g)$	+	$O_2(g)$	→	$2SO_3$ (g)
S^o_{298} (J/mol·K)	248.1		205.0		256.6

(2 pt) (a) Does the entropy of the system increase or decrease as the reaction goes forward? Why? (No calculation required).

(3 pts) (b) Calculate ΔS^o for the system:

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(3 pts) (d) Calculate $\Delta S^{o}_{surroundings}$ if the ΔH^{o} for the forward reaction is -197.6 kJ at $25^{o}C$:

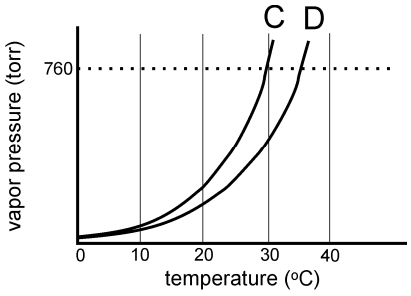
(2 pts) (e) Calculate $\Delta S^{o}_{universe}$ in J/K:

(1 pt) (f) Is the reaction spontaneous? _____ (yes or no)

(5 pts) **31.** An aqueous solution of 2.00 g of barium perchlorate in 450. mL will have an osmotic pressure (in torr) at $30^{o}C$ of approximately: (Assume complete dissociation of the salt.) For partial credit, use NaCl. R = 62.4 L·torr/mol·K.

32. (2 pts) Consider the diagram given on the right, showing the vapor pressure curves for two systems as a function of temperature. Curve C is the vapor pressure curve for Liquid C and Curve D results when a solute is dissolved in Liquid C.

What is the approximate normal boiling point of the solution: _____^{o}C:



33. Grammar Bonus (1pt): The average person _____ (breathes/breathe) 7 quarts of air per minute.

SCRAP PAPER OR COMMENTS ON EXAM

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