

CHEMISTRY 102**FALL 2010****EXAM 1 FORM C****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 36 questions (20 actual questions).

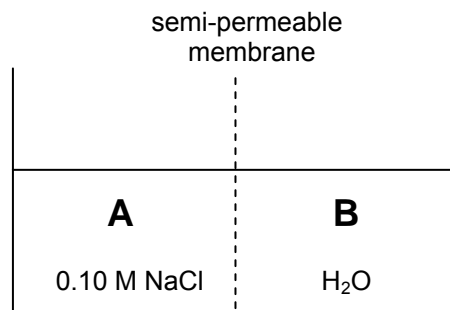
PART 1

1&2. Which of the following statements is **FALSE** about solubility and miscibility?

- (a) Iodine, $I_2(s)$, should be more soluble in carbon tetrachloride, CCl_4 , than water.
- (b) $CsCl$ is more soluble in water than CaS .
- (c) In the phrase "Like dissolves like," the term "like" refers to molecules with similar molecular weights.
- (d) Benzene, C_6H_6 , is miscible in chloroform, $CHCl_3$.
- (e) Water and methanol, CH_3OH are miscible.

3&4. Two liquids of equal volumes are separated by a semi-permeable membrane: 0.10 M NaCl and pure water, as shown in the diagram. Select the **CORRECT** answer.

- (a) The net flow of water molecules will be from 0.10 M NaCl into the pure water.
- (b) The solution level of Side A will rise.
- (c) This system does not exhibit a colligative property.
- (d) If the concentration of NaCl is increased to 0.20 M NaCl, no effect will be seen.
- (e) If side B is replaced with 0.10 KBr, the osmotic pressure will not change.



5&6. Which of the following has a value of 0 kJ/mol for its ΔH_f° ?

- (a) $Ti(g)$
- (b) $Hg(s)$
- (c) $N(g)$
- (d) $H_2(g)$
- (e) $I_2(g)$

7&8. The units of molarity are:

- (a) mol solute/kg solution (b) g solute/kg solvent (c) g solute/g solvent
(d) mol solute/L solution (e) mole solute/kg solvent

9&10. Which statement(s) list(s) the substance with the lower entropy first and the higher entropy second?

- (1) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3 < \text{CH}_3\text{CH}_3$
(2) 2 moles of $\text{O}_2(\text{g})$ in 10 liters < 2 moles of $\text{O}_2(\text{g})$ in 5 liters
(3) $\text{C}_6\text{H}_6(\ell)$ at $20^\circ\text{C} < \text{C}_6\text{H}_6(\ell)$ at 40°C

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

11&12. The best representation for the reaction whose heat of reaction is equal to the standard molar enthalpy of formation for $\text{CHCl}_3(\text{g})$ is:

- (a) $\text{C}(\text{s,graphite}) + \frac{1}{2} \text{H}_2(\text{g}) + \frac{3}{2} \text{Cl}_2(\text{g}) \rightarrow \text{CHCl}_3(\text{g})$
(b) $2\text{C}(\text{s,graphite}) + \text{H}_2(\text{g}) + 3 \text{Cl}_2(\text{g}) \rightarrow 2\text{CHCl}_3(\text{g})$
(c) $\text{CHCl}_3(\text{g}) \rightarrow \text{C}(\text{s,graphite}) + \frac{1}{2} \text{H}_2(\text{g}) + \frac{3}{2} \text{Cl}_2(\text{g})$
(d) $2\text{CHCl}_3(\text{g}) \rightarrow 2\text{C}(\text{s,graphite}) + \text{H}_2(\text{g}) + 3 \text{Cl}_2(\text{g})$
(e) $\text{C}(\text{s,graphite}) + \text{H}(\text{g}) + 3\text{Cl}(\text{g}) \rightarrow \text{CHCl}_3(\text{g})$

13&14. Which of the following statements is **FALSE**?

- (a) ΔS is a state function.
(b) A reaction is spontaneous if $\Delta S_{\text{universe}}$ decreases.
(c) Endothermic processes are those that absorb heat.
(d) At absolute 0 K, the entropy of a pure perfect crystalline substance is zero.
(e) The system's enthalpy alone does not determine the spontaneity of a reaction.

15&16. Which statement(s) is/are **TRUE**?

- (1) When $\Delta H < 0$, the reaction is exothermic.
(2) If $\Delta S > 0$, the reaction is becoming more ordered.
(3) When heat is released by the system, the entropy of the surroundings increases.

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

17&18. 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)	1.33 °C/m
(2)	3.72 °C/m
(3)	2.49 °C/m

- (a) (1) < (2) < (3) (b) (2) < (1) < (3) (c) (2) < (3) < (1)
 (d) (3) < (1) < (2) (e) (1) < (3) < (2)

19&20. Which statement is **TRUE** about aqueous solutions?

