Capillary Rise in a Tube (Jurin's Law)

Height a liquid rises (or is depressed) in a narrow tube from surface tension, contact angle, tube radius and density, with water's surface tension from IAPWS.

Method: Jurin's law h = 2σ cos θ/(ρ g r); IAPWS R1-76(2014) surface tension of water

Input parameters

Unit system: SI

Parameter	Value	Unit
Liquid	Water (surface tension from IAPWS at the temperature)	
Temperature (for water)	20.000	°C
Surface tension (other liquid)	0.048500	N/m
Contact angle	0	°
Tube inside diameter	1.0000	mm
Liquid density	998.00	kg/m³

Calculated results

Parameter	Value	Unit
Surface tension used	0.072736	N/m
Capillary rise 4σ cos θ/(ρ g d)	29.728	mm

Notes for this case

- Negative rise means depression (contact angle above 90°, as for mercury in glass).

Formula and method

$$h = \frac{4\sigma\cos\theta}{\rho g d}, \quad \sigma_w = B\tau^{\mu}(1+b\tau),\ \tau = 1 - \frac{T}{T_c}$$

Variables

liquid	Liquid	-
T	Temperature (for water)	K
σ	Surface tension (other liquid)	N/m
θ	Contact angle	rad
d	Tube inside diameter	m
ρ	Liquid density	kg/m³
σ_u	Surface tension used	N/m
h	Capillary rise 4σ cos θ/(ρ g d)	m

Method and standards

Surface tension balancing the column weight.

Assumptions and limits

- Narrow, clean tube: the diameter well below the capillary length √(σ/(ρg)) (about 2.7 mm for water); larger tubes are flagged.
- For water the surface tension follows the temperature but the density is your entry: a density more than 0.5 % from water's at that temperature is flagged.

References

- Jurin's law h = 2σ cos θ/(ρ g r)
- IAPWS R1-76(2014) surface tension of water

Report details

Report reference	FCC-H8YS-AF4D (the same inputs always give the same reference)
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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/mechanical/fluid-mechanics/capillary-rise

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.