

**CHEMISTRY 102****FALL 2010****EXAM 1 FORM B****SECTION 501****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.** Which of the following gives an element in its thermodynamic standard state?

- (a) Sr(s)      (b) Hg(s)      (c) CO<sub>2</sub>(g)      (d) C(s, diamond)      (e) N<sub>2</sub>(s)

**3&4.** Which observation(s) reflect(s) colligative properties?

- (1) A 0.50 m copper(II) sulfate solution has a lower freezing point than a 0.50 m glucose solution.  
(2) Pure water freezes at a higher temperature than does pure ethanol.  
(3) A 0.5 m copper(II) sulfate solution is blue, while a 0.50 m glucose solution is colorless.

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

**5&6.** In preparing a solution labeled in molality using a solvent for which the density is unknown, it would **NOT** be appropriate to measure:

- (1) solvent mass      (2) total solution volume      (3) solute mass      (4) solvent volume

- (a) 3,4      (b) 2,3      (c) 1,3      (d) 2,4      (e) 1,2

**7&8.** Which choice includes **ALL** the following processes that are accompanied by an increase in entropy?

- (1) Br<sub>2</sub>(s) → Br<sub>2</sub>(l)      (2) Mg(OH)<sub>2</sub>(s) → Mg<sup>2+</sup>(aq) + 2OH<sup>-</sup>(aq)  
(3) 2Br(g) → Br<sub>2</sub>(g)      (4) N<sub>2</sub>(g) + 3H<sub>2</sub>(g) → 2NH<sub>3</sub>(g)

- (a) 1,2      (b) 1,3      (c) 3,4      (d) 3      (e) 2,4

**9&10.** Which of the following statements about a mixture of water and methanol,  $\text{CH}_3\text{OH}$ , is/are **TRUE** ?

- (1) Methanol,  $\text{CH}_3\text{OH}$ , must have very different polarities because they mix.
- (2) A "boundary" will be formed between the two liquids.
- (3) Both molecules exhibit hydrogen bonding.

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

**11&12.** From the table of thermodynamic data, we see that  $\Delta H_{f,298}^\circ$  (kJ/mol) for  $\text{NO}_2(\text{g})$  is +33.1 kJ/mol. This value is the  $\Delta H$  for the following reaction:

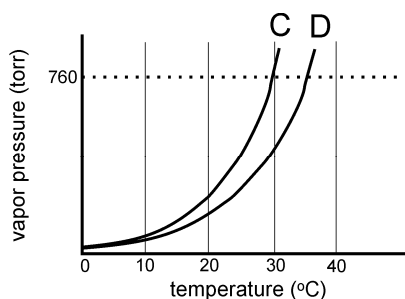
- (a)  $\text{N}_2(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow 2\text{NO}_2(\text{g})$
- (b)  $2\text{NO}_2(\text{g}) \rightarrow \text{N}_2(\text{g}) + 2\text{O}_2(\text{g})$
- (c)  $2\text{N}(\text{g}) + \text{O}_2(\text{g}) \rightarrow \text{NO}_2(\text{g})$
- (d)  $\text{NO}_2(\text{g}) \rightarrow \frac{1}{2} \text{N}_2(\text{g}) + \text{O}_2(\text{g})$
- (e)  $\frac{1}{2} \text{N}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow \text{NO}_2(\text{g})$

**13&14.** What are the ideal van't Hoff factors for the following compounds:  $\text{Li}_3\text{PO}_4$ ,  $\text{NaOH}$ ,  $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ ,  $\text{Ca}(\text{NO}_3)_2$  ?

- (a) 1, 1, 1, 1
- (b) 4, 2, 1, 3
- (c) 3, 1, 4, 2
- (d) 7, 2, 1, 9
- (e) none of the above

**15&16.** Which is a **FALSE** statement about this graph?

- (a) The rate of evaporation increases with increasing temperature.
- (b) It can represent how vapor pressure changes with temperature for a pure solvent and a solution.
- (c) The normal boiling point of the solvent is at the intersection between curve C and 760 torr.
- (d) The boiling point of a solution is higher than the boiling point of the pure solvent.
- (e) The boiling point of the solution is about  $30^\circ\text{C}$ .