- (a) As the value of the van't Hoff factor of the solute increases, the freezing point of the solution will increase.
 (b) When the molality of the solute doubles, the boiling point of the solution will double.
 (c) When a solute dissolves into the solvent, the vapor pressure of the solution will be lower than the vapor pressure of the pure solvent at a particular temperature.
 (d) A solution is a heterogeneous mixture in which no settling occurs.
 (e) A solution can only be made by dissolving a solid into a liquid.

21&22. Which of these aqueous solutions will freeze at the same temperature? No calculations required.

- (1) 0.2 m NaCl (2) 0.1 m Na_3PO_4 (3) 0.2 m $\text{C}_6\text{H}_{12}\text{O}_6$

- (a) all of these
 (b) none of these
 (c) 1&3
 (d) 2&3
 (e) 1&2

23&24. What will be the final solution volume (in mL) when 5.00 g of NiCl_2 is used to prepare a 0.165 M NiCl_2 solution?

- (a) 234 mL (b) 6.45 mL (c) 115 mL (d) 71.5 mL (e) 165 mL

25&26. What will be the freezing point of an aqueous solution prepared by dissolving 50.0 g of ethylene glycol ($\text{C}_2\text{H}_6\text{O}_2$ – a nonelectrolyte) in 250. g of water?

- (a) -4.91°C (b) -7.35°C (c) -1.27°C (d) -3.15°C (e) -5.99°C

27&28. Calculate the % by mass of a 5.33 M NaCl solution. The density of the solution is 1.20 g/mL.

- (a) 19.4% (b) 22.9% (c) 23.4% (d) 26.0% (e) 31.6%

29&30. Given: $4 \text{HNO}_3(\ell) \rightarrow 4 \text{NO}_2(\text{g}) + 2 \text{H}_2\text{O}(\ell) + \text{O}_2(\text{g})$ with $\Delta H_{\text{rxn}} = +250. \text{ kJ/mol rxn}$

How much heat must be absorbed to produce 30.0 g of $\text{NO}_2(\text{g})$?

- (a) 15.9 kJ (b) 166 kJ (c) 40.8 kJ (d) 212 kJ (e) 115 kJ

31&32. When 30.4 g of naphthalene, C_{10}H_8 (128 g/mol), is dissolved in 375 g of nitrobenzene, $\text{C}_6\text{H}_5\text{NO}_2$, the solution boils at 214.20°C . The boiling point of pure nitrobenzene is 210.88°C . Calculate the K_b for nitrobenzene.

- (a) 5.24°C/m (b) 2.11°C/m (c) 6.35°C/m (d) 0.677°C/m (e) 4.92°C/m

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:

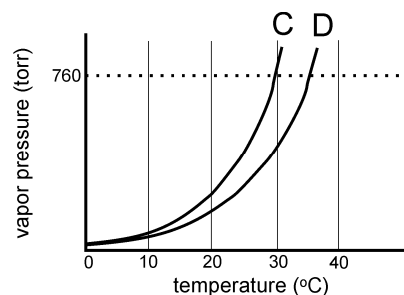
- (a) sodium iodide _____
- (b) ammonium hypochlorite _____
- (c) $\text{Cr}(\text{CN})_3$ _____
- (d) $\text{Ca}(\text{NO}_3)_2$ _____

(2 pts) **34.** Consider the diagram given on the right, showing the vapor pressure curves for a pure solvent and a solution made with that solvent as a function of temperature.

(a) The intersection of curve D with the line, 760 torr, represents:

_____.

(b) What is the boiling point elevation at 1 atm? _____



(5 pts) **35.** In the lab, the labels fell off two bottles of potassium salts: KF (58.1 g/mol) and KBr (119 g/mol). A 0.258 g sample of one of the salts was dissolved in enough water to make 250. mL of solution. Its osmotic pressure was measured to be 328 torr at 30°C. Which salt was dissolved? The correct answer without work will give you only 1 point; you must show all your calculations.

OVER ⇒

(5 pts) **36.** Using the data below, calculate ΔS of the universe to determine if this reaction is spontaneous or not at 25°C and explain.

	2 Fe ₂ O ₃ (s)	→	4 Fe(s)	+	3 O ₂ (g)
S° (J/mol•K)	87.4		27.3		205.0
$\Delta H_{f,298}^{\circ}$ (kJ/mol)	−824.2		0		0

SCRAP PAPER OR COMMENTS ON EXAM

CHEMISTRY 102

EXAM 1 Form C

FALL 2010

Section 502

NAME _____
