Capillary rise in wedges

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A wetting liquid put into contact with a thin vertical tube rises spontaneously in it, reaching a final height \( z = h_e \) given by Jurin’s law: \( \frac{h_e}{r} = 2 \left( \frac{a}{r} \right)^2 \cos \theta_c \) where \( r \) is the radius of the tube, \( a = \sqrt{\frac{\gamma}{\rho g}} \) is the capillary length, based on the liquid surface tension \( \gamma \), liquid density \( \rho \) and gravity \( g \), and \( \theta_c \) is the contact angle characterizing the wetting of the liquid on the solid.— Also, when \( z \ll h_e \), where gravity can be neglected, the front of the liquid follows Washburn’s law: \( z = \sqrt{2 \frac{\gamma \cos \theta_c \rho}{\eta} t} \), where \( \eta \) is the liquid viscosity.— This works for all systems having a “closed” geometry, that is a scaling length, provided this scaling length is smaller than \( a \).— We use systems of “open” geometry, without scaling length, typically wedges with different geometries and show both experimentally and theoretically that the meniscus rises following the universal law: \( \frac{h(t)}{a} \sim \left( \frac{\gamma \cos \theta_c \rho}{\eta} t \right)^{1/3} \). It differs from the case of “closed” geometry because it rises indefinitely and with a different dynamic. It is universal in the sense that it does not depend on the special geometry of the wedge.