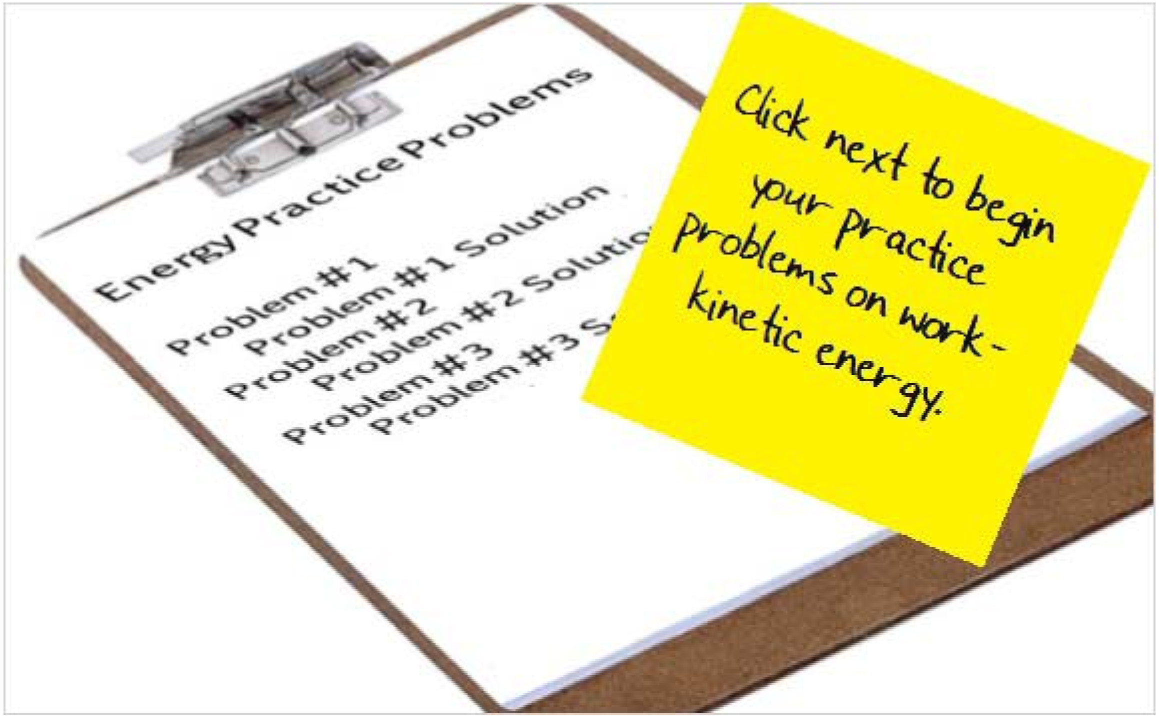
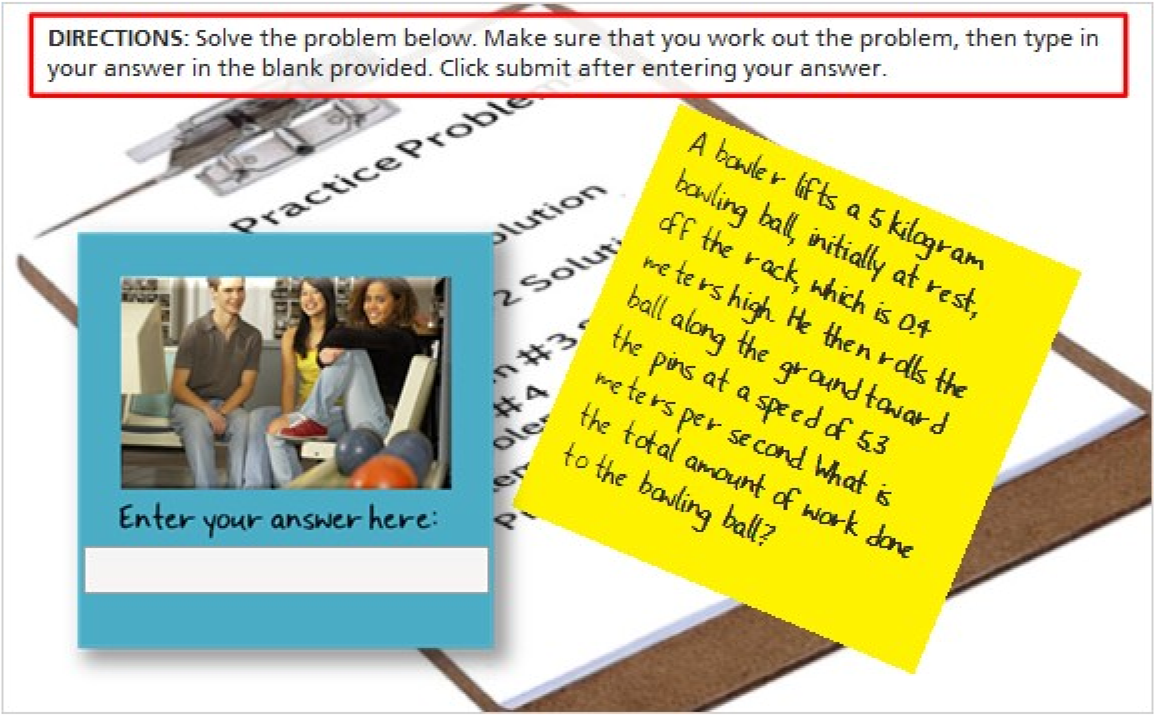
Module 3: Motion in Two Dimensions
Topic 3 Content: Work-Kinetic Energy Practice Solutions



