

Acetone is to be removed from an N_2 stream by scrubbing the gas with water. The gas enters the scrubber at 4 mole % acetone at a rate of 100 kmol/hr. *At least* 99% of the acetone is to be removed from the gas. The water enters the scrubber essentially free of acetone. The scrubber is to operate at 30 °C and 1 atm pressure. The vapor pressure of acetone at 30 °C is 5.505 psia and the activity coefficient at infinite dilution is 6.1615. You are to design a packed column to remove the acetone from the gas. 2 inch metal Hy-Pak packing is to be used and a pressure drop of 0.25 inches H_2O /ft of packing is specified. For calculating the liquid flow rate, use 1.4 times the minimum water flow. Specify the following design parameters for the column:

- a) Water flow rate in kmol/hr and gal/min.
- b) Mole fraction of acetone in the water exiting the column.
- c) For a tray column, estimate the number of ideal stages.
- d) Estimate the column overall efficiency, E_o .
- e) Estimate the number of real stages.
- f) Column diameter (in ft) rounded up to the nearest 6 inches.
- g) % flooding where $\% \text{ flooding} = (u_0/u_{0\text{flooding}}) * 100\%$
- h) Height of packing needed assuming $HETP = 3$ ft.