Assignments to be completed before class on Friday 10/25:

**Homework on content covered in previous class:**

- HW 12 (Due by 5:00 am on Fri 10/25)

**Material to be completed before we cover the content in class:**

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<td>Solids, Liquids, and Gases</td>
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<td>Vapor pressure and Antoine Eqn</td>
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<td>Multicomponent Gas-Liquid Systems</td>
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**Videos**

1. Raoult’s Law – Water as Condensable Component (4:20)
   - [Link](https://www.youtube.com/watch?v=G6WZjpVwMaE&list=PLD4476BAFA5A65111&index=58)
2. Relative and Absolute Humidity (3:51)
   - [Link](http://www.youtube.com/watch?v=8EoxIUaFB3w&list=PLD4476BAFA5A65111&index=59)
3. Single Condensable Species Balance (Raoult’s Law) (8:53)
   - [Link](http://www.youtube.com/watch?v=5gwnJr2-IV8&list=PLD4476BAFA5A65111&index=64)

**Key points:**

1. p* for water can be **looked up** in FRB Table B.3
2. p* for water and other substances can be **calculated** using the Antoine equation: \( \log_{10} p^* = A - \frac{B}{(T+C)} \)
3. The Antoine equation constants, A, B, and C, can be found in FRB Table B.4
4. Raoult’s law says that **if A is the only component that can condense (i.e., exist as a liquid)** in a vapor-liquid system, then:
   - at equilibrium the partial pressure of A equals the vapor pressure of A, i.e.,: \( p_A = p_A^* \)
   - By definition \( p_A = y_A P \), where \( y_A = \) vapor mole fraction of A and \( P = \) total system pressure, so \( y_A P = p_A^* \)
5. Relative saturation is ratio of the **actual** partial pressure of a substance to its vapor pressure times 100%, i.e., \( s_r = \left( \frac{p}{p_A^*} \right) \times 100\% \)
6. If the substance is water, ‘relative saturation (s_r)’ is called ‘relative humidity (h_r)’
A tank contains a 50/50 mixture of A and B in vapor-liquid equilibrium. The vapor is 60 mol% A. As the vapor is removed and the liquid boils away, the mole fraction of A in the liquid phase __________.

A. increases  
B. decreases  
C. remains the same

Water at a constant density flows through the cone-shaped pipe below. The volumetric flow rate of water at the outlet is _________ the volumetric flow rate at the inlet.

A. equal to  
B. greater than  
C. less than
If air flows at steady state and constant pressure through a cone that is heated by a furnace, which of the following is correct? \((V = \text{volumetric flow rate})\)

\[ V_1 \quad V_2 \]

A. The volumetric flow rate is higher at the outlet  
B. The pressure is higher at the outlet  
C. The quantity \(PV\) is higher at the outlet  
D. The mass flow rate is higher at the outlet  
E. Both A and C

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A constant-volume tank contains \(\text{CO}_2\) at 2 bar. Nitrogen is injected into the tank. The \(\text{CO}_2\) partial pressure ____________.

Assume ideal gases and an isothermal system.

A. decreases  
B. increases  
C. stays the same