Introduction

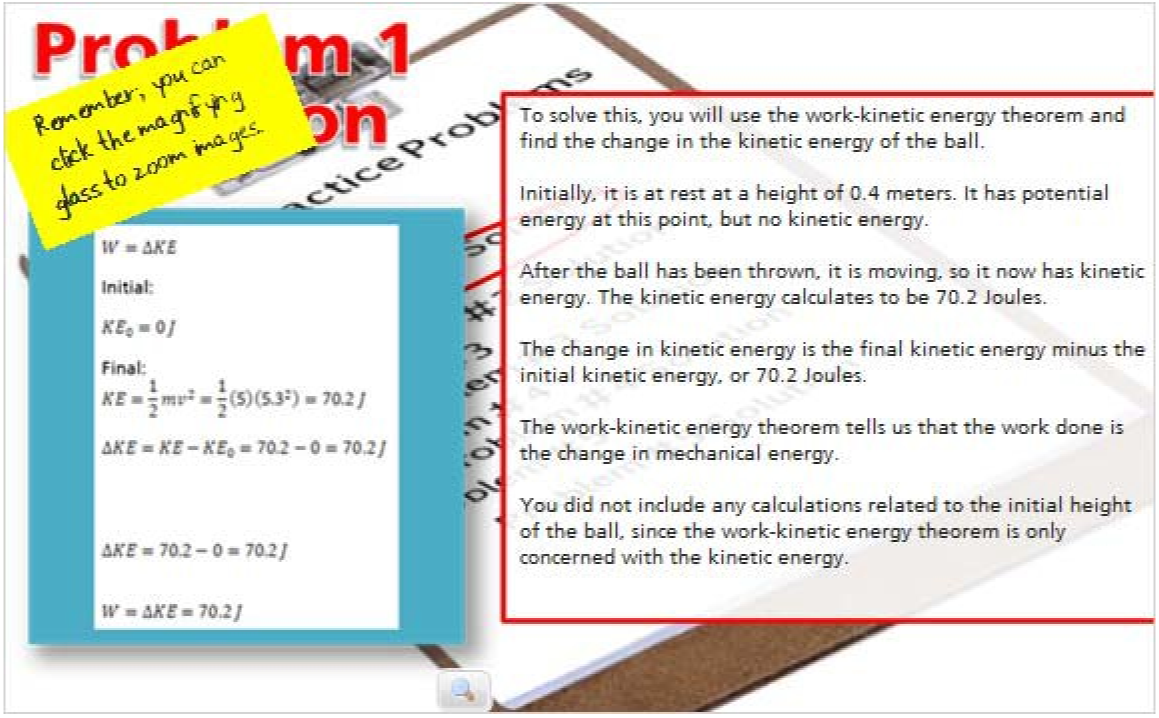
Module 3: Motion in Two Dimensions

Topic 3 Content: Work-Kinetic Energy Practice Solutions



Problem 1

A 6 kg bowling ball is lifted from a shelf 1 meter high to a shelf 1.6 meters high. What is the change in potential energy of the bowling ball?



Problem 1 Solution

To solve this, you will use the work-kinetic energy theorem and find the change in the kinetic energy of the ball.

