2nd hydraulic year

Fluid Mechanics
(Series : 1)

Exercise I.1

A volume of 3 m ^{3} of industrial oil weighs 23.5 kN . Calculate its Specific-weigh (ϖ), its density (ρ) and its relative density (d).

Exercise I.2

Calculate the density , ρ *and* the density ϖ of methane under ambient conditions of p = 8.3 10 ^{5} pa and T° = 38 °C. Knowing that the gas coefficient r = 518.5$J/kg.K$

Exercise I.3

A gas with a density of 1.408 kg/m^3 under ambient conditions of T° = 32°C and p = 2.07 10 ^{5} . Determine the gas constant *r* .

Exercise I.4

a) Find the change in volume of 28.32 dm^3 of water at 27 ° C for an increase in pressure of 20.7 10 ^{5} Pa. Knowing that χ = 4.46 10 $^{-10}$ Pa

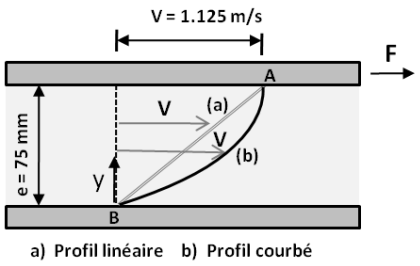
b) Based on the following experimental data, determine the compressibility (χ) of water: at 34.5 10^5 Pa the volume is 28.32 dm^3 and at 241.3 10^5 Pa it is 28.05 dm ^{3} .

Exercise I.5

Express in m^2/s the kinematic viscosity of a liquid whose dynamic viscosity is 15.14 poise and whose relative density is 0.964.

Exercise I.6

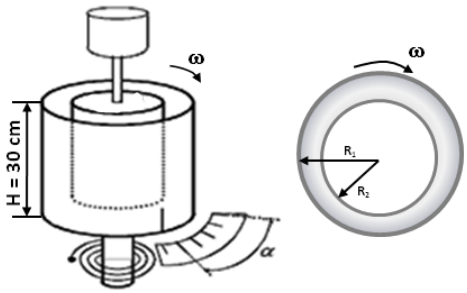
A Newtonian fluid at a dynamic viscosity is 0.048 Pa.s and a relative density of 0.913. Calculate the velocity gradient and the intensity of the tangential stress at the wall and at the points located at 25 mm, 50 mm and 75 mm from it, assuming *(a)* a linear velocity distribution, (*b)* a parabolic velocity distribution. The parabola of the figure at its vertex at *A.* The origin is in *B.*



a) Profil linéaire b) Profil courbé

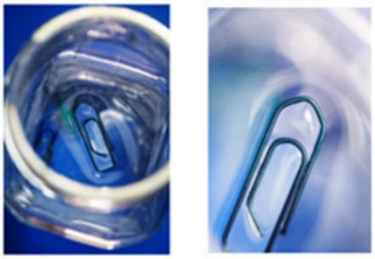
Exercise I.7

Two coaxial cylinders, the external one of radius R_1 = 12.8 cm rotating and the internal one is fixed and of radius R_2 = 12.2 cm. The two cylinders are 30 cm long. Determine the viscosity of the liquid that fills the space between the two cylinders, if it is necessary to apply a torque of 0.881 Nm to maintain the angular velocity (ω) at 2π rad/s.



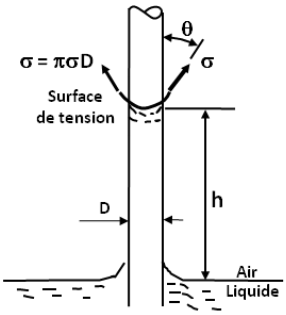
Exercise I.8

A needle with a length of 35 mm is placed on the surface of water at 20°C. What strength additional, in relation to its weight, should we apply it to get it out of the water? Knowing that the surface tension of water is σ= 0.0728 N/m



Exercise I.9

A glass tube of 0.2 mm in diameter contains a volume of water (T° = 32 °C) which is capable of climbing the internal wall by the phenomenon of surface tension. The angle (θ) between the water surface and the wall is 0°. What is the capillary rise (h) of water.



Exercise I.10

A car tire is under the conditions of P = 250 kPa and temperature T = 15°C in state A. The car is driven to state B, the tire receives the new temperature of 65°C without any air leaking outside the tire and the air volume remains constant.

Estimate the pressure in the tire in condition B.