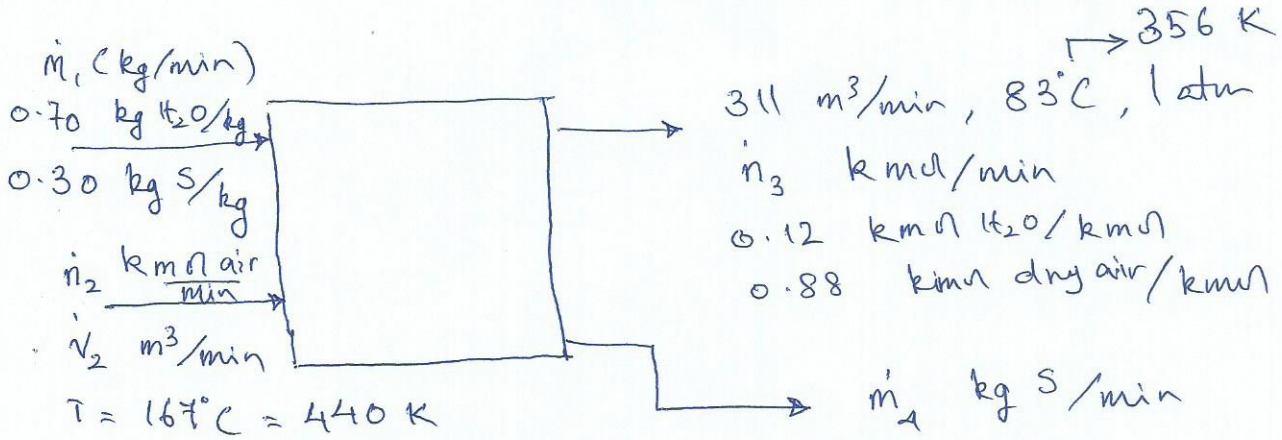
Quiz II (6 marks total)

S ≡ solid (milk)



(1 ½)

Physical law (Ideal gas assumption)

$$\dot{n}_3 = 311 \frac{m^3}{min} * \frac{1\ atm}{356\ K} * \frac{kmol \cdot K}{0.08206\ m^3 \cdot atm}$$

$$\boxed{\dot{n}_3 = 10.65\ kmol/min}$$ (1)

H_2O balance: $0.70 * \dot{m}_1 * \frac{kg\ H_2O}{kg} * \frac{kg}{min} = \dot{n}_3 * 0.12 * 18 * \frac{kmol}{min} * \frac{kg\ H_2O}{kmol} * \frac{kg}{kmol}$

$$\boxed{\dot{m}_1 = 32.86\ \frac{kg}{min}}$$ (1)

Solid balance: $0.30 * \dot{m}_1 = \dot{m}_4$

$$\boxed{\dot{m}_4 = 9.85\ kg\ S/min}$$ (½)

Dry air balance: $\dot{n}_2 = 0.88 * \dot{n}_3 \Rightarrow \boxed{\dot{n}_2 = 9.37\ \frac{kmol}{min}}$ (½)

$$\dot{V}_2 = 9.37 \frac{kmol}{min} * 0.08206 \frac{m^3 \cdot atm}{kmol \cdot K} * \frac{440\ K}{36\ cm\ Hg} * \frac{76\ cm\ Hg}{1\ atm}$$

$$\boxed{\dot{V}_2 = 714.2\ m^3/min}$$ (1)

Velocity Diameter not given. Assume it to be D m

$$u_{air} = \frac{\dot{V}_2}{(\pi/4) D^2} = \frac{909}{D^2} \frac{m}{min} = \frac{15.1}{D^2} \frac{m}{s}$$ (½)

If velocity is too high then the powdered milk will fluidize and might be blown out of the dryer.