Abdelhafid Boussouf University Center - Mila **Academic year 2023–2024**

Institute of Natural and Life Sciences

Module : physics

Series N°5 : Fluid Mechanics

Exercise 1 : Hydrostatics

A metal block in the shape of a parallelepiped, with edges measuring 1 m, 0.8 m, and 0.5 m.

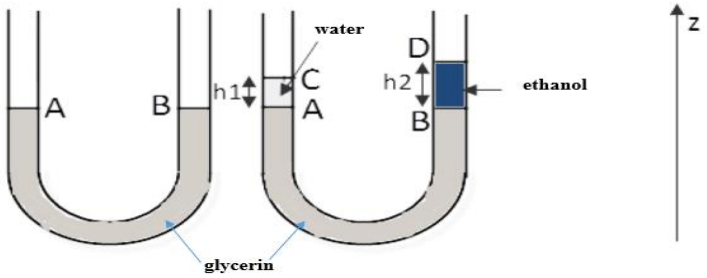
The block, with a density of 7800 $kg.m^{-3}$, rests on the ground with one of its faces.

1-Calculate the pressure exerted on the ground in the three possible cases.

2-Express the pressure p = 45.106 Pa in bar, hPa, mbar, atm, cmHg.

Exercise 2 : Hydrostatics

To determine the density $\rho_{ethanol}$ of ethanol, glycerin is introduced into a tube. In the left branch, water with a density ρ_{water} = 1000 kg/m^3 is poured to a height h_1=10 cm, causing a difference in level between points A and B. To bring points A and B back to the same height, methanol is poured to a height h_2=12.5cm.



1- Write the fundamental hydrostatic relationship for the three fluids.
2- Deduce the density $\rho_{ethanol}$ of ethanol.

Exercise 3 : Hydrostatics

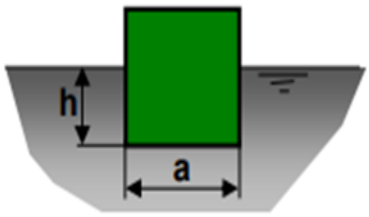
A steel cube with a side length of a=50 cm is floating on mercury.

We are given the densities:

Of steel ρ_1= 7800 kg/m^3

Of mercury ρ_2= 13600 kg/m^3

1- Applying Archimedes' principle,
2- Determining the submerged height h.



Exercise 4 : Hydrodynamics

In a tube with an inner diameter d = 12.7 mm, oil with a density of 820 kg/m^3 flows at an average velocity of 1.2 m/s.

1-Calculate the volumetric flow rate Qv and the mass flow rate Qm.On a high-pressure cleaner, it is marked 120 bars, 8.4 L/min.

2-What should be the outlet area so that the velocity of the water is 140 m/s.

3-What is the velocity of the water in the pipe, knowing that its section has a diameter of 1.2 cm.