

- 6.48.** When its 75-kW engine is generating full power, a small single-engine airplane with mass 700 kg gains altitude at a rate of 2.5 m/s. What fraction of the engine power is being used to make the airplane climb? (The engine power is being used to overcome the effects of air resistance and of inefficiencies in the propeller and engine.)

Identify and Set Up: Calculate the power used to make the plane climb against gravity. Consider the vertical motion since gravity is vertical.

Execute: The rate at which work is being done against gravity is
$$P = Fv = mgv = (700 \text{ kg})(9.80 \text{ m/s}^2)(2.5 \text{ m/s}) = 17.15 \text{ kW}.$$

This is the part of the engine power that is being used to make the airplane climb. The fraction this is of the total is

$$17.15 \text{ kW} / 75 \text{ kW} = 0.23.$$

Evaluate: The power we calculate for making the airplane climb is considerably less than the power output of the engine.