

Week 12 Problems/Exam 3 Review

Useful Information:

$\Delta H_{\text{melting}}$ $\text{H}_2\text{O} = 6.01 \text{ kJ/mol}$

$\Delta H_{\text{vaporization}}$ $\text{H}_2\text{O} = 40.79 \text{ kJ/mol}$

Specific heat $\text{H}_2\text{O(l)} = 4.18 \text{ J/g}\cdot^\circ\text{C}$

Specific heat $\text{H}_2\text{O(s)} = 2.03 \text{ J/g}\cdot^\circ\text{C}$

Specific heat $\text{H}_2\text{O(g)} = 1.99 \text{ J/g}\cdot^\circ\text{C}$

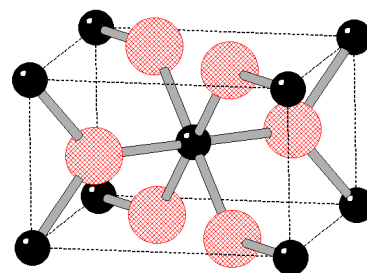
H_2CO_3 : $K_{a1} = 4.5 \times 10^{-7}$, $K_{a2} = 4.7 \times 10^{-11}$

Conceptual Questions

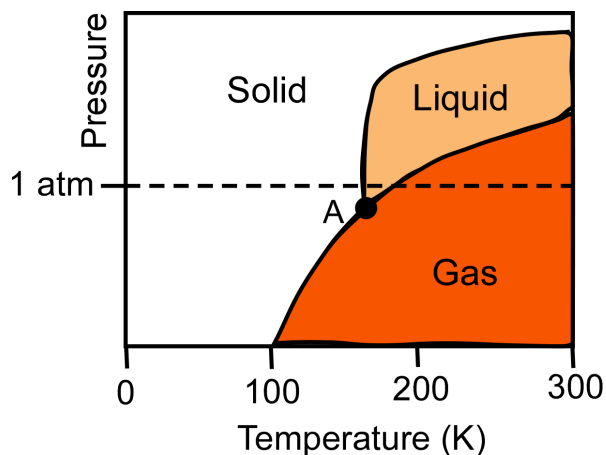
1. In the phase diagram for water, why does the melting point curve have a negative slope?
2. Is the boiling point raised or lowered at higher elevations? Why?
3. The boiling point of butane (lighter fluid) is 30.2°F . Why is it a liquid in lighters at room temp?
4. In the following titrations, would a reaction occur? If so, what would you expect the pH to be at the equivalence point? (<7 , $=7$, >7)
 - a. Sodium acetate titrated with HCl
 - b. Acetic acid titrated with HBr
 - c. HClO_4 titrated with KOH
5. Why is Cl_2 a gas at room temperature, Br_2 a liquid, and I_2 a solid?
6. How many atoms occupy the unit cell of a simple cubic, body-centered cubic, and face-centered cubic structure?

Chapter 10 Questions

1. How much heat is required to change 0.50 mol of ice at -10.0°C into 0.5 mol of steam at 120°C ?
2. An ice cube at 0°C weighing 100 g is dropped into 1 kg of water at 20°C . Does all of the ice melt? If not, how much of it remains? **What is the final temperature?**
 - a. Now consider 10 ice cubes at 0°C , each weighing 100 g are dropped into 1 kg of water at 20°C . **Does all of the ice melt? If not, how much of it remains? What is the final temperature?**
3. Rank the following in order of increasing polarizability and predict the order of their boiling points:
 - a. C_2H_4 , CH_4 , F_2 , $\text{C}_2\text{H}_5\text{OH}$, $\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$
 - b. CH_4 , $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$, $\text{CH}_3\text{CH}(\text{CH}_3)_2$
4. List the types of intermolecular forces that exist between molecules in each of the following species:
 - a. CF_2H_2
 - b. FCN
 - c. CH_3NH_2
 - d. H_3COCH_3
 - e. CH_3Cl
5. The mineral rutile crystallizes in a structure with 8 corner titanium atoms, 1 central titanium atom, 4 face oxygens, and 2 central oxygens. What is the structural formula for rutile? (This is a tetragonal structure and you aren't responsible for memorizing it, but treat it like a bcc/fcc hybrid)
6. Calculate the amount of heat given off when 138 g of steam at 172°C is converted to ice with a temperature of -10°C .



7. Use the phase diagram of xenon (shown at the right) to answer the following questions.
- When solid xenon is warmed at atmospheric pressure, does it melt or sublime? At what temperature does this occur? What happens if solid xenon is warmed at 0.5 atm?
 - What term is used to refer to point A on the phase diagram?
 - What phase(s) is present at 1 atm and 50 K?
 - What phase does xenon occupy at standard temperature and pressure?



Chapter 15:

- What is the pH of a solution made by mixing
 - 750 mL of 0.400 M NaOH and 250 mL of 0.800 M HCl?
 - 100 mL of 0.100 M NaHCO_3 and 200 mL 0.100 M H_2CO_3 ?
 - 100 mL of 0.250 M NaHCO_3 and 50 mL of 0.1 M NaOH?
 - 100 mL of 0.250 M NaHCO_3 and 50 mL of 0.1 M HCl?