Exercise No. 1:

Determine the flow regime in a 3 cm diameter pipe for:
1) Water flowing at the speed v =10.5 m/s and with a kinematic viscosity of 10^{-6} m^2/s.
2) Heavy fuel oil at 50°C circulating at the same speed and with a kinematic viscosity of 110. 10^{-6} m^2/s.
3) From heavy fuel oil at 10°C flowing at the same speed and with a kinematic viscosity of 290. 10^{-6} m^2/s., the linear pressure drop coefficient λ is deduced.

Exercise No. 2:

A pump with a volume flow $Q_v = 2.8$ *l* /s brings water up between a basin and a tank through a pipe with a diameter of d=135 mm as shown in Figure **1** .
We give: $Z_1 = 0$, $Z_2 = 35$ m, $P_1 = P_2 = P_{atm}$, dynamic viscosity of water: $\mu = 10^{-3}$ Pa.s and the length of the pipe L=65 m. All singular head losses will be neglected.
1) Calculate the flow velocity v of the water in the pipe.
2) Calculate the Reynolds number. Is the flow laminar or turbulent?.
3) Calculate the linear head loss coefficient. Deduce the head losses $\Delta H_{1\text{-}2}$ throughout the pipe.
4) Apply Bernoulli's theorem to calculate the net power P_{net} of the pump.
5) The efficiency of the pump being 80%, calculate the power absorbed by the pump.

Exercise No. 3:

A pump with a volume flow Q_v =2 *l* /s and an efficiency η =70% raises water from a lake to the reservoir located on a hill **(Figure 2)** , it is assumed that the levels of water vary slowly. The water is routed through a pipe with a diameter d=130 mm and a length L= 30 m in the presence of two 45° bends: BC and DE: each having a pressure drop coefficient $K_1 = K_2 = 0{,}33$.
We give: Z_1 =0 m, Z_2 = 10 m and the dynamic viscosity of water: $\mu = 10^{-3}$ Pa.s.

Required work :
1) Calculate the speed v of water flow in the pipe in m/s.
2) Calculate the Reynolds number Re.
3) Specify the nature of the flow.
4) Determine the linear pressure loss coefficient λ, specifying the formula used.
5) Calculate the linear head losses ΔH_l .
6) Calculate the singular head losses ΔH_s .
7) Determine the net power P_n of the pump in Watt.
8) Deduce the power P_a absorbed by the pump.

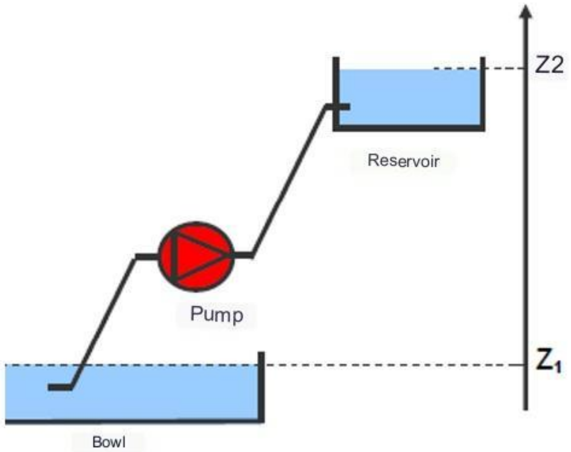

Figure 1

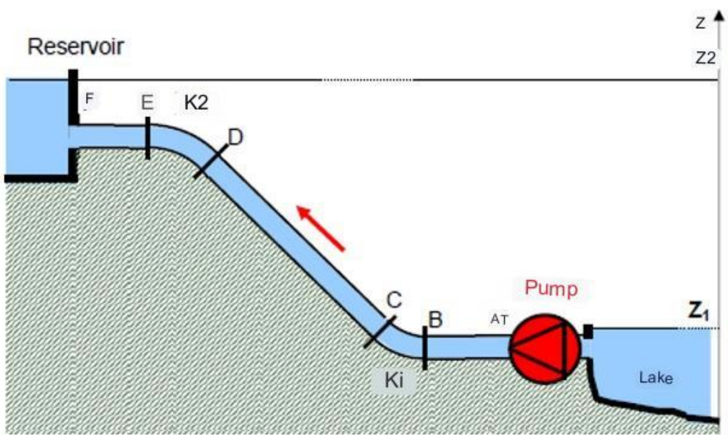

Figure 2