Sample Calculations #1

Average Volumetric Flow Rate [mL/min]

$$\frac{\text{Volume}}{\text{avg(time)}} = Q$$

from Table 2:

- Volume = 10 mL (constant)
- $time_1 = 5.54\,s$
- $time_2 = 4.97\,s$
- $time_3 = 5.06\,s$

$$\text{avg(time)} = \frac{5.54\,s + 4.97\,s + 5.06\,s}{3} = 5.19\,s$$

$$\frac{10\,mL}{5.19\,s} = 1.93\,\frac{mL}{s} \cdot \frac{60\,s}{1\,min} = \boxed{116.9\,\frac{mL}{min}}$$

Sample Calculations #2

a) Retentate concentration [g/L]

From Figure 2:

$$\begin{pmatrix}\text{Absorbance}\\ \text{at 325nm}\end{pmatrix} = 7.3112 \cdot [\text{xanthan}] - 0.0322$$

From Table 3:
Absorbance at 325 nm = 0

$$0 = 7.3112 \cdot [\text{xanthan}] - 0.0322$$

$$0.0322 = 7.3112 \cdot [\text{xanthan}]$$

$$[\text{xanthan}] = 0.004404$$

$$\times \quad 20 \quad \text{(account for 20x dilution)}$$

$$\boxed{0.0881\ g/L}$$

b) Permeate concentration [g/L]

from Table 3: Absorbance at 325nm = 0.004

$$0.004 = 7.3112 \cdot [\text{xanthan}] - 0.0322$$

$$0.0362 = 7.3112 \cdot [\text{xanthan}]$$

$$[\text{xanthan}] = \boxed{0.050\ g/L} \quad \text{(no 20x dilution}$$

Sample Calculations #3

Retention Coefficient, R [-]

from equation 1:

$$\frac{C_R - C_P}{C_R} = R$$

from table 4: $C_R = 0.881\ g/L$

$C_P = 0.050\ g/L$

$$\frac{0.881\ g/L - 0.050\ g/L}{0.881\ g/L} = \boxed{0.944}$$

Sample Calculations #4

Volumetric flow rate: $[m^3/s]$

$$F_p = \frac{\text{volume}}{\text{time}}$$

volume = 5mL
time = 2492s

$$F_p = \frac{5\,mL}{2492\,s} = 0.201\,\frac{mL}{s} \cdot \frac{0.000001\,m^3}{mL} = \boxed{2.01 \times 10^{-7}\,\frac{m^3}{s}}$$

Sample Calculations #5

Flux [$m^3/s/m^2$]

from Equation 2:

$$J_v = \frac{F_P}{A}$$

from Sample Calculations #4:

$F_p = 2.01 \times 10^{-7} \frac{m^3}{s}$

$A = 650\ cm^2$

$$J_v = \frac{2.01 \times 10^{-7}\ m^3/s}{650\ cm^2} \cdot \frac{cm^2}{0.0001\ m^2} = \boxed{3.09 \times 10^{-6}\ m^3/s/m^2}$$