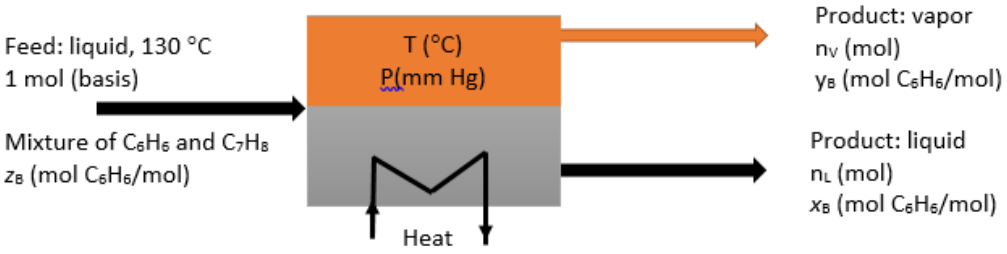
Assignment -1

BT201

Date: November 7, 2022

Due Date: November 15, 2022 (5 pm)

A liquid mixture of benzene and toluene is to be separated in a continuous single-stage equilibrium flash tank. The pressure in the unit may be adjusted to any desired value, and the heat input may similarly be adjusted to vary the temperature at which the separation is conducted. The vapor and liquid product streams both emerge at the temperature T (°C) and pressure P (mm Hg) maintained in the vessel.



Assume that the vapor pressures of benzene and toluene are given by the Antoine equation (take the value of A B and C from any reference book).

Table: Specific enthalpy value

Compound	T (°C)	$\hat{H}$ (kJ/mol)
C_6H_6 (liquid)	0	0
	80	10.85
C_6H_6 (vapour)	80	41.61
	120	45.79
C_7H_8 (liquid)	0	0
	111	18.58
C_7H_8 (vapour)	89	49.18
	111	52.05

a) Calculate the molar compositions of each phase, the moles of the liquid and vapor products, and the required heat input for T=90 °C and P=652 mm Hg using MATLAB [1+1+0.5]

b) For z_B =0.5 and T=90 °C, there is a range of feasible operating pressures for the evaporator, $P_{min} < P < P_{max}$. If the evaporator pressure fell outside this range, no separation of benzene and toluene would be achieved. Using MATLAB calculate P_{min} and P_{max} [1]

c) Generate a plot n_V versus P using MATLAB. (At several pressures between pressure between P_{min} and P_{max}). [1+0.5]
At approximately what pressure is half of the feed stream vaporized?