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## CHEMISTRY 102 EXAM 1 FORM A

### **SECTION 501**

## FALL 2010 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 35 questions (19 actual questions).

# PART 1

- **1&2.** In preparing a solution labeled in molality using a solvent for which the density is unknown, it would **NOT** be appropriate to measure:
  - (1) total solution volume
  - (2) solute mass
  - (3) solvent volume
  - (4) solvent mass
  - (a) 3,4 (b) 2,3 (c) 1,2 (d) 2,4 (e) 1,3

**3&4.** Which of the following statements about a mixture of water and benzene, C<sub>6</sub>H<sub>6</sub>, is/are **TRUE**?

- (1) Benzene, C<sub>6</sub>H<sub>6</sub>, and water must have similar polarities because they don't mix.
- (2) Both molecules exhibit hydrogen bonding because they both have hydrogens in their formula.
- (3) A "boundary" will be formed between the two liquids.

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

**5&6.** What are the ideal van't Hoff factors for the following compounds: Ba(OH)<sub>2</sub>, C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>, K<sub>2</sub>SO<sub>4</sub>, NaNO<sub>3</sub>?

- (a) 1, 1, 1, 1 (b) 2, 1, 2, 2
- (c) 3, 1, 3, 2
- (d) 6, 3, 5, 5
- (e) none of the above

7&8. Which of the following gives an <u>element</u> in its thermodynamic standard state?

(a) Sn(aq) (b) Hg(s) (c) K(g) (d)  $Cl_2(g)$  (e)  $CO_2(g)$ 

#### **9&10.** Which observation(s) reflect(s) colligative properties?

- (1) A 0.5 m copper(II) sulfate solution is blue, while a 0.50 m glucose solution is colorless.
- (2) A 0.50 m copper(II) sulfate solution has a lower freezing point than a 0.50 m glucose solution.
- (3) Pure water freezes at a higher temperature than does pure ethanol.
- (a) only 2 (b) 2,3 (c) only 1 (d) 1&3 (e) only 3
- 11&12. Which is a FALSE statement about this graph?
  - (a) It can represent how vapor pressure changes with temperature for a pure solvent and a solution.
  - (b) The normal boiling point of the solution is at the intersection between curve D and 760 torr.
  - (c) The boiling point of the pure solvent is about  $35^{\circ}$ C.
  - (d) The boiling point of a solution is higher than the boiling point of the pure solvent.
  - (e) The rate of evaporation increases with increasing temperature.



- **13&14.** Osmotic pressure is important in maintaining a proper solute concentration across a semipermeable membrane in biological systems. The following statements pertain to osmotic pressure. Which of the following statements is **TRUE**?
  - (a) Osmotic pressure is the pressure required to prevent the passage of a solute across a semipermeable membrane because of concentration differences .
  - (b) Solutions of 0.10 M NaCl and 0.10 M  $C_6H_{12}O_6$  would have the same osmotic pressure.
  - (c) A higher concentration of solute particles creates a lower osmotic pressure.
  - (d) The concentration of solution particles has no effect on the osmotic pressure of a solution.
  - (e) Only the pure solvent molecules will cross a semi-permeable membrane.
- **15&16.** From the table of thermodynamic data, we see that  $\Delta H_{f_{298}}^{\circ}$  (kJ/mol) for MgO(s) is -601 kJ/mol. This value is the  $\Delta H$  for the following reaction:
  - (a)  $Mg(s) + O(g) \rightarrow MgO(s)$
  - (b) MgO(s)  $\rightarrow$  Mg(s) +  $\frac{1}{2}$  O<sub>2</sub>(g)
  - (c)  $2MgO(s) \rightarrow Mg(s) + O_2(g)$
  - (d)  $Mg(s) + \frac{1}{2}O_2(g) \rightarrow MgO(s)$
  - (e)  $2Mg(s) + O_2(g) \rightarrow 2MgO(s)$

17&18. Which choice includes ALL the following processes that are accompanied by an increase in entropy?

