This print-out should have 18 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

001 10.0 points

Consider the following statements. Which are true?

I) Vapor pressure is a surface phenomenon.
II) The smaller the IMF, the smaller the vapor pressure.
III) The volume of a liquid does not affect the vapor pressure
IV) Vapor pressure is temperature dependent.

1. I, II, and IV

2. I, and III

3. I, III, and IV

4. I, II, III, and IV

5. III, and IV

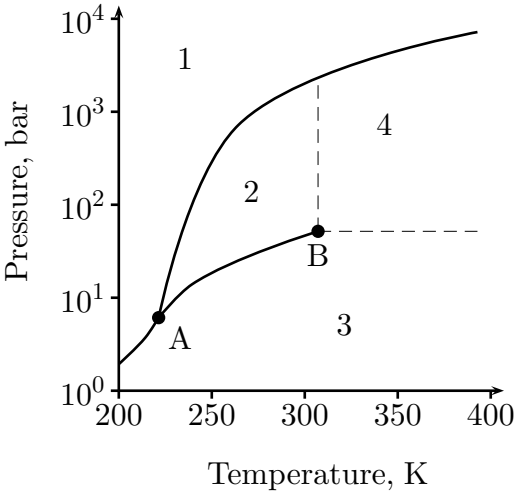
6. II, III, and IV

7. I, II, and III

002 10.0 points

According to the given phase diagram for carbon dioxide, what are regions 1, 3 and B respectively?

Carbon Dioxide



1. solid, vapor, critical point

2. solid, liquid, critical point

3. liquid, vapor, critical point

4. solid, liquid, triple point

5. solid, vapor, triple point

003 10.0 points

How much heat is released when 10 g of steam at 115 °C is cooled to ice at −15 °C? Use the approximate values below for your calculation.

$c_{ice} = 2$ J/g · °C
$c_{steam} = 2$ J/g · °C
$c_{water} = 4$ J/g · °C
$\Delta H_{vap} = 2,260$ J/g
$\Delta H_{fus} = 340$ J/g

1. -26,600 J

2. -4,000 J

3. -8,000 J

4. -30,300 J

5. -30,000 J

6. -30,600 J

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004 10.0 points

Rank the following liquids by their miscibility in heptane (C_7H_{16}), from most miscible to least: NH_3, CH_3OH, CH_3CH_2F, CCl_4.

1. $NH_3 > CH_3OH > CH_3CH_2F > CCl_4$

2. $CCl_4 > CH_3CH_2F > CH_3OH > NH_3$

3. $CH_3CH_2F > CCl_4 > CH_3OH > NH_3$

4. $CH_3CH_2F > CH_3OH > CCl_4 > NH_3$

5. $CCl_4 > CH_3CH_2F > NH_3 > CH_3OH$

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005 10.0 points

Assuming all of the following salts dissolve completely in water, which one would be the best to use if you were trying to raise the boiling point of the solution?

1. $Al_2(SO_4)_3$

2. KNO_3

3. Na_3PO_4

4. NaCl

5. $(NH_4)_2Cr_2O_7$

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006 10.0 points

Which of the following statements regarding colligative properties is/are true?

I) Pure liquid water exhibits a lower freezing point than a solution of magnesium chloride in water.

II) For completely soluble compounds that do not ionize in solution, the van't Hoff factor, $i = 1$.

III) Osmotic pressure is pressure exerted on a semipermeable membrane between solutions with different concentrations of solutes.

1. I, II, III

2. I, II

3. II only

4. III only

5. I only

6. II, III

7. I, III

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007 10.0 points

Nitric oxide, NO, is a toxic chemical produced in automobile engines.

$$O_2(g) + N_2(g) \longleftrightarrow 2\ NO(g)$$

Suppose that at 0 °C, $K = 0.5$ and at 10 °C, $K = 4$. ΔH of this reaction is (positive/negative) and it would be best to run an engine as (hot/cold) as possible to reduce emissions of NO.

1. positive, cold

2. negative, hot

3. positive, hot

4. negative, cold

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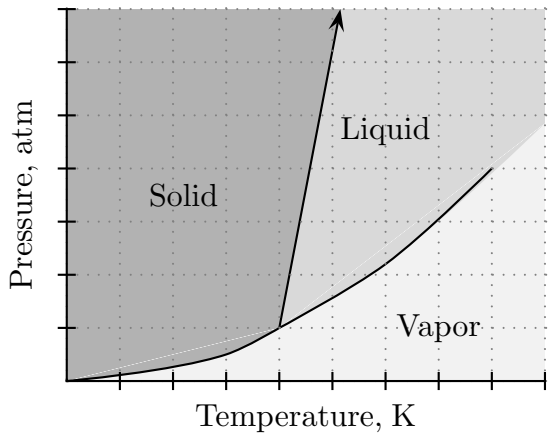
008 10.0 points

The phase diagram for CO_2 is given below.



The triple point is at 5.1 atm and 217 K. What happens if $CO_2(\ell)$ at 25 atm and 350 K is released into a room at 1 atm and 298 K?

