

001

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McCord CH302

unique: 49175 and 49190

Exam 1

Feb 13, 2019

Wednesday 7:30 - 9:00 PM

A-L in UTC 2.112A

M-Z In BUR 106

Remember to refer to the Periodic Table handout that is separate from this exam copy.

NOTE: Please keep this exam copy intact (all pages still stapled - including this cover page). You must turn in **ALL** the materials that were distributed. This means that you turn in your exam copy (name and signature included), bubble sheet, periodic table handout, and all scratch paper. Please also have your UT ID card ready to show as well.

This print-out should have 20 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

001 5.0 points

A 19.7 g sample of an unknown salt (formula = MX_2) is dissolved in 249.4 mL water. The boiling point of water in this solution is 100.657°C . What is the molecular weight of the unknown salt?

- 129.8 g/mol
- 61.6 g/mol
- 55.4 g/mol
- 185 g/mol
- 46.1 g/mol

002 5.0 points

Consider two ionic compounds that dissolve fully in water at room temperature. You run an experiment and determine the following:

- Compound A has stronger solute-solute attractions than solute-solvent attractions.
- Compound B has stronger solute-solvent attractions than solute-solute attractions.

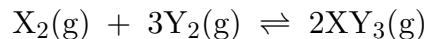
Which of the following best describes the $\Delta H_{\text{solution}}$ for Compound A and Compound B, respectively?

- Endothermic, exothermic
- Exothermic, exothermic
- Exothermic, endothermic
- Both processes are endothermic, but Compound A is more endothermic
- Both processes are exothermic, but Compound B is more exothermic

6. Both processes are equally exothermic

003 5.0 points

Consider the following generic gas phase reaction.

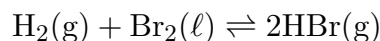


The value of K_p for this reaction is 107. Calculate the equilibrium partial pressure of gas Y_2 if the equilibrium partial pressures of XY_3 is 0.50 atm and X_2 is 0.15 atm?

- 0.031 atm
- 0.18 atm
- 0.42 atm
- 0.33 atm
- 5.6 atm
- 0.016 atm
- 0.25 atm

004 5.0 points

Write the equilibrium constant for the following reaction.



- $K_p = \frac{P_{\text{HBr}}}{P_{\text{H}_2}}$
- $K_p = \frac{P_{\text{HBr}}^2}{P_{\text{H}_2}}$
- $K_p = \frac{P_{\text{HBr}}^2}{P_{\text{H}_2}[\text{Br}_2]}$
- $K_p = \frac{P_{\text{H}_2}}{P_{\text{HBr}}^2}$
- $K_p = \frac{P_{\text{HBr}}^2}{P_{\text{H}_2}P_{\text{Br}_2}}$

005 5.0 points

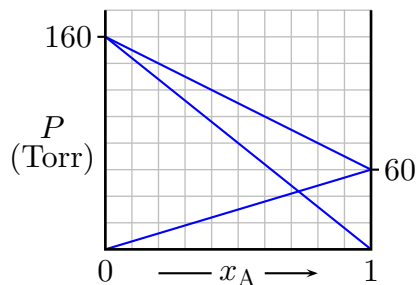
Isocarboxazid (MW = 231.25 g/mol) is an organic monoamine oxidase inhibitor used to

treat depression disorders. 38.00 grams of isocarboxazid are added to water to make a 350 mL aqueous solution. What is the osmotic pressure exerted by this solution across a semi-permeable membrane at 37°C?

- 1.43 atm
- 12.10 atm
- 329.6 atm
- 23.90 atm
- 144.4 atm
- 11.95 atm

006 5.0 points

A and B are mildly volatile solvents. A mixture is made by combining 2 moles of A with 3 moles of B. Interpret the diagram below to determine the vapor pressure of this mixture.



- 110 Torr
- 100 Torr
- 140 Torr
- 80 Torr
- 70 Torr
- 120 Torr
- 90 Torr
- 150 Torr
- 130 Torr

007 5.0 points

A sample of 44.1 g of *para*-dichlorobenzene ($C_6H_4Cl_2$, 147.0 g/mol) is dissolved into 350 mL of hexane (C_6H_{14} , 86.18 g/mol, density 0.661 g/mL). What is the molality of this solution?

- 0.101 *m*
- 0.567 *m*
- 1.17 *m*
- 0.857 *m*
- 1.30 *m*

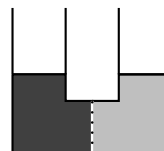
008 5.0 points

Calculate the number of moles of oxygen that will dissolve in 45 L of water at 20°C if the partial pressure of oxygen is 0.21 atm. Henry's constant for oxygen is 0.0013 M/atm.

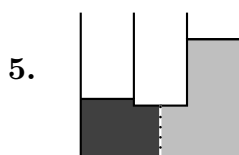
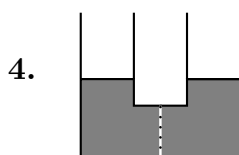
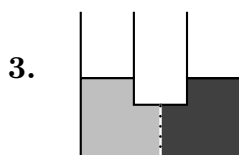
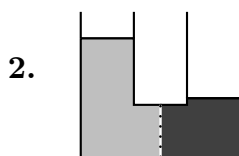
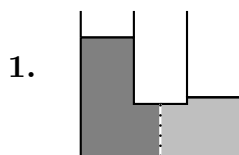
- 0.0062 mol
- 0.0013 mol
- 0.012 mol
- 0.00027 mol
- 0.28 mol

009 5.0 points

The following diagram shows a solution on the left (dark shade) and just the solvent on the right (light shade) separated by a semipermeable membrane.



Which diagram best represents the final state of this system after equilibrium is achieved?



