Problem 8.30

A .875 kg electric train accelerates at a constant rate from rest to .620 m/s in 21 milliseconds.

a.) What is the minimum power required to do this?

What's tricky about this is the fact that the only work being done is the work provided to the train by its engine (we are ignoring friction in this part). But the *net work* equal by the Work/Energy Theorem the *change of kinetic energy.* That is, we can write:

$$
\begin{aligned}
P &= \frac{W_{net}}{\Delta t} = \frac{\Delta KE}{\Delta t} \\
&= \frac{\frac{1}{2} m v_f^{\,2} - 0}{\Delta t} \\
&= \frac{\frac{1}{2}(.875\text{ kg})(.620\text{ m/s})^2 - 0}{\left(21\text{x}10^{-3}\text{ s}\right)} \\
&= 8.01\text{ W}
\end{aligned}
$$

b.) Why is this the *minimum* value required?

In the real world, not only is there need for power to accelerate the train, power will also be required to accommodate the fact that the tracks will heat up and sound will be produced. To accommodate all of that, the engine has to provide more than 8.01 W.