HW01 - Phase Changes and Solutions

This is a preview of the draft version of the quiz

Started: Sep 14 at 8:14pm

Quiz Instructions

Homework 01

Phase Changes and Solutions

Question 1 — 1.25 pts

Given that you have 14.5 moles of N_2, how many moles of H_2 are theoretically needed to produce 30.0 moles of NH_3 according to reaction below?

$$N_2 + 3H_2 \longrightarrow 2NH_3$$

- 15.0 moles of H_2
- 33.8 moles of H_2
- No matter how many moles of H_2 are added, 30.0 moles of NH_3 cannot be produced.
- 45.0 moles of H_2

Question 2 — 1.25 pts

Consider the following reaction:

$$2NH_3 + CH_3OH \longrightarrow \text{products}$$

How much NH_3 is needed to react completely with 34g of CH_3OH?

- 36g NH_3
- 1.3g NH_3
- 9g NH_3
- 128g NH_3

Question 3 — 1.25 pts

Ice is heated at a constant pressure until it melts and vaporizes. What signs are assoiated with the total change in entropy and enthalpy (ΔS and ΔH) for this sample of water?

- ΔS = +, ΔH = +
- ΔS = −, ΔH = −
- ΔS = −, ΔH = +

- ΔS = +, ΔH = −

Question 4 — 1.25 pts

Which of the phase changes below might have a $\Delta H = 11.6$ kJ/mol?

- condensation
- deposition
- evaporation
- freezing

Question 5 — 1.25 pts

Which of the following statements is ALWAYS true about deposition?

- ΔS > 0
- ΔG < 0
- ΔH < 0
- None of the other answers are correct

Question 6 — 1.25 pts

Consider liquid ethane (CH_3CH_3) and liquid methanol (CH_3OH). Which would you expect to have a larger ΔH of vaporization?

- Ethane, because it has stronger IMFs.
- It is impossible to tell unless you know the amount of each liquid involved.
- Methanol because it has a larger molar mass.
- Methanol, because it has stronger IMFs.

Question 7 — 1.25 pts

What is the change in entropy (ΔS_{vap}) for the vaporization of ethanol at its standard boiling temperature of 78.4°C ? (ΔH_{vap}= 38.6 kJ·mol^{-1})

- 0.492 J·mol-1·K-1
- 110 J·mol^{-1}·K^{-1}
- 492 J·mol-1·K-1
- 0.110 J·mol-1·K-1

Question 8

1.25 pts

The $\Delta H_{vap}°$ of methane is 8.519 kJ·mol^{-1} and its $\Delta S_{vap}°$ is 85.58 J·mol^{-1}·K^{-1}. What is the boiling point of methane?

- 0.09954 K
- 99.54 K
- 372.54 K
- 0.09954°C

Question 9

1.25 pts

How much heat is required to heat 2 grams of ice at -30°C to steam at 100°C. Use the values below for your calculations:

$$c_{ice} = 2 \text{ J/g °C}$$

$$\Delta H_{fus} = 340 \text{ J/g}$$

$$c_{water} = 2 \text{ J/g °C}$$

$$\Delta H_{vap} = 2260 \text{ J/g}$$

$$c_{steam} = 2 \text{ J/g °C}$$

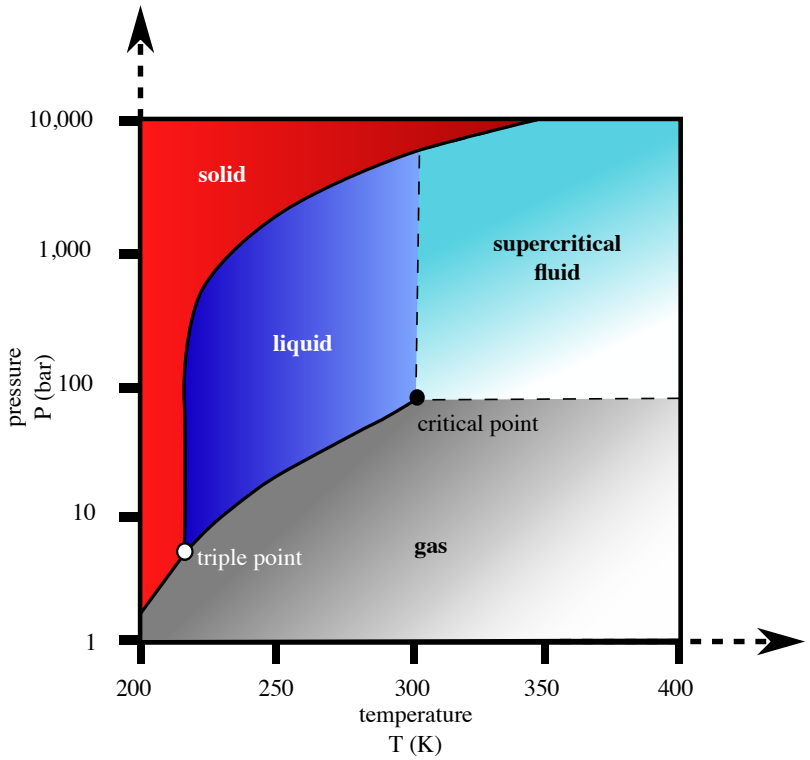
- 6.00 kJ
- 6.15 kJ
- 6150 kJ
- 1.60 kJ

Question 10

1.25 pts

Use the phase diagram for CO_2 provided below to answer the following question:

At 300K and 10 bar, what is the stable phase of carbon dioxide?



