Work and energy - challenge

1. The tops of the towers of the Golden Gate Bridge, in San Francisco, are 227 m above the water. Suppose a worker drops a wrench from the top of a tower. If the average force of air resistance is 22.0 percent of the force of free fall, with what speed will the wrench hit the water?

2. Bonny Blair of the United States set a world record in speed skating when she skated 5.00×10^2 m with an average speed of 12.92 m/s. Suppose Blair crossed the finish line at this speed and then skated freely until her speed was 8.00 m/s. If Blair's mass was 55.0 kg, how much work was done by friction.

3. The CN Tower in Toronto, Canada, is 553 m tall, making it the tallest free-standing structure in the world. Suppose a chunk of ice with a mass 25.0 g falls from the top of the tower. The speed of the ice is 30.0 m/s as it passes the restaurant, which is located 353 m above the ground. What is the average force due to air resistance?

4. In 1979, Dr. Hans Liebold of Germany drove a race car 12.6 km with an average speed of 404 km/h. Suppose Hans applied the brakes to reduce his speed. What was the car's final speed if 3.00 MJ of work was done by the brakes? Assume the mass of the car and driver to be 8.00×10^2 kg?

5. The summit of Mount Everest is 8848 m above sea level, making it the highest summit on Earth. In 1953, Edmund Hillary became the first person to reach the summit. Suppose that upon reaching the summit, he slid a rock with a 4.5 kg mass down the side of the mountain. If the rock's speed was 23 m/s when it was 8806 m above sea level, how much work was done on the rock by friction?

6. In 1990, Roger Hickey of California reached a speed of 35 m/s on his skateboard. Suppose it took 21 kJ of work for Hickey to reach this speed from a speed of 25 m/s. Calculate Hickey's mass.

7. At the 1984 Winter Olympics, William Johnson of the United States reached a speed of 104.5 km/h in the downhill skiing competition. Suppose Johnson left the slope at that speed and then slid freely along a horizontal surface. If the coefficient of sliding friction between the skis and the snow was 0.12 and his final speed was half of his initial speed, find the distance Johnson traveled.