**17&18.** Which statement is **TRUE**?

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

**19&20.** 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) The concentration of solution particles has no effect on the osmotic pressure of a solution.
- (b) Only the pure solute will cross a semi-permeable membrane.
- (c) Solutions of 0.10 M NaCl and 0.10 M NaNO<sub>3</sub> would have the same osmotic pressure.
- (d) Osmotic pressure is the pressure required to prevent the passage of a solute across a semi-permeable membrane because of concentration differences.
- (e) A higher concentration of solute particles creates a lower osmotic pressure.

**21&22.** Consider the following reaction:  $A \rightarrow C$  with  $\Delta H_{\text{rxn}} = -200 \text{ kJ}$  and  $\Delta S_{\text{rxn}} = +60 \text{ J/K}$ .  
We know:

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

**23&24.** When preparing a 0.350 m solution of Na<sub>2</sub>CO<sub>3</sub>, what mass of water (in grams) must be added to 10.0 g of Na<sub>2</sub>CO<sub>3</sub>?

- (a) 0.171 g      (b) 270 g      (c) 35 g      (d) 230 g      (e) 114 g

**25&26.** What is the boiling point of an aqueous solution prepared by dissolving 55.0 g of  $C_{12}H_{22}O_{11}$ , a non-electrolyte, in enough water to make 260.0 g of solution?

- (a)  $100.11^{\circ}\text{C}$     (b)  $0.40^{\circ}\text{C}$     (c)  $100.95^{\circ}\text{C}$     (d)  $100.40^{\circ}\text{C}$     (e)  $0.85^{\circ}\text{C}$

**27&28.** Calculate the molarity of an 11.0%  $\text{CuSO}_4$  solution. The resulting solution has a density of 1.12 g/mL.

- (a) 0.772 M    (b) 0.693 M    (c) 0.840 M    (d) 0.625 M    (e) 0.711 M

**29&30.** An aqueous solution containing 8.5 g of a polymer (nonelectrolyte) in 220. mL of a benzene solution has an osmotic pressure of 14 torr at 30.°C. What is the apparent formula weight of the polymer?

- |                 |                  |                  |
|-----------------|------------------|------------------|
| (a) 7,000 g/mol | (b) 37,000 g/mol | (c) 14,000 g/mol |
| (d) 1,000 g/mol | (e) 52,000 g/mol |                  |

**31&32.** Consider this process:  $\text{H}_2\text{O}(\ell) \rightarrow \text{H}_2\text{O}(\text{g})$        $\Delta H_{\text{process}} = +44.0 \text{ kJ}$     and  $\Delta S_{\text{process}} = +119 \text{ J/K}$   
What is the  $\Delta S_{\text{universe}}$  at 25°C and is the reaction spontaneous at 25°C?

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



---

---

**PART 2**

---

---

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

---

---

33. Consider the following reaction:

	$\text{SF}_6(\text{g})$	+	$3 \text{H}_2\text{O}(\ell)$	$\rightarrow$	$6 \text{HF}(\text{g})$	+	$\text{SO}_3(\text{g})$
$\Delta H_{\text{f}298}^\circ$ (kJ/mol)	-1209		-286		-271		-396

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

(4 pts) (b) How many grams of water must react when this reaction absorbs 200.0 kJ of heat?

**OVER  $\Rightarrow$**





(5 pts) **34.** How many grams of barium nitrate are required to dissolve in 250. mL of water to prepare a solution that will freeze at  $-1.00^{\circ}\text{C}$ ?

(8 pts) **35.** Give the name or formula to the following compounds:

- (a) iron(III) fluoride \_\_\_\_\_
- (b) ammonium carbonate \_\_\_\_\_
- (c)  $\text{Cu}(\text{ClO}_2)_2$  \_\_\_\_\_
- (d)  $\text{Na}_2\text{S}$  \_\_\_\_\_

## SCRAP PAPER OR COMMENTS ON EXAM

---

---

**CHEMISTRY 102**

**FALL 2010**

NAME \_\_\_\_\_

EXAM 1 Form B

Section 501

---

---