$$\text{Reynolds Number (Re)} = \frac{\rho \times d \times v}{\eta}$$

where : ρ = fluid density (kg/m^3)
d = internal pipe diameter (m)
v = fluid velocity (m/s)
η = fluid dynamic viscosity (Ns/m^2)

1. The flow of liquid through a pipe section in a chemical plant has the following fluid parameters.

   density of the liquid = $900kg/m^3$
   diameter of the pipe = 0.2m
   viscosity of the liquid = $0.04Ns/m^2$

Calculate the Reynolds number for the following velocities, and determine if it is laminar, transitional or turbulent:

(a) 0.4 m/s
(b) 0.6 m/s
(c) 1 m/s

2. For the flow rate corresponding to laminar flow, calculate the pressure loss across the pipe using the Hagen Poiseuille equation:

$$\boxed{h_f = 32\frac{\mu L C_m}{\rho g D^2}}$$

where:

h_f = head loss due to friction (m)
(note: convert to pressure loss by $\rho g h$)
μ = dynamic viscosity (Ns/m^2)
ρ = density (kg/m^2)
L = length pipe (m)
C_m = mean velocity (m/s)
D = diameter pipe (m)
g = gravitational acceleration (m/s^2)

Pipe length = 10m
Gravitational acceleration = $9.81m/s^2$

3. For the flow rate corresponding to turbulent flow, calculate the pressure loss across the pipe using the D'arcy Weishbach equation:

$$\boldsymbol{h_f = f_D \frac{L}{D} \frac{{C_m}^2}{2g}}$$

where:

h_f = head loss due to friction (m)
(note: convert to pressure loss by $\rho g h$)
f_D = 'D'arcy' friction factor[1]
L = length pipe (m)
C_m = mean velocity (m/s)
D = diameter pipe (m)
g = gravitational acceleration (9.81 m/s^2)

Pipe length = 10m
Gravitational acceleration = 9.81m/s^2
Friction Factor is taken from Moody Diagram