Weber, Bond, Capillary and Ohnesorge Numbers

Weber, Bond (Eötvös), capillary and Ohnesorge numbers and the capillary length, which show when surface tension matters against inertia, gravity and viscosity.

Method: Dimensionless groups of capillarity

Input parameters

Unit system: SI

Parameter	Value	Unit
Liquid density	998.00	kg/m³
Density difference with the surrounding fluid	997.00	kg/m³
Liquid viscosity	1.0000	mPa·s
Surface tension	72.800	mN/m
Velocity	2.0000	m/s
Length scale (drop or jet diameter)	2.0000	mm

Calculated results

Parameter	Value	Unit
Weber number ρV²L/σ	109.67	
Bond number ΔρgL²/σ	0.53721	
Capillary number μV/σ	0.027473	
Ohnesorge number μ/√(ρσL)	0.002623	
Capillary length √(σ/Δρg)	2.7287	mm

Notes for this case

• Surface tension competes with inertia (Weber number), gravity (Bond or Eötvös number) and viscosity (capillary number). Drops break up in a gas stream above We ≈ 12; bubbles and drops are nearly spherical for Bo ⍰ 1 and deform for Bo > 1; the capillary length (2.7 mm for water in air) separates the two regimes. The Ohnesorge number, independent of velocity, sorts atomisation and inkjet behaviour (printable fluids have about 0.1 < Oh < 1).

Formula and method

$$We = \frac{\rho V^2 L}{\sigma}, \quad Bo = \frac{\Delta\rho g L^2}{\sigma}, \quad Ca = \frac{\mu V}{\sigma}, \quad Oh = \frac{\mu}{\sqrt{\rho\sigma L}}$$

Variables

ρ	Liquid density	kg/m³
$\Delta\rho$	Density difference with the surrounding fluid	kg/m³
μ	Liquid viscosity	Pa·s
σ	Surface tension	N/m
V	Velocity	m/s
L	Length scale (drop or jet diameter)	m
We	Weber number ρV²L/σ	-
Bo	Bond number ΔρgL²/σ	-
Ca	Capillary number μV/σ	-
Oh	Ohnesorge number μ/√(ρσL)	-
ℓ_c	Capillary length √(σ/Δρg)	m

Method and standards

Capillary numbers.

Assumptions and limits

- Clean interfaces; constant properties; g = 9.80665 m/s².

References

Dimensionless groups of capillarity

Report details

Report reference	FCC-E0XB-NJ2N (the same inputs always give the same reference)
Generated	23 November 2026, 17:51 UTC
Calculator	Weber, Bond, Capillary and Ohnesorge Numbers
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 November 2026
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/weber-bond-capillary-numbers

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.