D.1

A small test filtration of antibiotic crystals in acetone uses a filter medium of negligible resistance. It gives the following data:

time (s)	volume (l)
10	0.500
20	0.707
30	0.866

In finding these data, we have used a filter with 89 cm^2 area and a solution of 0.34 g/100 cm^3. We now plan to filter a much larger crop of crystals containing 7300 liters of solvent at a concentration of 0.28 g/100 cm^3 by using a filter of 1.3 m^2. Using the same constant ΔP at both scales, how long will it take to filter this larger solution?

D.2

You are filtering a beer containing 6% citric acid crystals on a continuous rotary vacuum filter. The filter has an area of 18.1 m^2, a negligible medium resistance and a cycle time of 75 seconds. The cake which forms has a washing efficiency of only 60%, but it is incompressible and permeable with $\mu\alpha\rho_c/2\Delta P = 86$ s/cm^2. The cake retains 7% of filtrate leaving and should be washed until the cake contains only 10% citric acid originally entrained. Calculate the filtration time and the washing time required to process 3000 liters per hour of beer.

D.3

Determine the time necessary for the filtration of 50 m^3 of slurry in a plate and frame filter press having a total area of 40 m^2 and the following characteristics:

$\alpha = 8.55 \times 10^{10}$ m/kg
$R_M = 4.42 \times 10^{10}$ m^{-1}
$\mu = 0.0015$ kg/s·m
$\rho_C = 8.22$ kg/m^3

The centrifugal pump used for this filtration has characteristics shown on the attached page.

D.4

Determine the time necessary for the filtration of 40 m^3 of slurry in a plate and frame filter press having a total area of 25 m^2 and the following characteristics:

$\alpha = 7.65 \times 10^{10}$ m/kg
$R_M = 6.7 \times 10^{9}$ m^{-1}
$\mu = 0.0016$ kg/s·m
$\rho_C = 9.5$ kg/m^3

The centrifugal pump used has a impeller diameter of 6 ¾", and has characteristics shown on the attached page. Note: 1 m^3/s = 15,850 GPM; 1 ft. of head = 2,989 Pa

D.5

A small test filtration of crystals in isopropanol uses a filter medium giving the following data:

time (s)	volume (l)
10	0.41
20	0.62
30	0.78
40	0.92

In finding these data, we have used a filter with 129 cm^2 area and a solution of 2.43 g/100 cm^3. This experiment was conducted so that the pressure was constant with ΔP = 10 psi. Assume that the solution has the viscosity of isopropanol at 25°C. We now plan to filter a much larger crop of crystals containing 50,000 liters of solvent at a concentration of 3.25 g/100 cm^3 by using a filter of 8.0 m^2. The larger scale process is going to use a constant flowrate of 0.025 m^3/s until a pressure of 80 psi is reached, and then the process continues with a constant ΔP = 80 psi. How long will it take to filter the 50,000 liters?