- liquid carbon dioxide
- gaseous carbon dioxide
- carbon dioxide as supercritical fluid
- solid carbon dioxide

Question 11

1.25 pts

Use the phase diagram for CO_2 in the question above to answer the following:

A sample of carbon dioxide is stored at 10,000 bar and 250K. This sample is then decompressed to 1 bar at constant temperature. Then, at constant pressure it is heated to 400K. Next, it is compressed at constant temperature to 200 bar. According to the phase diagram, how many phase transitions has the sample of carbon dioxide gone through, and what is its final state?

- 3, supercritical fluid
- 2, gas
- 3, liquid
- 2, supercritical fluid

Question 12

1.25 pts

Which of the following would change the vapor pressure of a sample of water in a closed container?

1. decreasing the size of the container

2. lower the container temperature

3. removing water from the container

- 1, 2, and 3
- 2 and 3
- 2 only
- 1 and 2

Question 13

1.25 pts

Which would have a higher vapor pressure: ethanol (C_2H_5OH) or dimethyl ether (CH_3OCH_3)?

- ethanol
- dimethyl ether
- They would have the same vapor pressure as their molecular weights are the same.
- It is impossible to tell unless the amount of each substance is known.

Question 14

1.25 pts

Rank the following liquids by vapor pressure from lowest to highest: C_5H_{12}, CH_4, C_3H_8, C_2H_6, C_4H_{10}.

- $CH_4 < C_5H_{12} < C_4H_{10} < C_3H_8 < C_2H_6$
- $C_5H_{12} < C_4H_{10} < C_3H_8 < C_2H_6 < CH_4$
- $C_2H_6 < C_3H_8 < C_4H_{10} < C_5H_{12} < CH_4$
- $CH_4 < C_2H_6 < C_3H_8 < C_4H_{10} < C_5H_{12}$

Question 15

1.25 pts

In a closed vessel containing water, the pressure is 18 torr. If we add more water to the vessel, this equilibrium pressure would...

- remain the same.
- increase.
- change, but it is not possible to know if it will increase or decrease without more information.
- decrease.

Question 16

1.25 pts

Consider two empty containers A and B whose volumes are 10mL and 20mL respectively. 1mL of liquid water is put into each container and the temperature of each container is adjusted to 20°C. The gas pressure in container B, which still has some liquid water in it, is found to be 17 torr. How would the pressure in container A and the amount of liquid water in container A compare to that of container B?

- the pressure would be greater, there would be an equal amount of liquid water
- the pressure would be the same, there would be an equal amount of liquid water
- the pressure would be greater, there would be less liquid water
- the pressure would be the same, there would be more liquid water

Question 17

1.25 pts

What is the vapor pressure of carbon disulfide at its normal boiling point?

- 22.4 atm
- Not enough informaiton.
- 1.0 atm
- 2.0 atm

Question 18

1.25 pts

At 20°C the vapor pressure of dry ice is 56.5 atm. If 10g of dry ice (solid CO_2) is placed in an evacuated 0.25 L chamber at a constant 20°C, will all of the solid sublime?

- Yes.
- None of dry ice would sublime.
- Some of the dry ice will sublime, but not all of it.
- There is not enough information to answer this quesiton.

Question 19

1.25 pts

An unknown liquid has a vapor pressure of 88 mmHg at 45°C and 39 mmHg at 25°C. What is its heat of vaporization?

- 2000 kJ/mol
- 32 kJ/mol
- 2000 J/mol
- 32,000 kJ/mol

Question 20 1.25 pts

_____ are made when _____ are dissolved in _____.

- solutes, solutions, solvents
- solvents, solutes, solutions
- solutions, solvents, solutes
- solutions, solutes, solvents

Question 21 1.25 pts

Both ammonia (NH_3) and phosphine (PH_3) are soluble in water. Which is least soluble and why?

- phosphine because the P-H bonds are so strong that they cannot break to enable phosphine to hydrogen-bond with water
- phosphine because it does not form hydrogen bonds with water molecules
- ammonia because it does not form hydrogen bonds with water molecules
- ammonia because the N-H bonds are so strong that they cannot break to enable the ammonia to hydrogen-bond with water

Question 22 1.25 pts

Rank the following in terms of decreasing miscibility in C_8H_{18} (octane), a major component of gasoline: C_2H_5Cl (chloroethane), H_2O (water), C_2H_5F (fluoroethane), and C_9H_{20} (nonane).

- $C_9H_{20} > C_2H_5Cl > C_2H_5F > H_2O$
- $H_2O > C_2H_5F > C_2H_5Cl > C_9H_{20}$
- $H_2O > C_9H_{20} > C_2H_5Cl > C_2H_5F$
- $C_2H_5Cl > C_2H_5F > H_2O > C_9H_{20}$

Question 23 1.25 pts

Which of the following is a possible combination of values for $\Delta H_{\text{lattice}}$ and $\Delta H_{\text{hydration}}$ respectively for a salt whose dissolution is endothermic?

- -560, +560
- -200, -304
- +640, -620
- +500, -520

Question 24 1.25 pts

Which of the following would increase the solubility of a gas in water?

1. increase the temperature of the water

2. decrease the temperature of the water

3. increase the pressure of the gas above the water

- 2 and 3
- 1 and 3
- 1 only
- 2 only

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