This print-out should have 31 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

VDB Phase Change Thermo Signs 001
001 10.0 points

Substance A has undergone a phase transition (under constant pressure) where $\Delta H = 10 kJ/mol$ and $\Delta S = 36 J/K \cdot mol$. What phase transition could have occurred?

1. freezing

2. melting

3. deposition

4. condensation

LDE Gibbs Eqn 001
002 10.0 points

Phosphine (the common name for PH3, a highly toxic gas used for fumigation), has a $\Delta H^\circ_{vap} = 14.6\,kJ \cdot mol^{-1}$ and a $S^\circ_{vap} = 78.83\,J \cdot mol^{-1} \cdot K^{-1}$. What is the normal boiling point of phosphine expressed in centigrade?

1. 273 °C

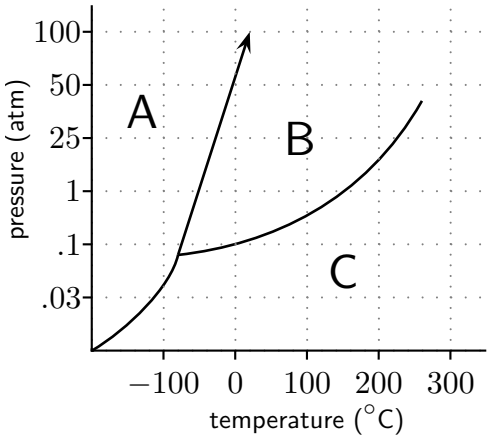
2. 185.2 °C

3. −87.8 °C

4. −0.2 °C

Phase diag3c
003 (part 1 of 2) 10.0 points

Refer to the following phase diagram for the next question also.



What is the normal boiling point of this substance?

1. 200°C

2. 230°C

3. 100°C

4. 260°C

5. 0°C

6. 150°C

004 (part 2 of 2) 10.0 points

What is the critical pressure for this substance?

1. > 100 atm

2. 1 atm

3. 44 atm

4. 25 atm

5. 50 atm

6. 0.08 atm

Msci 13 0911
005 10.0 points

The vapor pressure of benzene (C_6H_6) is 120 torr at 27.0°C, and its normal boiling point is 80.1°C. What is the molar heat of vaporization of benzene?

1. 4.95×10^4 J/mol

2. 4.56×10^3 J/mol

3. 3.07×10^4 J/mol

4. 2.49×10^2 J/mol

5. 1.31×10^3 J/mol

Vapor Pressure IMF 01
006 10.0 points

Rank these compound by vapor pressure from lowest to highest

1. $CH_4 < CH_3OH < C_3H_8 < C_3H_7OH$

2. $CH_4 < C_3H_8 < CH_3OH < C_3H_7OH$

3. $CH_3OH < C_3H_7OH < CH_4 < C_3H_8$

4. $C_3H_7OH < C_3H_8 < CH_3OH < CH_4$

5. $C_3H_7OH < CH_3OH < C_3H_8 < CH_4$

6. $C_3H_8 < CH_4 < C_3H_7OH < CH_3OH$

VDB Vapor Pressure Qualitative
007 10.0 points

The vapor pressure of a pure liquid depends on which of the following

I. the volume of the liquid
II. the volume of the gas
III. the surface area of the liquid
IV. the temperature

1. only I

2. only IV

3. only II

4. III and IV

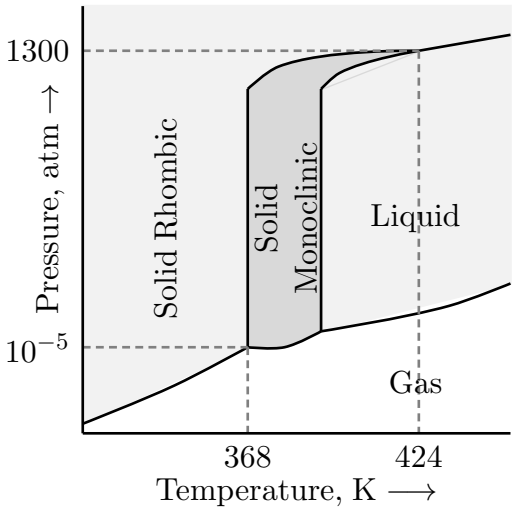
5. all of them

6. I and II

7. only III

ChemPrin3e T08 29
008 10.0 points

Consider the phase diagram for sulfur below.



