18th January 2024

TOPICS: Mass Conservation, Bernoulli's and Momentum Equations

Problem Solving:

1. What minimum diameter of pipe is necessary to carry 2.22 N/s of air with maximum velocity of 5.64 m/s? The air is 30°C and an absolute pressure of 230 kPa.

2. The compressed air tank has a volume of 0.84 ft^3. The temperature is 70°F and the atmospheric pressure is 14.7 psi (abs). When the tank is filled with air at a gage pressure of 50 psi, determine the density of the air in kg/m^3 and the weight of air in the tank in Newton.

3. For the 100 mm diameter suction pipe leading to a pump, the pressure at point A in the suction pipe is 180 mm Hg (vacuum). If the discharge is 0.03 m^3/s of oil (SG = 0.85), find the total energy head at point A with respect to a datum at the pump. Let γ_{water} = 9.79 kN/m^3 and the elevation head from point A be 1.2 m.

4. For the Venturi meter that is vertically positioned, the deflection of mercury in the differential gage is 14.3". Determine the flows of water through the meter if no energy is lost between A & B as shown below.

5. A pipe carrying oil of SG = 0.87 changes in size from 150 mm at Section E to 450 mm at Section R. Section E is 3.66 m lower than R and the pressures are 91 kPa and 60.3 kPa, respectively. If the discharge is 0.146 m^3/s, determine the lost head and the direction of flow.

6. Water enters a pump through a 25 cm diameter pipe at 262.5 mm Hg vacuum. It leaves the pump at 140 kPa through a 15 cm diameter pipe. If the flow rate is 150 L/s, find the horsepower delivered to the water by the pump.