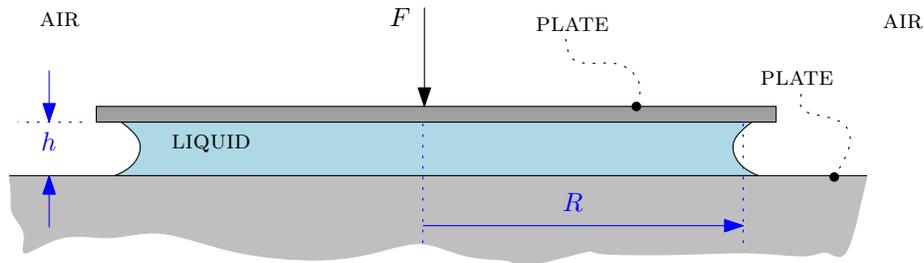


MIT Department of Mechanical Engineering
2.25 Advanced Fluid Mechanics

Problem 2.07

This problem is from “Advanced Fluid Mechanics Problems” by A.H. Shapiro and A.A. Sonin



A drop of liquid of volume V is squeezed between two parallel smooth plates until the liquid thickness h is very small compared with the liquid's radial extent R . The liquid/plate/air contact angle α , and the liquid/air surface tension is σ . Gravitational effects are negligible.

- (a) Derive an expression for the downward force F required to hold the plates in position. Express F in terms V , α , σ , and R .
- (b) If $\alpha = \pi$ radians (a perfectly nonwetting situation) and $T = 0.07 \text{ N/m}$, say (representing a clean air-water interface), what downward force is required to press a 3 mm^3 drop of liquid into a thin disc or radius $R = 2 \text{ cm}$?

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