PROB D.2

$$t_f = \frac{86\,s}{cm^2}\left(\frac{V_f}{A}\right)^2$$

← THIS IS THE FILTRATION EQUATION FOR THIS PROCESS WITH $R_m = 0$

WE WANT TO CALCULATE THE VOLUME, AREA AND TIME PER CYCLE.

$$V_f = \left(\frac{3000\,l}{h}\right)\left(\frac{75\,s}{cycle}\right)\left(\frac{h}{3600\,s}\right) = 62.5\,L \text{ PER CYCLE}$$

← THIS IS THE AMOUNT OF LIQUID WE NEED TO FILTER DURING ONE CYCLE.

$$= 62.5\times10^3\,cm^3$$

$$A = 18.1\,m^2 = 181000\,cm^2$$

$$t_f = \left(\frac{86\,s}{cm^2}\right)\left(\frac{62.5\times10^3\,cm^3}{181000\,cm^2}\right)^2 = \underline{10.3\,s}$$

← THIS IS THE TIME NECESSARY TO FILTER THE SOLUTION DURING ONE CYCLE. FORTUNATELY, THIS TIME IS A SMALL FRACTION OF TOTAL CYCLE TIME.... OTHERWISE WE COULDN'T DO IT!

$$r = (1-\varepsilon)^N$$

$r = 0.10$

$\varepsilon = 0.60$

so $N = 2.51$

$$t_w = 2\,t_f\,n\,f$$

$$t_w = 2\,(10.3)(2.51)(0.07) = \underline{3.6\,s}$$