H.1

Sucrose (M = 342 g/mol) has a solubility in water of 2040 g/kg water at 20°C, resulting in a solution having a density of 1.33 g/cm^3. A supersaturated solution has a concentration of 2450 g/kg water and density of 1.36 g/cm^3. Find the values of Δc, S and σ using the following bases for concentration: g/kg water, g/kg solution, g/L solution, mol/L solution, mol fraction sucrose.

H.2

A supersaturated sucrose solution flows into a continuous crystallizer. The slurry concentration is 335 g/L, and the density of sucrose is 1.588 g/cm^3. The flowrate is 400 L/h and the volume of the crystallizer is 1000 L. The following screen analysis is completed for the crystallization.

Screen size (cm)	cumulative number percent
0.120	0
0.084	3
0.060	14
0.042	38
0.030	76
0.020	92

For each pair of adjacent screen sizes, calculate the ΔL and the mean crystal size ($\overline{L}$). The population density of the crystals between two screens (n) can be estimated from:

$$n = \frac{fraction\ between\ screens \times Conc}{\rho \phi_V L^3 \Delta L}$$

For example, the value of n (0.060 cm screen)
= [(0.14 – 0.03)×335/1000]/(1.588×0.072^3×0.024) = 2590 crystals/cm^4.

The growth rate G is obtained from the slope of ln(n) versus L:

$$G = \frac{1}{-slope}\frac{Q}{V}$$

The value of n_0 is the value of n when L→ 0.

Find:

a) G
b) B
c) The dominant crystal size, L_D