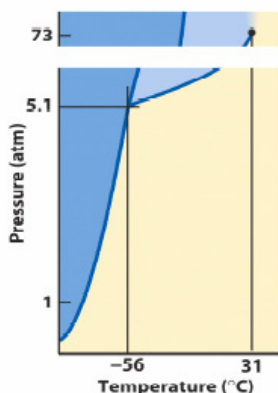


CH 302 Spring 2007 Worksheet 4

Practice Exam 1

- Predict the signs of ΔH and ΔS for the sublimation of CO_2 .
 - $\Delta H > 0, \Delta S > 0$
 - $\Delta H > 0, \Delta S < 0$
 - $\Delta H < 0, \Delta S > 0$
 - $\Delta H < 0, \Delta S < 0$
- Vapor pressure increases _____ with temperature.
 - Linearly
 - Exponentially
 - Logarithmically
 - Quadratically
- Which of the following salts will dissolve most easily in water?
 - KBr
 - MgO
 - BN
 - LiF

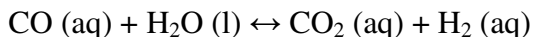


- For this question, refer to the phase diagram shown above. What is the phase of this substance at -56°C and 5.1 atm?
 - Solid
 - Liquid
 - Gas
 - Mixture of solid and gas
 - Mixture of solid, liquid, and gas
 - Supercritical fluid
- For this question, refer to the phase diagram shown above question 4. The substance is originally held in a container at -60°C and 20 atm. It is then heated to room temperature, and next allowed to expand to atmospheric pressure. What happens to the substance?
 - The liquid in the container boils.
 - The liquid in the container becomes a supercritical fluid.
 - The gas in the container becomes a supercritical fluid.
 - The solid in the container sublimates.
 - The solid in the container melts, then the resulting liquid boils.
 - The solid in the container sublimates, and then the resulting gas condenses.

6. 1 kg of water starts at 200°C and is allowed to cool to room temperature. For water, the specific heats are $c_{\text{ice}} = 2.093 \text{ J/g}^{\circ}\text{C}$, $c_{\text{water}} = 4.186 \text{ J/g}^{\circ}\text{C}$, and $c_{\text{steam}} = 2.009 \text{ J/g}^{\circ}\text{C}$. The enthalpy changes are $\Delta H_{\text{fusion}} = -335.5 \text{ J/g}$ and $\Delta H_{\text{vaporization}} = 2.26 \text{ kJ/g}$. What is ΔH_{sys} for this process?
- 2775 J
 - 2775 kJ
 - +2775 kJ
 - 1745 kJ
 - +1745 kJ
7. Which of the following gases will be most soluble in water?
- CH_4
 - O_2
 - CCl_4
 - He
 - Cl_2
8. Rank the following in terms of increasing miscibility with water: CH_3OH , CH_4 , $\text{CH}_3\text{CH}_2\text{OH}$, $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$.
- $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH} < \text{CH}_3\text{CH}_2\text{OH} < \text{CH}_3\text{OH} < \text{CH}_4$
 - $\text{CH}_4 < \text{CH}_3\text{OH} < \text{CH}_3\text{CH}_2\text{OH} < \text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
 - $\text{CH}_4 < \text{CH}_3\text{CH}_2\text{CH}_2\text{OH} < \text{CH}_3\text{CH}_2\text{OH} < \text{CH}_3\text{OH}$
 - $\text{CH}_3\text{OH} < \text{CH}_3\text{CH}_2\text{OH} < \text{CH}_3\text{CH}_2\text{CH}_2\text{OH} < \text{CH}_4$
9. You're cleaning your pet goldfish's tank, and you put him in a bowl containing pure water. Because the fish has a certain electrolyte balance inside its body that doesn't exist in the water, a concentration gradient is created. What is the name of the colligative property that explains why your fish blows up like a water balloon?
- Vapor pressure
 - Freezing point depression
 - Boiling point elevation
 - Osmotic pressure
 - Density depression
 - Ion diffusion
10. 25 g of acetic acid (CH_3COOH) and 75 g of ethanol ($\text{CH}_3\text{CH}_2\text{OH}$) are mixed together. At 25°C , the vapor pressures of these compounds are 16 and 59 torr, respectively. What is the vapor pressure of the mixture?
- 37.50 torr
 - 48.25 torr
 - 26.75 torr
 - 50.25 torr
 - 24.75 torr
11. Butanol boils at 118°C and has a ΔH_{vap} of 50 kJ/mol. What is butanol's vapor pressure at room temperature, 25°C ? Recall that 1 atm = 760 torr and $R = 8.314 \text{ J/mol K}$.
- 6.28 torr
 - 91965 torr
 - 756.4 torr
 - 763.7 torr

