Solution 1.20

A gas tank is being filled with gasoline at a specified flow rate. Based on unit considerations alone, a relation is to be obtained for the filling time.

Assumptions Gasoline is an incompressible substance and the flow rate is constant.

Analysis The filling time depends on the volume of the tank and the discharge rate of gasoline. Also, we know that the unit of time is 'seconds'. Therefore, the independent quantities should be arranged such that we end up with the unit of seconds. Putting the given information into perspective, we have

$$t \text{ [s]} \quad \leftrightarrow \quad V \text{ [L], and } \dot{V} \text{ [L/s}\}$$

It is obvious that the only way to end up with the unit "s" for time is to divide the tank volume by the discharge rate. Therefore, the desired relation is

$$t = \frac{V}{\dot{V}}$$

Discussion Note that this approach may not work for cases that involve dimensionless (and thus unitless) quantities.