BLOCKED AREA CALCULATION AT 0.4 BAR
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[1] Input Parameters
Pressure (P)   = 0.4 bar = 40000 Pa
Membrane radius (a)   = 37.50 µm = 0.00375 cm
Membrane thickness (t)   = 1.80 µm = 0.00018 cm
Young's modulus (E)   = 7.00e+06 Pa
Poisson's ratio (ν)   = 0.3
Constant (C_2f)   = 2.67
Channel cross-section A = 4.12500e-05 cm²

[2] Intermediate Calculations
Effective modulus (E′)   = 1.00e+07 Pa

Factor = (a × P × C_2f) / (E' × t)
       = (0.00375 × 40000 × 2.67) / (1.00e+07 × 0.00018)
       = 400.50000 / 1800.00000
       = 0.22250

w_0 = a × factor^(1/3)
   = 0.00375 × (0.22250)^(1/3)
   = 0.00227 cm = 22.72 µm

r = (a^2 + w_0^2) / (2 × w_0)
  = (0.00375^2 + 0.00227^2) / (2 × 0.00227)
  = (1.40625e-05 + 5.16356e-06) / 0.00454
  = 0.00423 cm

θ = 2 × arcsin(a / r)
  = 2 × arcsin(0.00375 / 0.00423)
  = 2.17916 rad

Triangle Area = a × (r - w_0)
              = 0.00375 × (0.00423 - 0.00227)
              = 7.34286e-06 cm²

Sector Area = 0.5 × r^2 × θ
            = 0.5 × 0.00423^2 × 2.17916
            = 1.94998e-05 cm²

Arc (Blocked) Area = Sector - Triangle
                   = 1.94998e-05 - 7.34286e-06
                   = 1.21569e-05 cm²

[3] Final Result
Blocked Area (%) = (Arc Area / Channel Area) × 100
                 = (1.21569e-05 / 4.12500e-05) × 100
                 = 29.47 %

➡ Final Blocked Area at 0.4 bar = 29.47 %

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BLOCKED AREA CALCULATION AT 0.6 BAR
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[1] Input Parameters
Pressure (P)             = 0.6 bar = 60000 Pa
Membrane radius (a)      = 37.50 µm = 0.00375 cm
Membrane thickness (t)   = 1.80 µm = 0.00018 cm
Young's modulus (E)      = 7.00e+06 Pa
Poisson's ratio (ν)      = 0.3
Constant (C₂f)           = 2.67
Channel cross-section A  = 4.12500e-05 cm²

[2] Intermediate Calculations
Effective modulus (E′)   = 1.00e+07 Pa

Factor = (a × P × C₂f) / (E' × t)
       = (0.00375 × 60000 × 2.67) / (1.00e+07 × 0.00018)
       = 600.75000 / 1800.00000
       = 0.33375

w₀ = a × factor^(1/3)
   = 0.00375 × (0.33375)^(1/3)
   = 0.00260 cm = 26.01 µm

r = (a² + w₀²) / (2 × w₀)
  = (0.00375² + 0.00260²) / (2 × 0.00260)
  = (1.40625e-05 + 6.76618e-06) / 0.00520
  = 0.00400 cm

θ = 2 × arcsin(a / r)
  = 2 × arcsin(0.00375 / 0.00400)
  = 2.42581 rad

Triangle Area = a × (r - w₀)
              = 0.00375 × (0.00400 - 0.00260)
              = 5.25937e-06 cm²

Sector Area = 0.5 × r² × θ
            = 0.5 × 0.00400² × 2.42581
            = 1.94422e-05 cm²

Arc (Blocked) Area = Sector - Triangle
                   = 1.94422e-05 - 5.25937e-06
                   = 1.41829e-05 cm²

[3] Final Result
Blocked Area (%) = (Arc Area / Channel Area) × 100
                 = (1.41829e-05 / 4.12500e-05) × 100
                 = 34.38 %

