18. ***REASONING*** According to Equation 2.1, when an object moves with a constant speed v and travels a distance d in an elapsed time t, these three quantities are related by $v = \frac{d}{t}$. In this situation, the stone sinks a distance d from the surface to the bottom, and the elapsed time is t. When viewed from above, the stone still sinks to the bottom in an elapsed time t, but the apparent depth d' to which it sinks is not equal to the actual depth d. Therefore, the apparent speed v' of the stone is not the same as its actual speed v, and we have that

$$v = \frac{d}{t} \qquad \text{and} \qquad v' = \frac{d'}{t} \tag{1}$$

The apparent depth d' is given by $d' = d\left(\frac{n_2}{n_1}\right)$ (Equation 26.3), where $n_2 = 1.000$ is the index of refraction of air and $n_1 = 1.333$ (See Table 26.1) is the index of refraction of water.

SOLUTION Solving the first of Equations (1) for t yields $t = \frac{d}{v}$. Substituting this expression into the second of Equations (1), we obtain

$$v' = \frac{d'}{t} = \frac{d'}{\left(\frac{d}{v}\right)} = v\left(\frac{d'}{d}\right) \tag{2}$$

Substituting $d' = d\left(\frac{n_2}{n_1}\right)$ (Equation 26.3) into Equation (2), we find that

$$v' = v\left(\frac{d'}{d}\right) = v\frac{\cancel{d}\left(\frac{n_2}{n_1}\right)}{\cancel{d}} = v\left(\frac{n_2}{n_1}\right) = (0.48\text{ m/s})\left(\frac{1.000}{1.333}\right) = \boxed{0.36\text{ m/s}}$$