12. 1 mol of each of the following is added to 1 L of water. Rank the solutions in terms of **increasing freezing point**. BaS, CaCl₂, sugar, LiCl.
- BaS < sugar < LiCl < BaCl₂
 - BaCl₂ < LiCl < sugar < BaS
 - sugar < BaS < LiCl < BaCl₂
 - BaCl₂ < LiCl < BaS < sugar
13. Which of these is **not** an example of using a colligative property to your advantage?
- Adding salt to water so that your spaghetti cooks faster.
 - Mixing ethylene glycol and water in your radiator so that the liquid remains liquid over a wide range of temperatures.
 - Cooking your spaghetti in a pressure cooker so that it cooks faster.
 - Salting the roads after it snows.
14. 20 g of BaCl₂ is added to 1 L of water ($d_{\text{water}} = 1 \text{ g/mL}$). What is the boiling point of the water, given the boiling point of pure water is 100°C and K_b for water is 0.512 °C/m?
- 99.852°C
 - 100.148°C
 - 99.951°C
 - 100.0492°C
 - 89.760°C
 - 110.240°C
15. Which is the correct expression of K given the reaction
- $$\text{NaCl (aq)} + \text{AgNO}_3 \text{ (aq)} \rightarrow \text{NaNO}_3 \text{ (aq)} + \text{AgCl (s)}$$
- $K = \frac{[\text{NaNO}_3][\text{AgCl}]}{[\text{NaCl}][\text{AgNO}_3]}$
 - $K = \frac{[\text{NaCl}][\text{AgNO}_3]}{[\text{NaNO}_3][\text{AgCl}]}$
 - $K = \frac{[\text{NaNO}_3]}{[\text{NaCl}][\text{AgNO}_3]}$
16. For the reaction below, 1 atm C₈H₁₈ and 1 atm O₂ (and no CO₂ or H₂O) are mixed together. The equilibrium pressure of O₂ is 0.1 atm. What is K_p for this process?
- $$2 \text{ C}_8\text{H}_{18} \text{ (g)} + 25 \text{ O}_2 \text{ (g)} \leftrightarrow 16 \text{ CO}_2 \text{ (g)} + 18 \text{ H}_2\text{O (g)}$$
- 4.02
 - 0.25
 - 1.45×10^{-18}
 - 6.92×10^{17}
 - 2.78×10^{25}
17. For some temperature, assume that K_p for the combustion reaction below is 10^5 . You mix 1 atm each of C₂H₅OH, O₂, H₂O, and CO₂. Which of the following is a possible set of equilibrium concentrations?
- $$\text{C}_2\text{H}_5\text{OH (g)} + 3 \text{ O}_2 \text{ (g)} \leftrightarrow 2 \text{ CO}_2 \text{ (g)} + 3 \text{ H}_2\text{O (g)}$$
- $P_{\text{C}_2\text{H}_5\text{OH}} = 1.31 \text{ atm}$, $P_{\text{O}_2} = 1.92 \text{ atm}$, $P_{\text{CO}_2} = 0.390 \text{ atm}$, $P_{\text{H}_2\text{O}} = 0.0845 \text{ atm}$
 - $P_{\text{C}_2\text{H}_5\text{OH}} = 0.0652 \text{ atm}$, $P_{\text{O}_2} = 0.691 \text{ atm}$, $P_{\text{CO}_2} = 1.94 \text{ atm}$, $P_{\text{H}_2\text{O}} = 1.62 \text{ atm}$
 - $P_{\text{C}_2\text{H}_5\text{OH}} = 0.691 \text{ atm}$, $P_{\text{O}_2} = 0.0652 \text{ atm}$, $P_{\text{CO}_2} = 1.62 \text{ atm}$, $P_{\text{H}_2\text{O}} = 1.94 \text{ atm}$
 - $P_{\text{C}_2\text{H}_5\text{OH}} = 1.92 \text{ atm}$, $P_{\text{O}_2} = 1.31 \text{ atm}$, $P_{\text{CO}_2} = 0.0845 \text{ atm}$, $P_{\text{H}_2\text{O}} = 0.390 \text{ atm}$