➡ Final Blocked Area at 0.6 bar = 34.38 %
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BLOCKED AREA CALCULATION AT 0.8 BAR
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[1] Input Parameters
Pressure (P)             = 0.8 bar = 80000 Pa
Membrane radius (a)      = 37.50 µm = 0.00375 cm
Membrane thickness (t)   = 1.80 µm = 0.00018 cm
Young's modulus (E)      = 7.00e+06 Pa
Poisson's ratio (ν)      = 0.3
Constant (C₂f)           = 2.67
Channel cross-section A  = 4.12500e-05 cm²

[2] Intermediate Calculations
Effective modulus (E′)   = 1.00e+07 Pa

Factor = (a × P × C₂f) / (E' × t)
       = (0.00375 × 80000 × 2.67) / (1.00e+07 × 0.00018)
       = 801.00000 / 1800.00000
       = 0.44500

w₀ = a × factor^(1/3)
   = 0.00375 × (0.44500)^(1/3)
   = 0.00286 cm = 28.63 µm

r = (a² + w₀²) / (2 × w₀)
  = (0.00375² + 0.00286²) / (2 × 0.00286)
  = (1.40625e-05 + 8.19664e-06) / 0.00573
  = 0.00389 cm

θ = 2 × arcsin(a / r)
  = 2 × arcsin(0.00375 / 0.00389)
  = 2.60824 rad

Triangle Area = a × (r - w₀)
              = 0.00375 × (0.00389 - 0.00286)
              = 3.84163e-06 cm²

Sector Area = 0.5 × r² × θ
            = 0.5 × 0.00389² × 2.60824
            = 1.97078e-05 cm²

Arc (Blocked) Area = Sector - Triangle
                   = 1.97078e-05 - 3.84163e-06
                   = 1.58662e-05 cm²

[3] Final Result
Blocked Area (%) = (Arc Area / Channel Area) × 100
                 = (1.58662e-05 / 4.12500e-05) × 100
                 = 38.46 %

➡ Final Blocked Area at 0.8 bar = 38.46 %
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BLOCKED AREA CALCULATION AT 1.2 BAR
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[1] Input Parameters
Pressure (P)             = 1.2 bar = 120000 Pa
Membrane radius (a)      = 37.50 µm = 0.00375 cm
Membrane thickness (t)   = 1.80 µm = 0.00018 cm
Young's modulus (E)      = 7.00e+06 Pa
Poisson's ratio (ν)      = 0.3
Constant (C₂f)           = 2.67
Channel cross-section A  = 4.12500e-05 cm²

[2] Intermediate Calculations
Effective modulus (E′)   = 1.00e+07 Pa

Factor = (a × P × C₂f) / (E' × t)
       = (0.00375 × 120000 × 2.67) / (1.00e+07 × 0.00018)
       = 1201.50000 / 1800.00000
       = 0.66750

w₀ = a × factor^(1/3)
   = 0.00375 × (0.66750)^(1/3)
   = 0.00328 cm = 32.77 µm

r = (a² + w₀²) / (2 × w₀)
  = (0.00375² + 0.00328²) / (2 × 0.00328)
  = (1.40625e-05 + 1.07406e-05) / 0.00655
  = 0.00378 cm

θ = 2 × arcsin(a / r)
  = 2 × arcsin(0.00375 / 0.00378)
  = 2.87293 rad

Triangle Area = a × (r - w₀)
              = 0.00375 × (0.00378 - 0.00328)
              = 1.90050e-06 cm²

Sector Area = 0.5 × r² × θ
            = 0.5 × 0.00378² × 2.87293
            = 2.05692e-05 cm²

Arc (Blocked) Area = Sector - Triangle
                   = 2.05692e-05 - 1.90050e-06
                   = 1.86687e-05 cm²

[3] Final Result
Blocked Area (%) = (Arc Area / Channel Area) × 100
                 = (1.86687e-05 / 4.12500e-05) × 100
                 = 45.26 %

➡ Final Blocked Area at 1.2 bar = 45.26 %
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