Capillary Pressure, Height Above Free Water and Leverett J

Capillary pressure in a pore throat, capillary rise, capillary pressure at a height above the free-water level and the dimensionless Leverett J-function.

Input parameters

Unit system: SI

Parameter	Value	Unit
Interfacial tension	50.000	mN/m
Contact angle	0	°
Pore throat (tube) radius	5.0000	µm
Water density	1,050.0	kg/m³
Oil (or gas) density	200.00	kg/m³
Height above the free-water level	50.000	ft
Permeability (for J)	10.000	mD
Porosity (for J)	12.000	%

Calculated results

Parameter	Value	Unit
Capillary pressure in the throat	2.9008	psi
Capillary rise for that throat	7.8718	ft
Capillary pressure at the height h	18.425	psi
Leverett J at the height h	0.72863	

Notes for this case

• Water saturation at a height follows from the rock's capillary pressure curve at p_c(h). The J-function normalises curves from rocks of different k and φ so that one curve can describe a whole formation.

Formula and method

$$p_c = \frac{2\sigma\cos\theta}{r}, \quad h_c = \frac{2\sigma\cos\theta}{r\,g\Delta\rho}, \quad p_c(h) = \Delta\rho\,g\,h, \quad J = \frac{p_c}{\sigma}\sqrt{\frac{k}{\phi}}$$

Variables

σ	Interfacial tension	N/m
θ	Contact angle	rad
r	Pore throat (tube) radius	m
ρ_w	Water density	kg/m³
ρ_o	Oil (or gas) density	kg/m³
h	Height above the free-water level	m
k	Permeability (for J)	m²
ϕ	Porosity (for J)	-
p_c	Capillary pressure in the throat	Pa
h_c	Capillary rise for that throat	m
$p_c(h)$	Capillary pressure at the height h	Pa
J	Leverett J at the height h	-

Method and standards

Capillary equilibrium.

Assumptions and limits

- Static capillary equilibrium.

Report details

Report reference	FCC-GYQ3-HM8A (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/chemical/reservoir-engineering/capillary-pressure-height-leverett

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.