PRACTICE B

Kinetic Energy

1. Calculate the speed of an 8.0×10^4 kg airliner with a kinetic energy of 1.1×10^9 J.
2. What is the speed of a 0.145 kg baseball if its kinetic energy is 109 J?
3. Two bullets have masses of 3.0 g and 6.0 g, respectively. Both are fired with a speed of 40.0 m/s. Which bullet has more kinetic energy? What is the ratio of their kinetic energies?
4. Two 3.0 g bullets are fired with speeds of 40.0 m/s and 80.0 m/s, respectively. What are their kinetic energies? Which bullet has more kinetic energy? What is the ratio of their kinetic energies?
5. A car has a kinetic energy of 4.32×10^5 J when traveling at a speed of 23 m/s. What is its mass?

work–kinetic energy theorem

the net work done by all the forces acting on an object is equal to the change in the object's kinetic energy

The net work done on a body equals its change in kinetic energy

The equation $W_{net} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$ derived at the beginning of this section says that the net work done by a *net* force acting on an object is equal to the *change* in the kinetic energy of the object. This important relationship, known as the **work–kinetic energy theorem,** is often written as follows:

WORK–KINETIC ENERGY THEOREM

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

net work = change in kinetic energy

When you use this theorem, you must include all the forces that do work on the object in calculating the net work done. From this theorem, we see that the speed of the object increases if the net work done on it is positive, because the final kinetic energy is greater than the initial kinetic energy. The object's speed decreases if the net work is negative, because the final kinetic energy is less than the initial kinetic energy.

The work–kinetic energy theorem allows us to think of kinetic energy as the work that an object can do while the object changes speed or as the amount of energy stored in the motion of an object. For example, the moving hammer in the ring-the-bell game in **Figure 5** has kinetic energy and can therefore do work on the puck. The puck can do work against gravity by moving up and striking the bell. When the bell is struck, part of the energy is converted into sound.

Figure 5
The moving hammer has kinetic energy and can do work on the puck, which can rise against gravity and ring the bell.