At 424 K and 1300 atm,

1. only rhombic sulfur and sulfur gas exist in equilibrium.

2. only monoclinic sulfur is present.

3. rhombic sulfur, monoclinic sulfur, and liquid sulfur exist in equilibrium.

4. only rhombic sulfur is present.

5. rhombic sulfur, monoclinic sulfur, sulfur liquid, and sulfur gas exist in equilibrium.

Colligative Property Concepts 01
009 10.0 points

Which of the following statements about colligative properties of solutions is FALSE?

1. Osmosis is a colligative property.

2. Colligative properties assume ideal solutions

3. Colligative properties are identical for all solvents

4. The higher the concentration of solute in

the solution, the lower the vapor pressure of the solvent.

5. Colligative properties arise from the concentration of the solute but not the intermolecular forces of the solute

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Henrys Law
010 10.0 points

The partial pressure of CO_2 in the atmosphere is 3.9×10^{-4} atm. When drinking soda is put in a can, assume that there is 2.0 atm CO_2 in the 2.0 mL gas space above the soda. (The actual CO_2 pressure varies with type of soda.) What is the approximate ratio of the molar concentrations of CO_2(aq) in the soda before it is opened to that in the soda after it has been opened and reached equilibrium with the surrounding atmosphere; *i.e.*, has "gone flat?"

1. You need Henry's Law constant for CO_2 in this soda.

2. 2×10^{-4}

3. You need Rault's Law constant for CO_2 in this soda.

4. 5×10^{3}

5. 2×10^{2}

LDE Salt Dissolution Theory 002
011 10.0 points

Which of the following is a possible combination of values for $\Delta H_{lattice}$, $\Delta H_{hydration}$ and $\Delta H_{solution}$, respectively, for a salt whose dissolution is exothermic.

1. $+380,\ -351,$ and $29\ kJ \cdot mol^{-1}$

2. $-260,\ -278,$ and $18\ kJ \cdot mol^{-1}$

3. $+461,\ -465,$ and $-4\ kJ \cdot mol^{-1}$

4. $+302,\ -274,$ and $-28\ kJ \cdot mol^{-1}$

Freezing Point Depression Multiple 01
012 10.0 points

Given that the freezing point depression constant for water is 1.86 K m^{-1}, what is the freezing point of a solution that contains 0.5 moles KNO_3 and 1 mole of sucrose ($C_{12}H_{22}O_{11}$) in 500 g of water?

1. -5.58 °C

2. -7.44 °C

3. -2.79 °C

4. -3.72 °C

5. -1.86 °C

6. -37.2 °C

7. +2.79 °C

ChemPrin3e T08 69
013 10.0 points

The addition of 125 mg of caffeine to 100 g of cyclohexane lowered the freezing point by 0.13 K. Calculate the molar mass of caffeine. The k_f for cyclohexane is 20.1 $K \cdot kg \cdot mol^{-1}$.

1. 19.3 $g \cdot mol^{-1}$

2. 47.8 $g \cdot mol^{-1}$

3. 193 $g \cdot mol^{-1}$

4. 481 $g \cdot mol^{-1}$

5. 96.5 $g \cdot mol^{-1}$

ChemPrin3e T08 72
014 10.0 points

An animal cell assumes its normal volume when it is placed in a solution with a total solute molarity of 0.3 M. If the cell is placed in a solution with a total solute molarity of 0.1 M,

1. water enters the cell, causing expansion.

2. water leaves the cell, causing contraction.

3. no movement of water takes place.

4. the escaping tendency of water in the cell increases.

Mlib 06 0027
015 10.0 points

Which of the statements concerning equilibrium is NOT true?

1. The value of the equilibrium constant for a given reaction is the same regardless of the direction from which equilibrium was attained.

