$$\rho g_x - \frac{\partial p}{\partial x} + \mu\left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2}\right) = \rho\frac{Du}{Dt}$$

$$\rho g_y - \frac{\partial p}{\partial y} + \mu\left(\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} + \frac{\partial^2 v}{\partial z^2}\right) = \rho\frac{Dv}{Dt}$$

$$\rho g_z - \frac{\partial p}{\partial z} + \mu\left(\frac{\partial^2 w}{\partial x^2} + \frac{\partial^2 w}{\partial y^2} + \frac{\partial^2 w}{\partial z^2}\right) = \rho\frac{Dw}{Dt}$$

Solution: (*a*) The analytic formula is found by integrating Eq. (2.17) of the text:

$$\ln\left(\frac{p}{p_o}\right) = -\frac{g}{R}\int_0^z \frac{dz}{T} = -\frac{g}{R}\int_0^z \frac{dz}{T_o e^{-Cz}} = -\frac{g}{RT_o C}(e^{Cz}-1)$$

$$\text{or, finally,} \quad p = p_o \exp\left[-\frac{g}{RT_o C}(e^{Cz}-1)\right] \qquad \textit{Ans}$$

(*b*) From Table A.4 for CO_2, R = 189 $m^2/(s^2\text{-}K)$. Substitute p = 1 Pa to find the altitu

$$p = 1\,Pa = p_o \exp\left[-\frac{g}{RT_o C}(e^{Cz}-1)\right] = (700\,Pa)\exp\left[-\frac{3.71\,m/s^2}{(189)(250)(1.3E-5)}\{e^{(1.3\text{E}-}\right.$$

$$or:\ \ln\left(\frac{1}{700}\right) = -6.55 = -6.04\{e^{(1.3\text{E}-5)z}-1\}, \quad \text{Solve for} \quad z \approx \mathbf{56,500}\ m$$

What age do you need a fishing license?

16