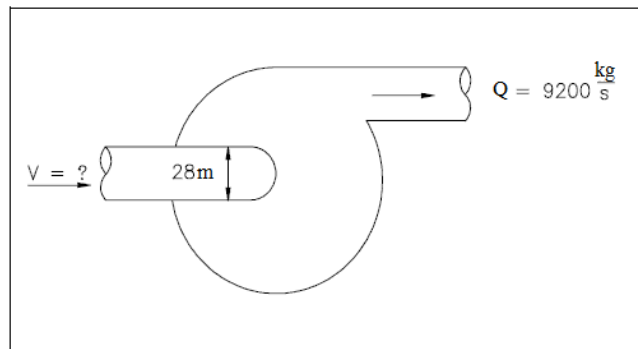


## Problem Set 8

### Physics, summer 2020/21

- 1) **(2p.)** A pipe with an inner diameter of 4 m contains water that flows at an average velocity of 14 m/s. The water in the pipe has a density of  $62.44 \text{ kg/m}^3$ . Calculate the volumetric flow rate of water in the pipe and the mass flow rate.
- 2) **(2p.)** Steady-state flow exists in a pipe that undergoes a gradual expansion from a diameter of 6 m to a diameter of 8 m. The density of the fluid in the pipe is constant at  $60.8 \text{ kg/m}^3$ . If the flow velocity is 22.4 m/s in the 6 m section, what is the flow velocity in the 8 m section?



- 3) **(2p.)** Suppose the flow rate of blood in a coronary artery has been reduced to half its normal value by plaque deposits. By what factor has the radius of the artery been reduced, assuming no turbulence occurs (laminar flow)?
- 4) **(3p)** Assume frictionless flow in a long, horizontal, conical pipe. The diameter is 2.0 m at one end and 4.0 m at the other. The pressure head at the smaller end is 16 m of water. If water flows through this cone at a rate of  $125.6 \text{ m}^3/\text{s}$ , find the velocities at the two ends and the pressure head at the larger end.
- 5) **(1p.)** Daniel Bernoulli and his famous principle get a lot of attention when it comes to lift. A lot of aviation enthusiasts would argue, however, that Bernoulli is only part of the lift story though. A different, more modern view of airplane flight relies on another famous scientific principle. Which one?
  - a) Darwin's theory of natural selection.
  - b) Newton's third law of motion.
  - c) Einstein's theory of relativity.

Sylvia Majchrowska  
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