Filtration Extra Problem 1

For the filtration of a solution containing incompressible particles, a series of runs were completed at a constant 12 psi (for the entire run) using a 5 cm diameter cloth filter. The slurry to be filtered has a viscosity of 0.014 g/s·cm and solids concentration of 0.028 g of cake solids/cm^3, and the cake has a volume of 0.0084 cm^3/cm^3 of filtrate. The results were:

Time (s)	V (mL)
10	46
20	66
40	97

a) What are the values for the cake resistance coefficient α and the media resistance R_M? (Note: 1 psi = 69,000 g/cm·s^2.)

b) The same cloth filter is used in a small plate and frame filter press, each of 18 frames having dimensions of 0.22 m × 0.22 m × 0.01 m, to filter the same slurry. The flow rate of the slurry is to be a constant 1,200 cm^3/s until the pressure reaches 50 psi, and then the filtration continues at that constant pressure until the frame capacity has been reached.

i. How long does the constant flowrate portion of the process take?
ii. How much slurry will be filtered at the end of the constant flowrate portion of the process?
iii. How much slurry can be filtered before the filter reaches capacity (in total)?
iv. How long will the entire process take to reach this capacity?