1. The liquid and vapor are in equilibrium.

2. The liquid and solid are in equilibrium.

3. The liquid vaporizes.

4. The liquid freezes.

5. The liquid remains stable.

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009 10.0 points

Based simply on the molecular formula provided, which of the following compounds is least likely to be miscible in cyclohexane (C_6H_{12})?

1. methanol (CH_3OH)

2. benzene (C_6H_6)

3. Each contains a hydrocarbon unit and should be equally miscible.

4. phenol (C_6H_5OH)

5. naphthalene ($C_{10}H_8$)

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010 10.0 points

Calculate the vapor pressure at 25°C of a mixture of benzene and toluene in which the mole fraction of benzene is 0.650. The vapor pressure at 25°C of benzene is 94.6 torr and that of toluene is 29.1 torr.

1. 71.7 torr

2. 124 torr

3. 51.3 torr

4. 61.5 torr

5. 84.4 torr

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011 10.0 points

What would be the expression for K_c for the reaction

$$4\,NH_3(g) + 5\,O_2(g) \rightleftharpoons 4\,NO(g) + 6\,H_2O(g)$$

at equilibrium?

1. $\dfrac{[NO]^4\,[H_2O]^6}{[NH_3]^4\,[O_2]^5}$

2. $\dfrac{[NH_3]^4\,[O_2]^5}{[NO]^4\,[H_2O]^6}$

3. $[NO]^4\,[H_2O]^6$

4. $[NH_3]^4\,[O_2]^5$

5. $\dfrac{[NO]^4\,[H_2O]}{[NH_3]^4}$

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012 10.0 points

Suppose the reaction

$$A \rightleftharpoons B$$

has an equilibrium constant of 1.0 and the initial concentrations of A and B are 0.5 M and 0.0 M, respectively. Which of the following is the correct value for the final concentration of A?

1. 1.00 M

2. None of these is correct.

3. 1.50 M

4. 0.500 M

5. 0.250 M

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013 10.0 points

The equilibrium constant K_c for the reaction

$$2\,SO_2(g) + O_2(g) \rightarrow 2\,SO_3(g)$$

is 11.7 at 1100 K. A mixture of SO_2, O_2, and SO_3, each with a concentration of 0.015 M, was introduced into a container at 1100 K. Which of the following is true?

1. $SO_2(g)$ and $O_2(g)$ will be formed until equilibrium is reached.

2. $[SO_3] = [SO_2] = [O_2]$ at equilibrium.

3. $[SO_3] = 0.015$ M at equilibrium.

4. $SO_3(g)$ will be formed until equilibrium is reached.

5. $[SO_3] = 0.045$ M at equilibrium.

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014 10.0 points

Write the equilibrium constant for

$$2\,NaBr(aq) + Pb(ClO_4)_2(aq) \rightarrow PbBr_2(s) + 2\,NaClO_4(aq)\,.$$

1. $K = \dfrac{1}{[Pb^{2+}][Br^-]^2}$

2. $K = [Pb^{2+}][Br^-]^2$

3. $K = \dfrac{1}{[Pb(ClO_4)_2][NaBr]^2}$

4. $K = \dfrac{[PbBr_2]}{[Pb^{2+}][Br^-]^2}$

5. $K = \dfrac{[NaClO_4]^2}{[NaBr]^2[Pb(ClO_4)_2]}$

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015 10.0 points

Consider the reaction

$$C(s) + CO_2(g) \rightarrow 2\,CO(g)\,.$$

At equilibrium at a certain temperature, the partial pressures of $CO(g)$ and $CO_2(g)$ are 1.22 atm and 0.780 atm, respectively. Calculate the value of K for this reaction.

1. 3.13

2. 1.91

3. 0.640

4. 1.56

5. 2.00

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016 10.0 points

Suppose the reaction

$$A + 3\,B \rightarrow 2\,C$$

has a value of $K = 10.0$ at a certain temperature. If 0.5 moles of A, 0.5 moles of B and 0.5 moles of C are placed in a 5 L solution, the reaction

1. is at equilibrium.

2. shifts to the right.

3. shift cannot be determined without the temperature.

4. shifts to the left.

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017 10.0 points

The reaction

$$A + B \rightleftharpoons C + D$$

is at equilibrium. Increasing the temperature of the reaction causes more C and D to be formed. This reaction is

1. neither endothermic nor exothermic.

2. Cannot tell from the information given

3. endothermic.

4. exothermic.

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018 10.0 points

The equilibrium constant K_p is 5.00×10^{17} at 25°C for the reaction

$$C_2H_4(g) + H_2(g) \rightleftharpoons C_2H_6(g)\,.$$

From this information, calculate ΔG^0 at 25°C.

1. insufficient information

2. −101 kJ/mol

3. −43.9 kJ/mol

4. +43.9 kJ/mol

5. −517 kJ/mol

6. 101 kJ/mol

7. −996 J/mol