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FILTRATION
EXTRA PROBLEM 1

<u>t(s)</u>	<u>V(cm³)</u>	<u>A(cm²)</u>	<u>V/A(cm)</u>	<u>At/V(s/cm)</u>
10	46	19.64	2.34	4.27
20	66	19.64	3.36	5.95
40	97	19.64	4.94	8.10

$$A = \frac{\pi}{4} (5)^2 = 19.64 \text{ cm}^2$$

a) FROM PLOT SLOPE = $K = 1.5 \text{ s/cm}^2$
(SEE PAGE 3)

$$\text{INTERCEPT} = 0.9 \text{ s/cm}$$

$$\frac{\mu R_m}{\Delta P} = \frac{0.9 \text{ s}}{\text{cm}} = \frac{(0.014) R_m}{(12)(69000)}$$

$$R_m = 5.32 \times 10^7 \text{ cm}^{-1}$$

$$\frac{\mu \alpha p_c}{2 \Delta P} = 1.5 \text{ s/cm}^2 = \frac{(0.014) \alpha (0.028)}{(2)(12)(69000)}$$

$$\alpha = 6.34 \times 10^9 \text{ cm/g}$$

b) 18 FRAMES

$$\text{VOLUME} = 0.22 \times 0.22 \times 0.01 \times 18 = 0.008712 \text{ m}^3$$

$$= 8712 \text{ cm}^3$$

$$\text{AREA} = 2 \times 18 \times 0.22 \times 0.22 = 1.74 \text{ m}^2$$

$$= 17400 \text{ cm}^2$$

PHASE I $Q = 1200 \text{ cm}^3/\text{s}$

PHASE II $\Delta P = 50 \text{ psi} (69000) = 3450000 \text{ g/cm}^2 \text{ s}^2$

(2)

i) PHASE I $\Delta P = \alpha \mu_p v^2 t_s + \mu R_m v$

$$v = \frac{Q_I}{A} = \frac{1200}{17424} = 0.0689 \text{ cm/s}$$

$$\Delta P = (6.34 \times 10^9)(0.014)(0.028)(0.0689)^2 t_s + (0.014)(5.32 \times 10^7)(0.0689)$$

$$\Delta P = 11798 t_s + 51317$$

$$\Delta P = 3450000 = 11798 t_s + 51317$$

$$t_s = 288 \text{ s}$$

ii) $V_s = Q_I t_s = (1200)(288) = 345600 \text{ cm}^3$
 $= 345.6 \text{ L}$

iii) $8712 \text{ cm}^3 \times \frac{\text{cm}^3 \text{ Atroto}}{0.0084 \text{ cm}^3 \text{ coke}} = 1037143 \text{ cm}^3$
 $= 1037 \text{ L}$

iv) PHASE II $t_{\text{TOTAL}} = t_s + \frac{\mu \mu_p c}{2A^2 \Delta P} (V^2 - V_s^2) + \frac{\mu R_m}{A \Delta P} (V - V_s)$

$$t_{\text{TOTAL}} = 288 + \frac{(0.018)(6.34 \times 10^9)(0.028)}{2(17400)^2(3450000)} (1037143^2 - 345600^2) + \frac{(0.018)(5.32 \times 10^7)}{(17400)(3450000)} (1037143 - 345600)$$

$$t_{\text{TOTAL}} = 288 + 1462.6 + 11.0 = 1762 \text{ s}$$

$$= 29.4 \text{ min}$$

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