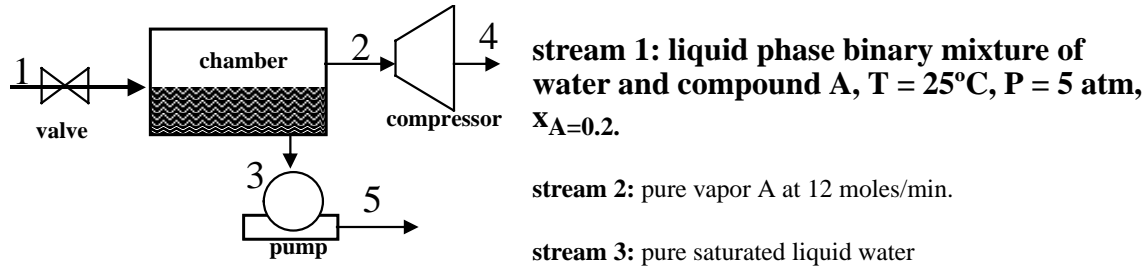


**WRITE YOUR NAME ON YOUR BLUE BOOK.
SHOW YOUR SOLUTION METHOD CLEARLY.**

Problem 1 of 1 (100 pts total)

Consider the steady-state, operation of the separation unit below.



stream 4: $P = 1 \text{ atm}$, $T = 25^\circ\text{C}$, pure liquid A

stream 5: $P = 1 \text{ atm}$, $T = 25^\circ\text{C}$, pure liquid water

The chamber operates at 10°C and the surroundings are at 25°C .

At 25°C and 5 atm , water and A form a nonideal solution having

$$H^E = -(4 \text{ kJ/mol})x_w x_A \quad \text{and} \quad S^E = 0.$$

- (5 points) What is the pressure in the chamber?
- (5 points) Is the normal boiling point for A:
 - less than or equal to 10°C ,
 - greater than 10°C but less than 25°C ,
 - greater than or equal to 25°C , or
 - is the information given insufficient to determine this?
- (10 points) Calculate the total flow rate of stream 1 in units of mol/s.
- (30 points) Calculate the minimum work required for the overall process.
- (20 points) For the actual process, if the rate of lost work is 4 kW , calculate the rate of heat flow.
- (30 points) Calculate the difference between $\overset{\blacksquare}{H}_A$ in stream 1 and H_A^{pure} at 5 atm and 25°C .