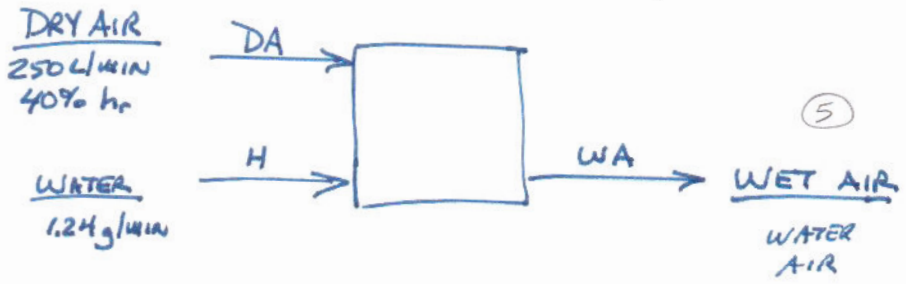
(1)



(5)

$T = 295K$

$P_w^* = 19.66$ mm Hg

$P_w(40\%) = 7.86$ mm Hg

$P_w(50\%) = 9.83$ mm Hg

$P_{TOTAL} = 745$ mm Hg

a) AIR BALANCE

$$ACC = IN - OUT + GEN$$
$$0 = \dot{n}_{AIR}^{DA} - \dot{n}_{AIR}^{WA}$$

(4)

DA IN

$$P_A Q = \dot{n}_A RT$$
$$(737.14)(250) = \dot{n}_{AIR}^{DA}(62.36)(295)$$
$$\dot{n}_{AIR}^{DA} = 10.02 \text{ mol/min}$$

(2)

$$\dot{n}_{AIR}^{WA} = 10.02 \text{ mol/min}$$

WATER BALANCE

$$ACC = IN - OUT + GEN$$
$$0 = \dot{n}_w^{DA} + \dot{n}_w^{H} - \dot{n}_w^{WA}$$

(4)

DA

$$P_w Q = \dot{n}_w RT$$
$$(7.86)(250) = \dot{n}_w^{DA}(62.36)(295)$$
$$\dot{n}_w^{DA} = 0.107 \text{ mol/min}$$

(2)

$$\dot{n}_w^{H} = 1.24 \text{ g/min} * \frac{\text{mol}}{18 \text{ g}} = 0.069 \text{ mol/min}$$

(2)

$$0 = 0.107 + 0.069 - \dot{n}_w^{WA}$$
$$\dot{n}_w = 0.176 \text{ mol/min}$$

WET AIR CONTAINS:

10.02 mol/min AIR
0.176 mol/min WATER
10.196 mol/min

(3)

$$PQ = \dot{n}RT$$
$$(745)(Q) = (10.196)(62.36)(295)$$

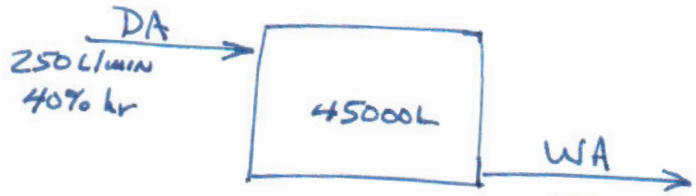
(3)

$$Q = 251.8 \text{ L/min}$$

b) $P_w = y_w P = \left(\frac{0.176}{10.196}\right)(745) = 12.86 \text{ mm Hg}$

$h_r = \left(\frac{12.86}{19.66}\right)(100) = \underline{\underline{65.4\%}}$ (5)

c)



(3)

WATER BALANCE

$ACC = IN - OUT + GEN$

$\frac{d(cV)}{dt} = 0.107 - c(251)$

$45000 \frac{dc}{dt} = 0.107 - 251c$ (6)

$\frac{dc}{dt} = 2.38\times10^{-6} - 5.58\times10^{-3}c$ B.C. (1)

INITIAL CONC. OF WATER c^{INIT} = [redacted] (65.4%)

$P = cRT$ (2)

$12.86 = c(62.36)(295) \Rightarrow c = 6.99\times10^{-4} \frac{mol}{L}$

FINAL CONC. OF WATER C_{FIN} (50%) (2)

$9.83 = c(62.36)(295) \Rightarrow c = 5.34\times10^{-4} \frac{mol}{L}$

$$\int_{C^{INIT}}^{C_{FIN}} \frac{dc}{2.36\times10^{-6} - 5.58\times10^{-3}c} = \int_0^t dt = t$$

$$-\frac{1}{5.58\times10^{-3}} \ln\left[\frac{2.36\times10^{-6} - 5.58\times10^{-3}(6.99\times10^{-4})}{2.36\times10^{-6} - 5.58\times10^{-3}(5.34\times10^{-4})}\right] = t$$ (6)

$\underline{\underline{163.1 \text{ min} = t}}$