2. The equilibrium constant usually is independent of temperature.

3. A system moves spontaneously toward a state of equilibrium.

4. A system that is disturbed from an equilibrium condition responds in a manner to restore equilibrium.

5. Equilibrium in molecular systems is dynamic, with two opposing processes balancing one another.

ChemPrin3e T09 15
016 10.0 points

Consider the reaction

$$2\,Fe_2O_3(s) + 3\,C(s) \rightarrow 4\,Fe(s) + 3\,CO_2(g)\,,$$

$\Delta H^\circ = 462$ kJ, $\Delta S^\circ = 558\ J \cdot K^{-1}$. Calculate the equilibrium constant for this reaction at 525°C.

1. 2.18×10^{-2}

2. 5.20×10^{-7}

3. 8.07×10^{-2}

4. 3.04×10^{-3}

5. 1.9×10^{6}

ChemPrin3e T09 42
017 10.0 points

Which of the following is TRUE?

1. When the value of Q is large, the equilibrium lies on the product side of the equilibrium reaction.

2. A small value of K means that the equilibrium concentrations of the reactants are small compared to the equilibrium concentrations of the products.

3. When the value of K is large, the equilibrium lies on the reactant side of the equilibrium reaction.

4. A large value of K means that the equilibrium concentrations of products are large compared to the equilibrium concentrations of the reactants.

5. When the value of K is small, the equilibrium lies on the product side of the equilibrium reaction.

ChemPrin3e T09 47
018 10.0 points

A mixture consisting of 0.250 M $N_2(g)$ and 0.500 M $H_2(g)$ reaches equilibrium according to the equation

$$N_2(g) + 3\,H_2(g) \rightarrow 2\,NH_3(g)\,.$$

At equilibrium, the concentration of ammonia is 0.150 M. Calculate the concentration of $H_2(g)$ at equilibrium.

1. 0.0750 M

2. 0.425 M

3. 0.275 M

4. 0.350 M

5. 0.150 M

Msci 17 0520 alt

019 10.0 points

Suppose the reaction

$$H_2(g) + I_2(g) \rightleftharpoons 2\,HI(g)$$

has an equilibrium constant $K_c = 49$ and the initial concentrations of H_2, I_2 and HI are 0.50 M, 0.50 M and 0.00 M, respectively. What is the correct value for the final concentration of $I_2(g)$?

1. 0.219 M

2. 0.599 M

3. 0.250 M

4. 0.778 M

5. 0.111 M

6. 0.389 M

7. 0.438 M

LDE Q vs K Reaction Direction 003

020 10.0 points

Consider the reaction:

$$H_2CO_3(aq) \longleftrightarrow H_2O(\ell) + CO_2(g)$$

If K = 3.7 and the concentrations of H_2CO_3, H_2O, and CO_2 are 7.63 M, 55.4 M, and 0.564 M, respectively, what will happen in order for the system to reach equilibrium?

1. the reaction will shift to the left

2. the reaction will shift to the right

3. not enough information

4. nothing will occur

ChemPrin3e T09 58

021 10.0 points

Consider the reaction

$$3\,Fe(s) + 4\,H_2O(g) \rightarrow 4\,H_2(g) + Fe_3O_4(s)\,.$$

If the volume of the container is reduced,

1. more Fe(s) is produced.

2. more $H_2(g)$ is produced.

3. the equilibrium constant increases.

4. more $H_2O(g)$ is produced.

5. no change occurs.

LDE Equilibrium Conditions from K 006

022 10.0 points

Consider the reaction below:

$$AgNO_3(aq) + KCl(aq) \leftrightarrow AgCl(s) + KNO_3(aq)$$

If K is 20 and the initial concentrations of $AgNO_3$, KCl and KNO_3 are 1.5 M, 1.1 M and 0 M respectively, what is the equilibrium concentration of KCl in the rice diagram?

1. 0.1 M

2. 0 M

3. 0.5 M

4. 1 M

ChemPrin3e T09 45

023 10.0 points

The equilibrium constant K_c for the reaction

$$2\,NOCl(g) \rightarrow 2\,NO(g) + Cl_2(g)$$

is 0.51 at a certain temperature. A mixture of NOCl, NO, and Cl_2 with concentrations 1.3, 1.2, and 0.60 M, respectively, was introduced into a container at this temperature. Which of the following is true?