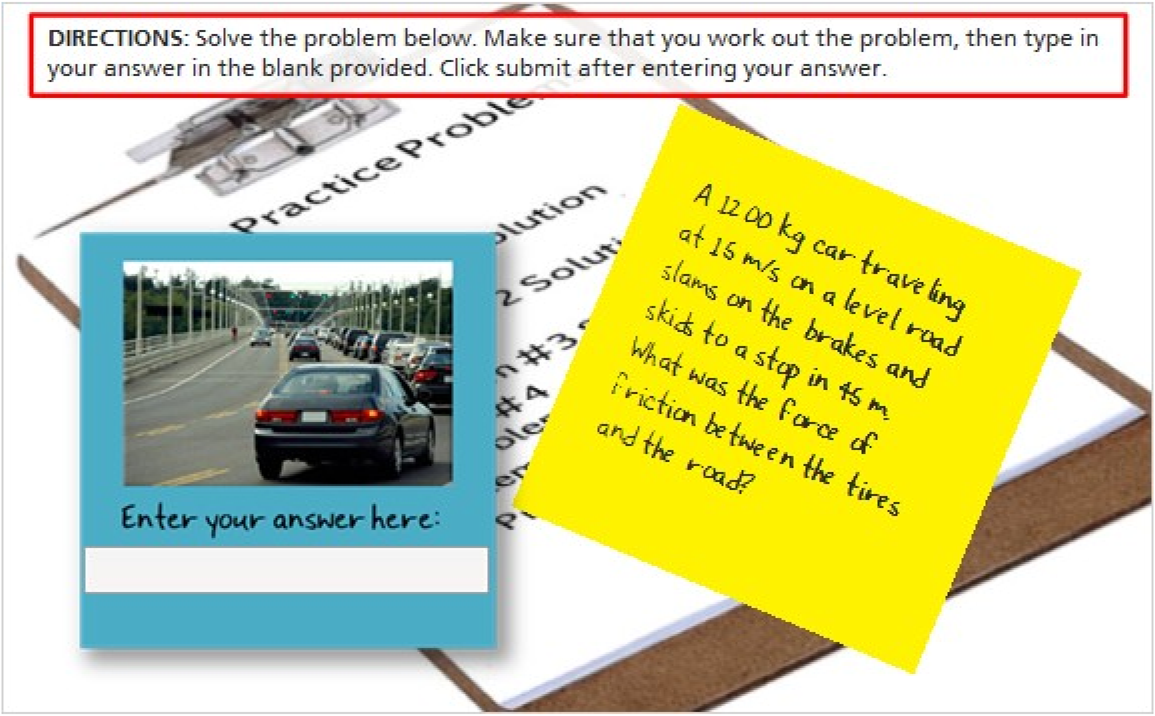
Initially, it is at rest at a height of zero point four meters. It has potential energy at this point, but no kinetic energy.

After the ball has been thrown, it is moving, so it now has kinetic energy. The kinetic energy calculates to be seventy point two Joules.

The change in kinetic energy is the final kinetic energy minus the initial kinetic energy, or seventy point two Joules.

