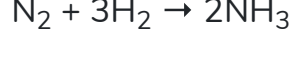


## HW 01 - CH301 Review, Phase Changes, and Vapor Pressure

### Question 1

2.0 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?

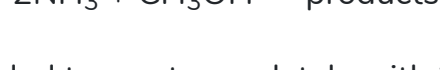


- 15.0 moles of  $H_2$
- No matter how many moles of  $H_2$  are added, 30.0 moles of  $NH_3$  cannot be produced.
- 45.0 moles of  $H_2$
- 33.8 moles of  $H_2$

### Question 2

1.75 pts

Consider the following reaction:



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

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

### Question 3

1.75 pts

Ice is heated at a constant pressure until it melts and vaporizes. What signs are associated with the total change in entropy and enthalpy (  $\Delta S$  and  $\Delta H$  ) for this sample of water?

- $\Delta S = +$  ,  $\Delta H = +$
- $\Delta S = -$  ,  $\Delta H = -$
- $\Delta S = +$  ,  $\Delta H = -$
- $\Delta S = -$  ,  $\Delta H = +$

### Question 4

1.75 pts

Which of the phase changes below might have a  $\Delta H = 11.6 \text{ kJ}\cdot\text{mol}^{-1}$ ?

- evaporation
- freezing
- deposition
- condensation

### Question 5

1.75 pts

Which of the following statements is ALWAYS true about deposition?

- $\Delta S > 0$
- None of the other answers are correct
- $\Delta H < 0$
- $\Delta G < 0$

### Question 6

1.75 pts

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

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

### Question 7

1.75 pts

What is the change in entropy ( $\Delta S_{\text{vap}}$ ) for the vaporization of ethanol ( $\Delta H_{\text{vap}} = 38.6 \text{ kJ}\cdot\text{mol}^{-1}$ ) at its standard boiling temperature ( $78.4 \text{ }^\circ\text{C}$ )?

- $0.110 \text{ J}\cdot\text{mol}^{-1}\cdot\text{K}^{-1}$
- $492 \text{ J}\cdot\text{mol}^{-1}\cdot\text{K}^{-1}$
- $0.492 \text{ J}\cdot\text{mol}^{-1}\cdot\text{K}^{-1}$
- $110 \text{ J}\cdot\text{mol}^{-1}\cdot\text{K}^{-1}$

### Question 8

1.75 pts

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

- 99.54 K
- 0.09954 K
- 372.54 K
- 0.09954  $^\circ\text{C}$

### Question 9

1.75 pts

How much heat is required to heat 2 grams of ice at  $-30^\circ\text{C}$  to steam at  $100^\circ\text{C}$ . Use the approximate values below for your calculations:

$$c_{\text{ice}} = 2 \text{ J g}^{-1} \cdot \text{ }^\circ\text{C}^{-1}$$

$$\Delta H_{\text{fus}} = 340 \text{ J g}^{-1}$$

$$c_{\text{water}} = 4 \text{ J g}^{-1} \cdot \text{ }^\circ\text{C}^{-1}$$

$$\Delta H_{\text{vap}} = 2260 \text{ J g}^{-1}$$

$$c_{\text{steam}} = 2 \text{ J g}^{-1} \cdot \text{ }^\circ\text{C}^{-1}$$

- 6.12 kJ
- 1.60 kJ
- 6.00 kJ
- 6120 kJ

### Question 10

1.75 pts

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

- decreasing the size of the container
- lower the container temperature
- removing water from the container

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

### Question 11

1.75 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 12

1.75 pts

Rank the following liquids by vapor pressure from lowest to highest:

$C_5H_{12}$ ,  $CH_4$ ,  $C_3H_8$ ,  $C_2H_6$ ,  $C_4H_{10}$ .

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

### Question 13

1.75 pts

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

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

### Question 14

1.75 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  $20^\circ\text{C}$ . 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 the same, there would be an equal amount of liquid water
- the pressure would be greater, there would be an equal amount of liquid water
- the pressure would be the same, there would be more liquid water
- the pressure would be greater, there would be less liquid water

### Question 15

1.75 pts

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

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

### Question 16

1.75 pts

At  $20^\circ\text{C}$  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  $20^\circ\text{C}$ , will all of the solid sublime?

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

### Question 17

1.75 pts

An unknown liquid has a vapor pressure of 88 mmHg at  $45^\circ\text{C}$  and 39 mmHg at  $25^\circ\text{C}$ . What is its heat of vaporization?

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