

Numerical PROBLEMS N°6

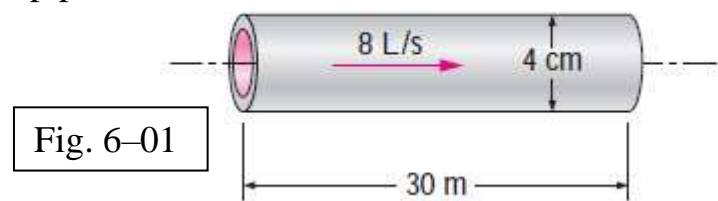
1/ A fluid with dynamic viscosity $\mu = 0.209$ (Pa.s) and SG = 0.95 circulates in a pipe of length $L=500$ (m) and diameter $D =20$ (cm) at a flow rate $Q_v=7.85$ (l/s).

We give the density of water $\rho = 1000$ (kg / m³).

- 1) Determine the kinematic viscosity ν of this fluid.
- 2) Calculate the flow velocity v .
- 3) Calculate the Reynolds number Re .
- 4) Deduce the nature of the flow.
- 5) Determine the linear pressure loss coefficient λ .
- 6) Calculate the head loss in the pipe.

2/ Water at 15°C ($\rho =999,1$ kg/m³ and $\mu = 1,138 \cdot 10^{-3}$ kg/m.s) is flowing steadily in a 30m long and 4cm diameter horizontal pipe made of stainless steel at a rate of 8 L/s. Determine:

- 1- the pressure drop,
- 2- the head loss,
- 3- the pumping power requirement to overcome this pressure drop.



3/ A fluid with a density $\rho = 961$ kg/m³ at a speed $v=1.5$ m/s in a horizontal pipe with a diameter $D = 120$ mm from a very large section tank open to the air.

On the horizontal part of this tube are installed two manometers separated by $L = 130$ m. A pressure drop $\Delta P = P_1 - P_2 = 1.5$ bar is noted.

- 1) Applying Bernoulli's theorem:

Determine the value of the loss coefficient of linear load λ as a function of: ΔP , ρ , L , D and v .

- 2) It is assumed that the flow is laminar: Calculate the Reynolds number as a function of λ .
- 3) Deduce the kinematic viscosity of the fluid.

MCQ (Multiple Choice Questions)

1/ Which one of the following is a major loss?

- a) frictional loss
- b) shock loss
- c) entry loss
- d) exit loss

2/ Which property of the fluid accounts for the major losses in pipes?

- a) density
- b) specific gravity
- c) viscosity
- d) compressibility

3/ Which one of the following is correct?

- a) the frictional resistance depends on the nature of the surface area of contact
- b) the frictional resistance is independent of the nature of the surface area of contact
- c) the frictional resistance depends on the nature of the surface area of contact for laminar flows but is independent of the nature of the surface area of contact for turbulent flows
- d) the frictional resistance is independent of the nature of the surface area of contact for laminar flows but depends on the nature of the surface area of contact for turbulent flows

4/ A liquid flows through pipes 1 and 2 with the same flow velocity. If the ratio of their pipe diameters d_1/d_2 be $3/2$, what will be the ratio of the head loss in the two pipes?

- a) $3/2$
- b) $9/4$
- c) $2/3$
- d) $4/9$

5/ Energy gradient line takes into consideration

- a) potential and kinetic heads only
- b) potential and pressure heads only
- c) kinetic and pressure heads only
- d) potential, kinetic and pressure heads