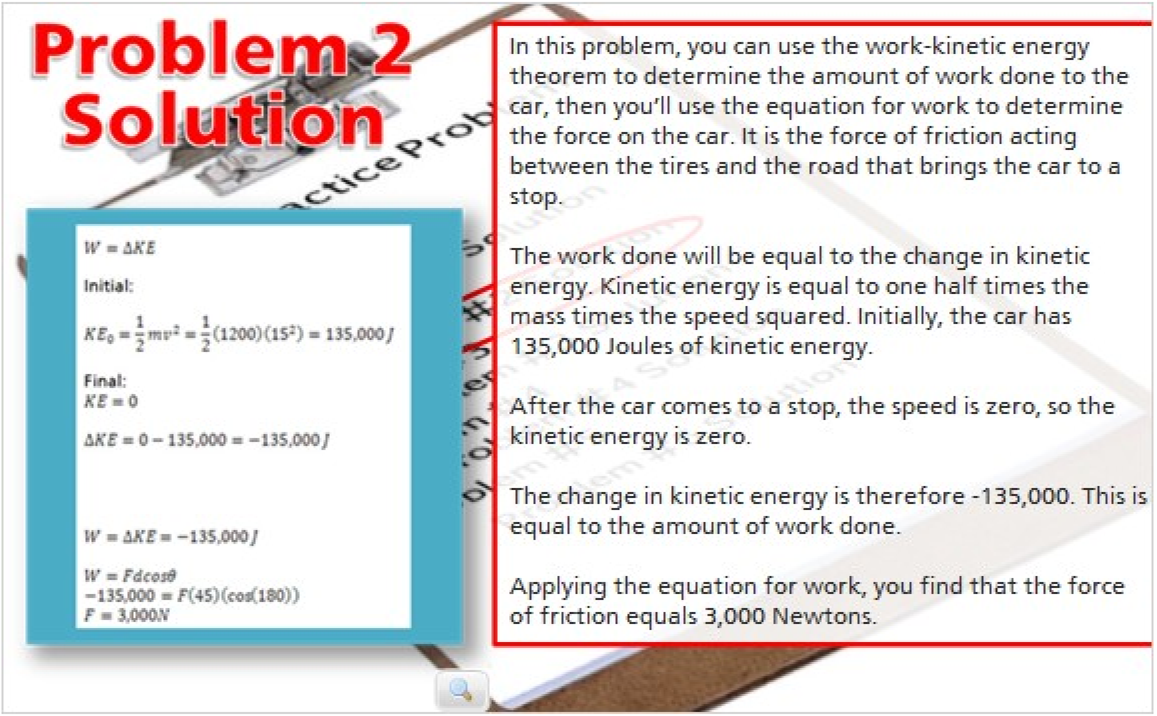
The work-kinetic energy theorem tells us that the work done is the change in mechanical energy.

You did not include any calculations related to the initial height of the ball, since the work-kinetic energy theorem is only concerned with the kinetic energy.



Problem 2

A twelve hundred kilogram car traveling at fifteen meters per second on a level road slams on the brakes and skids to a stop in forty five meters. What was the force of friction between the tires and the road?



Problem 2 Solution

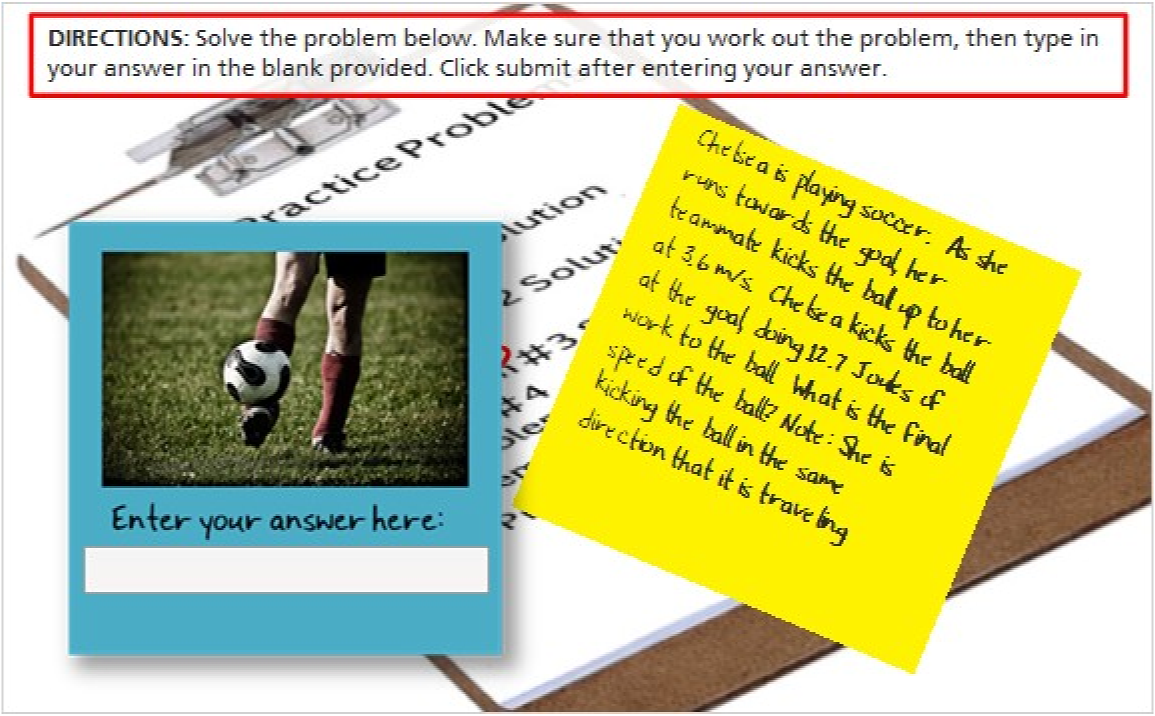
In this problem, you can use the work-kinetic energy theorem to determine the amount of work done to the car, then you'll use the equation for work to determine the force on the car. It is the force of friction acting between the tires and the road that brings the car to a stop.