18. Calculate the equilibrium concentration of CO_2 , given that you start with 1 M each of CO , CO_2 , and H_2 in water, and $K_c = 223$.



- a. 1.98 M
 - b. 0.126 M
 - c. 0.00893 M
 - d. 1.87 M
19. For the formation of ammonia, imagine you start with 1.5 M N_2 , 1 M H_2 and 2.5 M NH_3 . Which way will the reaction shift, given $K_c = 3.8$?
- $$\text{N}_2(\text{g}) + 3 \text{H}_2(\text{g}) \leftrightarrow 2 \text{NH}_3 (\text{g})$$
- a. To the products.
 - b. To the reactants.
 - c. It won't.
 - d. Up.
 - e. Down.
20. An exothermic reaction is placed over a flame. What happens to the reaction?
- a. Nothing happens.
 - b. The reaction shifts toward the reactants.
 - c. The reaction shifts toward the products.
21. The pressure on the vessel in which the following reaction is taking place is doubled. What happens to the reaction?
- $$\text{N}_2 (\text{l}) + \text{O}_2 (\text{g}) \leftrightarrow 2 \text{NO (g)}$$
- a. Nothing happens.
 - b. The reaction shifts toward the reactants.
 - c. The reaction shifts toward the products.
22. At 298 K, ΔG for a given reaction is -25.7 kJ. What is K for this reaction at 298 K?
- a. 1.01
 - b. 0.990
 - c. 3.20×10^4
 - d. 3.13×10^{-5}
 - e. 22.0
23. At some temperature, $K_w = 5 \times 10^{-14}$. What is the pOH of pure water at this temperature?
- a. 6.00
 - b. 6.65
 - c. 7.00
 - d. 7.35
 - e. 8.00
24. Which of the following is the most likely temperature at which $K_w = 5 \times 10^{-14}$ as above, given $K_w = 1 \times 10^{-14}$ at room temperature?
- a. 0 °C
 - b. 12 °C
 - c. 25 °C
 - d. 50 °C

25. 1 mole of HNO_3 is added to 10 L of water. What is the pH of this solution?
- 0
 - 1
 - 2
 - 7
 - 12
 - 13
 - 14
26. The pK_a of hydrofluoric acid (HF) is 3.15. If 132 g of HF is dissolved in 1 L of water, what is the pOH of the resulting solution?
- 13.5
 - 12.83
 - 14.66
 - 1.17
 - 14.82
27. 1 mole of ethylenediamine is dissolved in 1 L water, and the resulting $[\text{OH}^-]$ is 3.16×10^{-11} M. What is K_a for ethylenediamine?
- 10^{-22}
 - 10^{-7}
 - 5×10^{-6}
 - 1.8×10^{-2}
28. Which of the following is **not** a strong acid?
- HF
 - HCl
 - HBr
 - HI
 - HClO_4
 - HClO_3
29. What is the pH of a solution with $[\text{OH}^-] = 3.7 \times 10^{-4}$ M?
- 2.7×10^{-11}
 - 3.43
 - 10.57
 - 11.43
 - 2.69
 - 12.54
30. Which of the following is the strongest base?
- Ammonia, $K_b = 1.8 \times 10^{-5}$
 - Aniline, $K_b = 4.2 \times 10^{-10}$
 - Dimethylamine, $K_b = 5.1 \times 10^{-4}$
 - Pyridine, $K_b = 1.4 \times 10^{-9}$
 - Urea, $K_b = 1.5 \times 10^{-14}$