

Sheet #4: "Pipes"

1. A 10 cm commercial steel pipe 100 m long carries oil of sp.gr. 0.9 and viscosity 0.0025 N.s/m^2 from A to B which is 2 m lower than A. Calculate the required pressure at A to deliver 20 lit/sec. If the pressure at B = 4 bar cm
2. A 0.314 lit/sec of oil of sp.gr. 0.8 and viscosity 0.01 N.s/m^2 flow from point 'A' to point 'B' through a pipe 5 cm diameter and 1000 m long. The pressure at 'B' is 0.8 bar. Calculate the pressure at 'A'. Neglect secondary losses. If the discharge is reduced to 0.0314 lit/sec, and the pressure at 'B' is still the same, calculate the pressure at 'A'. If the flow is turbulent take $f = 0.03$.
3. A pump delivers 1 lit/s of a liquid through a galvanized iron pipe "AB" 5 cm diam. and 1 km long discharging into the atmosphere at "B" which is 4 m higher than "A". What should be the pressure at "A" if the liquid is :-
 - 1- Water
 - 2- Liquid of sp.gr. 0.9 and viscosity 0.004 N.s/m^2 (0.04 poise)
 - 3- Liquid of sp.gr. 0.95 and viscosity 0.35 N.s/m^2 (3.5 poise)
4. Water from a large reservoir is discharged to atmosphere through a 100 mm diam. pipe 450 m long. The entry from the reservoir to the pipe is sharp and the outlet is 12 m below the surface level in the reservoir. Calculate the discharge. (cast iron pipe)
5. Water discharged from a large tank into atm. through a pipe 50 mm. diam. and 45 m. long which is sharp at entry, after which there is a sudden enlargement to a pipe of 75 mm. diam., and 30 m. long. The point of delivery is 6 m. below the surface water in the tank. Determine the discharge in cu.m./sec. Assume that $f = 0.02$ for both pipes.
6. A pipe 2 km long connects two water tanks where the free surface level difference = 10 m. The first km is 4 cm diameter and the second km is 6 cm diameter, and each has one bend ($c=0.8$). f for the pipe = 0.02 compute the discharge.

7. Two water reservoirs with a difference in level of 10 mt. are connected by a pipe line 100 mt. long and 0.5 mt. diameter. If the friction factor for the pipe is 0.001. Calculate the flow rate. If at a later date the pipe line is replaced by two pipes in parallel each 0.4 mt. diameter with the same friction factor as the original pipe. Calculate the flow rate.
8. What is the effect of pipe roughness on the friction loss under laminar flow condition? Explain your answer.
9. The friction loss in pipe flow can be written in the form $h = f \cdot L \cdot v^2 / 2gd$. Is it possible for the factor f to be greater than one? Explain your answer.
10. Why are eddies formed when there is a change in the velocity vector through a pipe?
11. In a pipe flow, under what condition can you measure the energy difference between two points using only two pressure gauges?
12. What are the measuring instruments required to determine the energy difference between two points along an inclined convergent pipe transmitting liquid?
13. What is the effect of temperature rise on the coefficient of friction. Of a rough pipe transmitting liquid at highly turbulent flow condition.
14. What are the factors affecting the friction loss in case of laminar and turbulent flow?