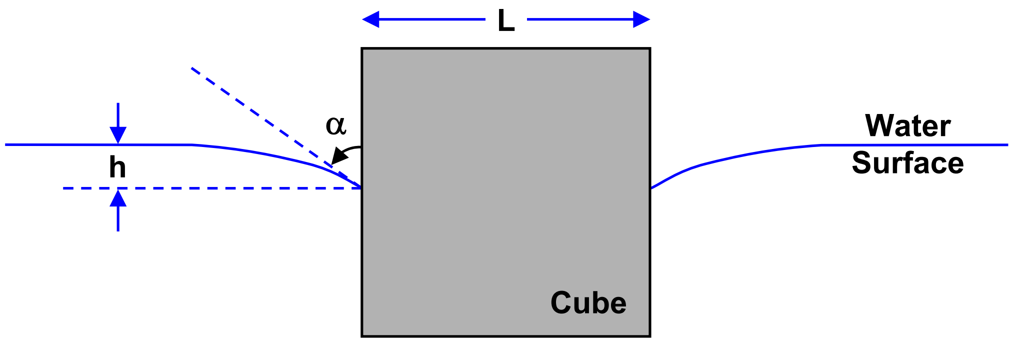
Problem 108F

A cube with sides, L, and density, ρ_S, floats in a pool of water whose density is ρ_L and whose surface tension is S. The acceleration due to gravity is denoted by g. The cube is made of hydrophobic material with a contact angle of $\pi - \alpha$ so that it floats in the following configuration:



Because the material is hydrophobic the density of the cube can be greater than that of the water and it will still float. Assuming that

- $\alpha = \pi/4$
- the surface tension, S, is such that $(S/\rho_L g L^2) = 0.1$
- the elevation difference, h, between the line of contact on the sides of the cube and the water surface far from the cube is given by $h = \cot\alpha(S/\rho_L g)^{\frac{1}{2}}$.
- it is stipulated that the water surface can only contact the cube along the vertical faces of that cube.

determine the maximum specific gravity of the cube (ρ_S/ρ_L) for which the cube will still float.