Série n°1 - Mécanique des Fluides

Exercise 1:
If an object has a mass of 2.0 slugs at the sea level, what would be its mass at location where acceleration due to gravity is about 30.0 ft/s^2.

Exercise 2:
Under standard conditions a certain gas weighs 0.14 lb/ft^3. Calculate its density, specific volume and specific gravity relative to air weighting 0.075 lb/ft^3.

Exercise 3:
If K = 2.2GPa is the bulk modulus or elasticity for water, what pressure is required to reduce a volume by 6%?

Exercise 4:
A rigid steel container is partially filled with liquid at 15 atm. The volume of the liquid is 1.23200L. At a pressure or 30 atm, the volume of the liquid is 1.23100L. Find the average bulk modulus of elasticity of the liquid over the given range of pressure if the temperature after compression is allowed to return to its initial value. What is the coefficient of compressibility β?

Exercise 5:

A heavy tank contains oil (A) and water (B) subject to variable air pressure; the dimensions shown in figure 1 correspond to 1 atm. If air is slowly added from a pump to bring pressure p up to 1 MPa gage, what will be the total downward movement of the free surface of oil and water ? Take the average values of bulk moduli of elasticity of the liquids as 2050 MPa for oil and 2075 MPa for water. Assume the container does not change volume. Neglect hydrostatic pressure.

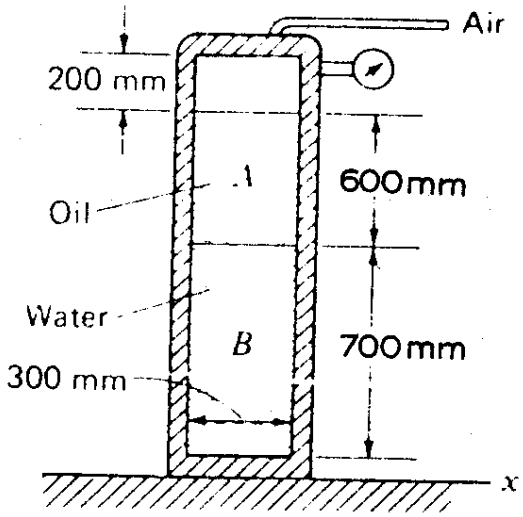

Figure 1: Oil and Water tank

Exercice 6 : contrainte dans une huile

On suppose que de l'huile ayant une viscosité μ=0.29 Pa.s s'écoule entre les deux plaques dont l'une est soumise à la force $\vec{F}$ (voir figure 2). Calculer la contrainte visqueuse τ dans l'huile si la vitesse de la plaque supérieure est de U = 3 m.s^{-1} et que la distance entre plaque est de h = 2 cm.

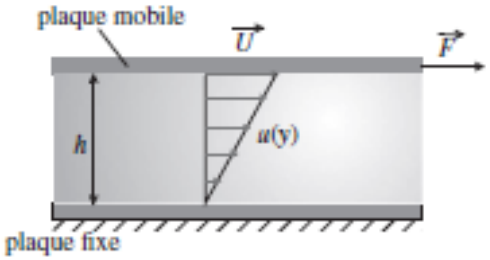

Figure 2 : Représentation 2D de l'expérience de Newton

Exercice 7 : Plaque mobile dans un fluide

Une grande plaque mobile se trouve entre deux grandes plaques fixes comme illustré sur la figure ci-dessus. Deux fluides newtoniens ayant des viscosités indiquées sur la figure se trouvent de part et d'autre de la plaque mobile, le profil de vitesse étant linéaire. Déterminer l'amplitude et la direction des contraintes de cisaillement qui agissent sur les murs fixes lorsque la plaque mobile se déplace à une vitesse de U = 4 m.s–1. On supposera que la distribution des vitesses entre les parois de part et d'autre de la plaque mobile est linéaire.