2019A F=ma Exam: Problem 19

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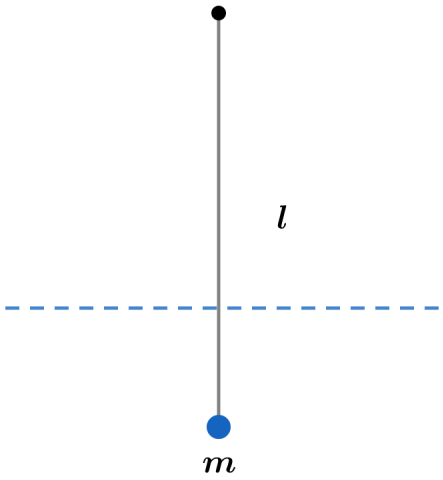
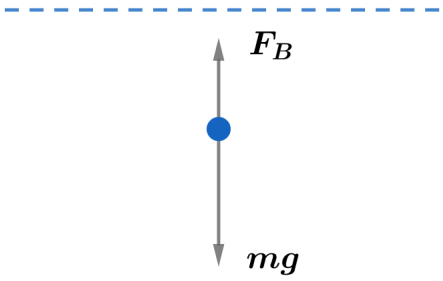


Recall the angular frequency for a simple pendulum is given by

$$\omega = \sqrt{\frac{g}{l}}$$

The presence of water changes the effective gravitational acceleration.



We have

$$mg_e = mg - F_B$$
$$\rho_r V g_e = \rho_r V g - \rho_o V g$$
$$g_e = \frac{\rho_r - \rho_o}{\rho_r} g = \frac{2\rho_o - \rho_o}{2\rho_o} g = \frac{g}{2}$$

Thus,

$$\omega = \sqrt{\frac{g_e}{l}} = \sqrt{\frac{g}{2l}} = \sqrt{\frac{10\,\mathrm{m/s^2}}{2(5\,\mathrm{m})}} = \boxed{1\,\mathrm{rad/s}}$$