1. No apparent reaction takes place.

2. $[NOCl] = [NO] = [Cl_2]$ at equilibrium.

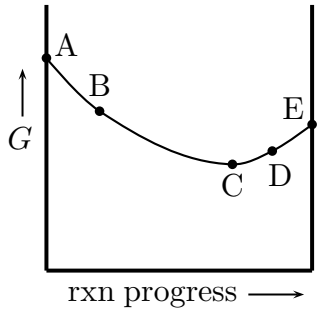
3. $Cl_2(g)$ is produced until equilibrium is reached.

4. $[Cl_2] = 0.30$ M at equilibrium.

5. NOCl(g) is produced until equilibrium is reached.

Equil Rctn Diag 05 W
024 10.0 points

The figure represents a reaction at 298 K.



Based on the figure, which of the following statements (if any) is false

1. at point C, the system is at equilibrium

2. none of the statements are false

3. at point D, the reaction will move towards the reactants to get to equilibrium

4. at point B, Q < K

5. for this reaction ΔG° is negative

K from DeltaG
025 10.0 points

For the following reaction

$$HgO(s) \leftrightarrow Hg(l) + O_2(g)$$

A sample of solid HgO is heated to a temperature at which it is in equilibrium with liquid Hg and O_2 gas. At this temperature $\Delta G^\circ = 0$ kJ mol^{-1}. What do you know about the O_2 gas at equilibrium?

1. the concentration of O_2 is 1 M

2. the concentration of O_2 is 1 ppm

3. the partial pressure of O_2 is 1 Torr

4. the partial pressure of O_2 is 1 atm

5. there is no way to know without the initial mass of the HgO solid

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miscibility concept 02
026 10.0 points

"Like dissolves like" refers to the fact that two compounds are likely to spontaneously form a mixture when the two compounds

1. have similar molecular weights

2. have similar entropies

3. have intermolecular forces of the same strength

4. have intermolecular forces of the same type

LDE Equilibrium Conditions from K 003
027 10.0 points

Consider the reaction below:

$$2H_2O(g) \longleftrightarrow 2H_2(g) + O_2(g)$$

If K is 10^{-80} and the initial concentrations of H_2O, H_2 and O_2 are 10 M, 0 M and 0 M respectively, what are the **approximate** equilibrium concentrations of these species, respectively?

1. 1 M, 9 M and 4.5 M, respectively

2. 0 M, 10 M and 5 M, respectively

3. 5 M, 5 M and 2.5 M, respectively

4. 10 M, 0 M and 0 M, respectively

Temperature Dependence of K 01
028 10.0 points

The temperature dependence of the equilibrium constant is determined by

1. the standard enthalpy of the reaction

2. the standard free energy of the reaction

3. the equilibrium constant is independent of temperature

4. the standard entropy of the reaction

ChemPrin3e T09 52
029 10.0 points

Consider the reaction

$$PCl_5(g) \rightarrow PCl_3(g) + Cl_2(g)\,.$$

At a certain temperature, if the initial concentration of $PCl_5(g)$ is 2.0 M, at equilibrium the concentration of $Cl_2(g)$ is 0.30 M. Calculate the value of K_c at this temperature.

1. 0.045

2. 19

3. 0.064

4. 0.053

5. 0.090

Equilibrium Binding 01
030 10.0 points

A particular small molecule drug works by binding to the active site in a given enzyme

$$Drug(aq) + Enzyme(aq) \leftrightarrow BoundComplex(aq)$$

If the equilibrium constant for this reaction is 10^{10}, at what concentration of free drug is there 1000 times more bound enzyme (complex) than unbound enzyme?

1. 10^{-3} M

2. 10^{-13} M

3. 10^{-7} M

4. 10^{-10} M

5. 1 M

Extra credit
031 10.0 points

If more points are awarded on this assignment, would you like them added to your score?

1. YES, I would like the points and the higher score.

2. NO, leave my score alone, I prefer the lower score