The work done will be equal to the change in kinetic energy. Kinetic energy is equal to one half times the mass times the speed squared. Initially the car has one hundred thirty five thousand Joules of kinetic energy.

After the car comes to a stop, the speed is zero so the kinetic energy is zero.

The change in kinetic energy is therefore negative one hundred thirty five thousand Joules. This is equal to the amount of work done.

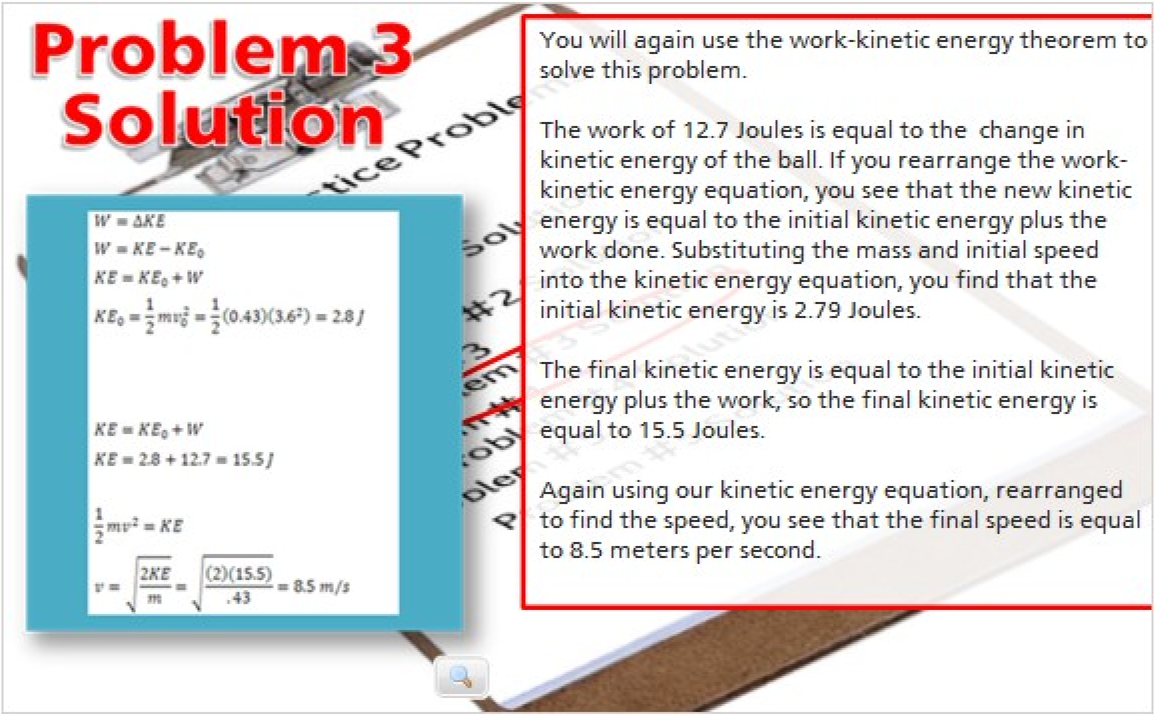
Applying the equation for work, you find that the force of friction equals three thousand Newtons.



Problem 3

Chelsea is playing soccer. As she runs towards the goal, her teammate kicks the ball up to her at three point six meters per second. Chelsea kicks the ball at the goal, doing twelve point seven Joules of work to the ball. What is the final speed of the ball?

Note: She is kicking the ball in the same direction that it is traveling.



Problem 3 Solution

You will again use the work-kinetic energy theorem to solve this problem.

The work of twelve point seven Joules is equal to the change in kinetic energy of the ball. If you rearrange the work-kinetic energy equation, you see that the new kinetic energy is equal to the initial kinetic energy plus the work done. Substituting the mass and initial speed into the kinetic energy equation, you find that the initial kinetic energy is two point seven nine Joules.

The final kinetic energy is equal to the initial kinetic energy plus the work, so the final kinetic energy is equal to fifteen point five Joules.

Again using our kinetic energy equation, rearranged to find the speed, you see that the final speed is equal to eight point five meters per second.