

Homework Problem Set 6 - Solution

Exercise 1

For the same momentum, the lighter truck must have a greater speed. It also has a greater KE and thus requires more work to stop. Whenever two bodies of different masses have the same momentum, the lighter one not only is the faster of the two, it also has the greater KE. That's because in the formula $KE = 1/2 mv^2$, the mass m enters once but the speed v enters twice (that is, it is squared). That means that the effect of higher speed for the lighter truck more than offsets the effect of smaller mass.

Exercise 2

The string tension is everywhere perpendicular to the bob's direction of motion, which means there is no component of tension along the bob's path, and therefore no work done by the tension. The force of gravity, on the other hand, has a component along the direction of motion everywhere except at the bottom of the swing, and does work, which changes the bob's KE.

Exercise 3

Kinetic energy doesn't have a direction - only the speed counts in $1/2 mv^2$. So both balls start out with the same kinetic energy - the same speed - and the same potential energy - the same height. With only gravity at work (neglecting air resistance), the sum total of kinetic and potential energy will be conserved and will be the same as the initial one all the way until either ball strikes the ground. Both balls also end with the same potential energy (0) when they strike the ground, and therefore must have the same kinetic energy ($K.E. = E_{tot} - U_{pot}$, where both E_{tot} and U_{pot} are the same for both balls). Therefore, they must have the same speed (although the overall flight durations and flight paths are different).