

Homework: Ch. 12

1. What is the difference between a laminar and turbulent flow? Sketch a diagram to show this difference.
2. What is Poiseuille's law and how does it apply to viscosity?
3. For each quantity below, record the abbreviation, the SI unit, and the unit abbreviation.

Quantity	Quantity Abbreviation	SI unit	Unit Abbreviation
Flow rate			
Viscosity			
Pressure			
Density			
Area			
Force			

4. Calculate the average time (in hours) it takes a glucose molecule to move 1.0 cm in water if its diffusion constant is $D = 6.7 \times 10^{-10} \text{ m}^2/\text{s}$.
5. Suppose that you release a small ball from rest at a depth of 0.600 m below the surface in a pool of water. If the density of the ball is 0.300 that of water and if the drag force on the ball from the water is negligible, how high above the water surface will the ball shoot as it emerges from the water? Neglect any transfer of energy to the splashing and waves produced by the emerging ball.
6. Water is pumped steadily out of a flooded basement at 5.0 m/s through a hose of radius 1.0 cm, passing through a window 3.0 m above the waterline. What is the pumps power?
7. What force is needed to pull one microscope slide over another at a speed of 1.00 cm/s, if there is a 0.500 mm thick layer of 20°C water between them and the contact area is 8.00 cm²?
8. The left ventricle of a resting adult's heart pumps blood at a flow rate of 83.0 cm/s, increasing its pressure by 110.0 mmHg, it speed from 0 to 30.0 cm/s and its height by 5.00 cm. Calculate the total power output of the left ventricle. Assume that the density is $1.05 \times 10^3 \text{ kg/m}^3$.

9. Water is moving with a speed of 5.0 m/s through a pipe with a cross-sectional area of 4.0 cm². The water gradually descends 10.0 m as the pipe cross-sectional area increases to 8.0 cm².
- What is the speed of the water at the lower level?
 - If the pressure at the upper level is 1.5×10^5 Pa, what is the pressure at the lower level?
10. A liquid of density 900.0 kg/m³ flows through a horizontal pipe that has a cross-sectional area of 0.0190 m² in a region *A* and a cross-sectional area of 0.0950 m² in region *B*. The pressure difference between the two regions is 7200.0 Pa. What is the flow rate for the liquid?
11. A river flowing steadily at a rate of 170 m³/s is considered for hydroelectric power generation. It is determined that a dam can be built to collect water and release it from an elevation difference of 80 m to generate power. Determine how much power can be generated from this river water after the dam is filled.
12. The human circulatory system has about 1.00×10^9 capillary vessels. Each vessel has a diameter of about 8.00 μm. Assuming cardiac output of 5.00 L/min, determine the average velocity of blood flow through each capillary vessel.