Problem 7.31

This is a very simple, basic problem designed to introduce you to kinetic energy.

a.) What is the kinetic energy of a particle of mass .600 kg moving at 2.00 m/s?

$$\begin{aligned} KE &= \frac{1}{2}mv^2 \\ &= \frac{1}{2}(.600\ \text{kg})(2.00\ \text{m/s})^2 \\ &= 1.20\ \text{J} \end{aligned}$$

b.) With 7.50 joules of kinetic energy, what is its velocity?

$$KE = \frac{1}{2}mv^2 = (7.50\ \text{J})$$

$$\begin{aligned} \Rightarrow \quad v &= \left[2\frac{KE}{m}\right]^{1/2} \\ &= \left[2\frac{(7.50\ \text{J})}{(.600\ \text{kg})}\right]^{1/2} \\ &= 5.00\ \text{m/s} \end{aligned}$$

NOTE: This should be abundantly clear, but if it is not, kindly note that the only relationship you need to remember here is $KE = \frac{1}{2}mv^2$. Additionally memorizing that $v = \left[2\,KE/m\right]^{1/2}$ is just plain dumb. Again, this should be obvious; I'm just saying . . .

c.) What is the net work done by the force that moves the body between those two velocities?

$$W_{net} = \Delta KE$$

$$\begin{aligned} \Rightarrow \quad W_F &= \frac{1}{2}mv_2^2 - \frac{1}{2}mv_1^2 \\ &= \frac{1}{2}(.600\ \text{kg})(5.00\ \text{m/s})^2 - \frac{1}{2}(.600\ \text{kg})(2.00\ \text{m/s})^2 \\ &= 6.30\ \text{J} \end{aligned}$$

Note: I've done this the complete way to show you the math. An obviously quicker way would have been:

$$W_{net} = \Delta KE = KE_2 - KE_1$$

$$\Rightarrow \quad W_{net} = (7.50\ \text{J}) - (1.20\ \text{J}) = (6.30\ \text{J})$$