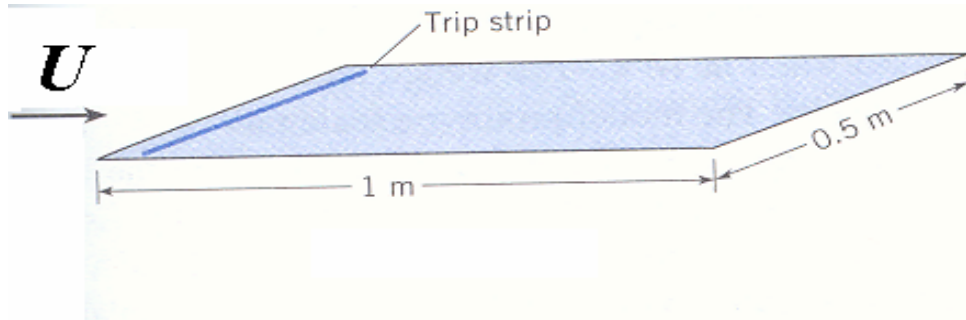
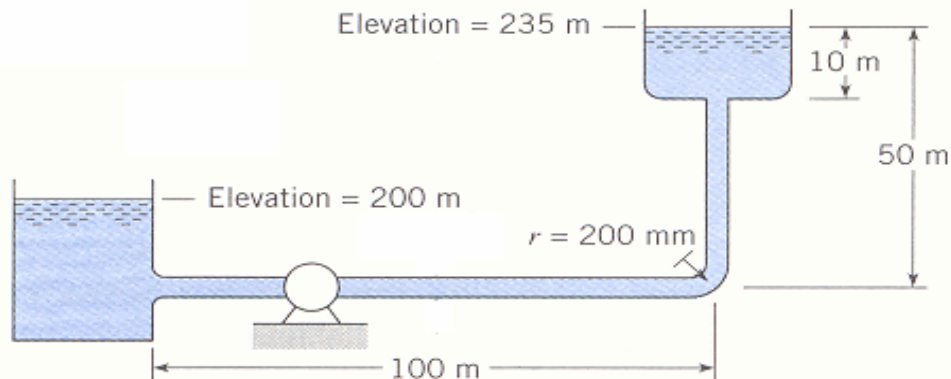


1. A flat plate is oriented parallel to a 15 m/s air flow at 20°C and atmospheric pressure. The plate is 1m long in the flow direction and 0.5m wide. On one side of the plate, the boundary layer is tripped at leading edge and on the other side is no tripping device. Find the total drag force on the plate.



2. Water at 20°C flows through a 6 cm diameter smooth brass tube at the rate of 0.002m³/s. What is f for this flow ?
3. What power must be supplied by the pump to the flow if water (at 20°C) is pumped through the 300 mm steel pipe from the lower tank to the upper one at a rate of 0.314 m³/s ?



4. A bicyclist is capable of delivering 100W of power to the wheels. The rolling resistance of a bicycle is negligible, so the power equals the aerodynamic drag times the velocity. How fast can the bicyclist travel in a 5m/s head wind if his or her projected area is 0.5 m², the drag coefficient is 0.3 and air density is 1.2kg/m³ ?