(1)  $I_2(s) \rightarrow I_2(g)$ (2)  $2I(g) \rightarrow I_2(g)$ (3)  $2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$ (4)  $Mg^{2+}(aq) + 2OH^{-}(aq) \rightarrow Mg(OH)_2(s)$ (a) 1,2(b) 1,3(c) 3,4(d) 3(e) 2,4

**19&20.** Consider the following reaction:  $X \rightarrow Y$  with  $\Delta$ Hrxn = +200 kJ and  $\Delta$ Srxn = -60 J/K. We know:

- (a) the reaction is exothermic and becoming more ordered
- (b) the reaction is exothermic and becoming less ordered
- (c) the reaction is endothermic and becoming more ordered
- (d) the reaction is endothermic and becoming less ordered
- (e) it is impossible to know

#### 21&22. Which statement is TRUE?

- (a) The sign of  $\Delta H$  determines whether or not a reaction is spontaneous.
- (b) A synonym for entropy is order.
- (c) The entropy of any substance is 0 at absolute 0 Kelvin.
- (d) For a spontaneous reaction, the entropy of the system must increase.
- (e) The ionization of a weak acid is reactant-favored.

**23&24.** How many grams of water must be added to 15.0 g of Ca(NO<sub>3</sub>)<sub>2</sub> to prepare a 0.200 m Ca(NO<sub>3</sub>)<sub>2</sub> solution?

(a) 0.471 g (b) 19.0 g (c) 75.0 g (d) 214 g (e) 457 g

**25&26.** What is the boiling point of an aqueous solution prepared by dissolving 45.0 g of C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>, a nonelectrolyte, in 160.0 g of <u>solution</u>?

(a) 101.11°C (b) 1.11°C (c) 100.95°C (d) 100.42°C (e) 0.85°C

**27&28.** Calculate the molarity of a 10.0% MgSO<sub>4</sub> solution. The resulting solution has a density of 1.10 g/mL.

(a) 0.914 M	(b) 0.749 M	(c) 0.840 M	(d) 0.955 M	(e) 0.711 M
	(*) •	(0) 010 10 11	()	(•) •

29&30.	Consider this process: $H_2O(g) \rightarrow H_2O(\ell)$	$\Delta H_{\text{process}} = -44.0 \text{ kJ}$	ar
	What is the $\Delta S_{\text{universe}}$ at 25°C and is the read	ction spontaneous at 25°C?	

- (a) +370 J/K, no (b) +29 J/K, yes
- (c) -62 J/K, yes (d) -75 J/K, no
- (e) +22 kJ/K, no

**31&32.** An aqueous solution containing 10.5 g of a polymer (nonelectrolyte) in 200. mL of a benzene solution has an osmotic pressure of 0.037 atm at 35°C. What is the apparent formula weight of the polymer?

- (a) 73,000 g/mol
- (d) 21,000 g/mol
- (b) 49,000 g/mol
- (e) 3,300 g/mol

(c) 36,000 g/mol

and  $\Delta S_{\text{process}}$  = –119 J/K

# CHEMISTRY 102

FALL 2010

NAME\_\_\_\_\_

EXAM 1

Section 501

(Please Block Print)

Form A

# PART 2

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

(8 pts) **33.** Give the name or formula to the following compounds:

(a) lithium bromide \_\_\_\_\_

(b) cobalt(III) sulfite \_\_\_\_\_

(c) Fe(CH<sub>3</sub>COO)<sub>2</sub>

(d) Na<sub>2</sub>CO<sub>3</sub>

(5 pts) **34.** How many grams of potassium phosphate are required to dissolve in 350. mL of water to prepare a solution that will freeze at -1.00°C?

### $OVER \Rightarrow$

#### **35.** Consider the following reaction:

	SiCl <sub>4</sub> (g)	+	2 H₂O(ℓ)	$\rightarrow$	SiO <sub>2</sub> (s)	+	4 HCI(g)
$\Delta H^{o}_{f_{298}}$ (kJ/mol)	-663.8		-285.8		-910.9		-92.3

(3 pts) (a) What is the  $\Delta H_{rxn}$  for this reaction?

(4 pts) (b) How many grams of water must react when this reaction releases 100.0 kJ of heat?

# SCRAP PAPER OR COMMENTS ON EXAM

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