010 5.0 points

Consider the following substances: acetic acid (CH_3COOH), propane (C_3H_8), and acetone (CH_3COCH_3). The boiling points (in no particular order) are -42°C , 56°C , and 118°C . The vapor pressures (in no particular order) are 225 Torr, 15 Torr, and 6400 Torr. What is the boiling point and vapor pressure for acetic acid?

1. 118°C , 15 Torr
2. -42°C , 6400 Torr
3. -42°C , 15 Torr
4. 118°C , 6400 Torr
5. 56°C , 225 Torr

011 5.0 points

A reaction has a negative change in entropy. This reaction can only be spontaneous if...

1. None of these choices are correct because a reaction with a negative change in entropy can never be spontaneous
2. heat is released at a sufficiently low temperature
3. heat is absorbed by the system at any temperature
4. heat is released at any temperature
5. heat is absorbed at a sufficiently high temperature

012 5.0 points

Which of the following solutions have a boiling point equal to a 1.12 *m* $\text{Fe}(\text{NO}_3)_3$ aqueous solution? Assume all solutions are aqueous and all salts dissolve completely.

- I. 4.48 *m* glucose
- II. 1.12 *m* $\text{Cu}(\text{NO}_3)_2$
- III. 2.24 *m* KNO_3
- IV. 2.24 *m* CaCl_2

1. I, II, III, and IV
2. I and III only
3. I only
4. I and II only
5. II and IV only
6. II only

013 5.0 points

Two liquids mix spontaneously at 180°C . At room temperature, the liquids separate into two layers instead of mixing. Which of the following is true for the process of mixing at

room temperature?

1. $\Delta H < T\Delta S$
2. $\Delta G < 0$
3. $\Delta S < 0$
4. $\Delta H < 0$
5. $\Delta H > T\Delta S$

014 5.0 points

A given reaction is found to have an equilibrium constant $K_p = 2.29$. What is the equilibrium constant for the REVERSE reaction?

1. 0.326
2. -2.29
3. 0.897
4. More information is needed.
5. 0.437
6. 2.29

015 5.0 points

Consider the following reactions at 550 K:

Reaction	K_p
$2\text{HI}(\text{g}) \rightleftharpoons \text{H}_2(\text{g}) + \text{I}_2(\text{g})$	9.1×10^{-3}
$2\text{HBr}(\text{g}) \rightleftharpoons \text{H}_2(\text{g}) + \text{Br}_2(\text{g})$	1.1×10^{-11}
$2\text{HCl}(\text{g}) \rightleftharpoons \text{H}_2(\text{g}) + \text{Cl}_2(\text{g})$	2.6×10^{-19}

Beginning with equal starting conditions, which compound will produce the greatest amount of hydrogen gas?

1. Each reaction will produce the same quantity of hydrogen gas
2. HBr
3. HI

4. HCl

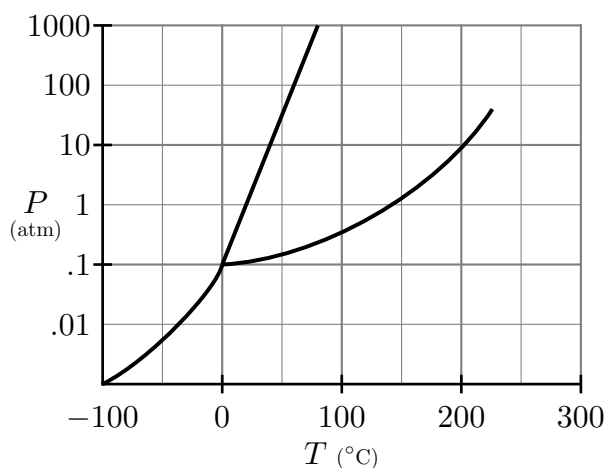
016 5.0 points

The enthalpy of vaporization of a liquid is measured to be about 28.4 kJ/mol and its normal boiling point is 128°C. At what temperature is the partial pressure of this substance 1180 torr?

1. 162°C
2. 181°C
3. -281°C
4. -381°C
5. 176°C
6. -7.92°C
7. 150°C

017 (part 1 of 2) 5.0 points

Use the following phase diagram for the next two questions.



What is the normal melting point for this substance? Note: the vertical axis is logarithmic in scale.

1. 0°C
2. 150°C

3. 45°C

4. 20°C

5. 75°C

6. 120°C

018 (part 2 of 2) 5.0 points

A sample of this substance is held at 0.1 atm and -50°C . The sample is pressurized to 3 atm and then heated to 250°C . In total, what phase transitions occurred?

1. melting and freezing
2. sublimation only
3. melting and boiling
4. sublimation and condensation
5. melting and condensation

019 5.0 points

Which of the following statements is/are true at the normal boiling point for a given substance?

- I. The vapor pressure of the substance equals the applied pressure
- II. The free energy of the gas phase is equal to the free energy of the liquid phase
- III. The free energy of the solid, liquid, and gas phases are all equal
- IV. $\Delta H_{\text{vap}}^{\circ} = 0$

1. I, II, and IV only
2. I and IV only
3. I and II only
4. I only
5. II only
6. I and III only

020 5.0 points

You measure the boiling points for three unique aqueous solutions with unknown concentrations. The data is shown below:

KCl solution, $T_b = 100.379^{\circ}\text{C}$ CaCl₂ solution, $T_b = 100.113^{\circ}\text{C}$ C₆H₁₂O₆ solution, $T_b = 100.217^{\circ}\text{C}$

Which of these solutions is expected to have the lowest freezing point?

1. KCl solution
2. The freezing point will be equal for all solutions
3. CaCl₂ solution
4. C₆H₁₂O₆ solution