Oil–Water Relative Permeability and Capillary Pressure (Corey Form)

Oil and water relative permeability and capillary pressure at a water saturation from Corey-type end points and exponents, with water cut and mobility ratio.

Input parameters

Unit system: SI

Parameter	Value	Unit
Water saturation	50.000	%
Connate water saturation	20.000	%
Residual oil saturation to water	25.000	%
Oil relative permeability at connate water	0.90000	
Water relative permeability at residual oil	0.30000	
Oil exponent	2.0000	
Water exponent	3.0000	
Capillary pressure at connate water	8.0000	psi
Capillary pressure exponent	1.0000	
Oil viscosity	5.0000	cP
Water viscosity	0.60000	cP

Calculated results

Parameter	Value	Unit
Oil relative permeability	0.18595	
Water relative permeability	0.048685	
Oil–water capillary pressure	3.6364	psi
Water cut, horizontal flow	68.571	%
End-point mobility ratio	2.7778	

Notes for this case

• These analytic forms are what simulators use to represent laboratory curves; fit the end points and exponents to core data. M above 1 means water is more mobile than the oil it displaces: an unfavourable flood.

Formula and method

$$k_{ro} = (k_{ro})_{S_{wc}} \left(\frac{1 - S_w - S_{orw}}{1 - S_{wc} - S_{orw}} \right)^{n_o}, \quad k_{rw} = (k_{rw})_{S_{orw}} \left(\frac{S_w - S_{wc}}{1 - S_{wc} - S_{orw}} \right)^{n_w}, \quad p_c = (p_c)_{S_{wc}} \left(\frac{1 - S_w - S_{orw}}{1 - S_{wc} - S_{orw}} \right)^{n_p}$$

Variables

S_w	Water saturation	-
S_{wc}	Connate water saturation	-
S_{orw}	Residual oil saturation to water	-
$(k_{ro})_{S_{wc}}$	Oil relative permeability at connate water	-
$(k_{rw})_{S_{orw}}$	Water relative permeability at residual oil	-
n_o	Oil exponent	-
n_w	Water exponent	-

$(p_c)_{S_{wc}}$	Capillary pressure at connate water	Pa
n_p	Capillary pressure exponent	-
μ_o	Oil viscosity	Pa·s
μ_w	Water viscosity	Pa·s
k_{ro}	Oil relative permeability	-
k_{rw}	Water relative permeability	-
p_{cwo}	Oil–water capillary pressure	Pa
f_w	Water cut, horizontal flow	-
M	End-point mobility ratio	-

Method and standards

Corey-type analytic relative permeability.

Assumptions and limits

- Two-phase oil–water system.

Report details

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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/relative-permeability-oil-water

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Reopens the calculator with the inputs of this report.