5-minute Quiz #14

Answer these two questions:

1. A 1-kg wood log is floating on pure fresh water at a temperature of $4°$ C. The density of the log is 500 kg/m^3. (a) What is the volume of the log? *[2 points]* (b) What fraction of the log will be submerged? *[2 points]*

2. A hose of radius 8 cm and length 20 m is laying on the ground and carries a water flow of 10.0 L/s (Note: 1 L $= 10^{-3}$ m^3). (a) What is the velocity of the water in the hose? *[3 points]* (b) What is the pressure drop due to the Bernoulli effect if one end of the hose is raised to a height of 10 meters? *[3 points]*

Key Equations

Density of a sample at constant density	$\rho = \frac{m}{V}$
Pressure	$p = \frac{F}{A}$
Pressure at a depth h in a fluid of constant density	$p = p_0 + \rho gh$
Change of pressure with height in a constant-density fluid	$\frac{dp}{dy} = -\rho g$
Absolute pressure	$p_{\text{abs}} = p_{\text{g}} + p_{\text{atm}}$
Pascal's principle	$\frac{F_1}{A_1} = \frac{F_2}{A_2}$
Volume flow rate	$Q = \frac{dV}{dt}$
Continuity equation (constant density)	$A_1 v_1 = A_2 v_2$
Continuity equation (general form)	$\rho_1 A_1 v_1 = \rho_2 A_2 v_2$
Bernoulli's equation	$p + \frac{1}{2}\rho v^2 + \rho gy = \text{constant}$
Viscosity	$\eta = \frac{FL}{vA}$
Poiseuille's law for resistance	$R = \frac{8\eta l}{\pi r^4}$
Poiseuille's law	$Q = \frac{(p_2 - p_1)\pi r^4}{8\eta l}$