Solution to Problem 402A:

[1] Using the Rayleigh-Plesset equation:

$$\frac{p_B - p_\infty}{\rho_L} = R\frac{d^2R}{dt^2} + \frac{3}{2}\left(\frac{dR}{dt}\right)^2 + \frac{2S}{\rho_L R} \tag{1}$$

when $p_B - p_\infty = 10^4 \ Pa$, $\rho_L = 10^3 kg/m^3$, $S = 0$, steady growth proceeds at

$$\frac{dR}{dt} = \left[\frac{2}{3}\frac{10^4}{10^3}\right]^{1/2} = 2.58 \ m/s \tag{2}$$

[2] Same as [1] except that $S = 0.07N/m$ so when $R = 10^{-4}m$:

$$\frac{dR}{dt} = \left[\frac{2}{3}\frac{(10^4 - 2 \times 0.07 \times 10^4)}{10^3}\right]^{1/2} = 2.39 \ m/s \tag{3}$$

[3] Equilibrium bubble:

$$R_E = \frac{2S}{(p_B - p_\infty)} = 1.4 \times 10^{-5} \ m \tag{4}$$