Answer on Question #60139-Physics-Mechanics-Relativity

In a capillary tube of radius 'R', a straight thin metal wire of radius 'r' (R > r) is inserted symmetrically and one end of the combination is dipped vertically in water such that the lower end of the combination is at same level. The rise of water in the capillary tube is [T = surface tension of water, ρ = density of water, g = gravitational acceleration]

Solution

For a vertical cylindrical tube:

$$LT = A\rho gh.$$

$$A = \pi R^2 - \pi r^2 = \pi(R + r)(R - r)$$

$$L = 2\pi R + 2\pi r = 2\pi(R + r)$$

Therefore,

$$2\pi(R + r)T = \pi(R + r)(R - r)\rho gh.$$

$$2T = (R - r)\rho gh.$$

$$h = \frac{2T}{(R - r)\rho g}$$