Energy

Use conservation of energy to solve these problems.

1. A horizontal force of 25 N pulls a box along a table. How much work does it do in pulling the box 80 cm? (20 J)

2. How much work must be done to lift a 5.00 kg child through a vertical distance of 40.0 cm? (19.6 J)

3. The coefficient of kinetic friction between a 20.0 kg box and the floor is 0.40. How much work does a pulling force do on the box in pulling it 8.0 m across the floor at constant speed? The pulling force is directed 37^{o} above the horizontal. (480 J)

4. A spring stretches 10 cm under a load of 200 g. How much work is required to stretch it 5 cm from its equilibrium position? (0.02 J)

5. A certain tractor is said to be capable of pulling with a steady force of 14 000 N while moving at a constant speed of 3.0 ms^{-1}. How much power is the tractor developing under these conditions? ($4.2x10^{4}$ W)

6. How large a force is required to accelerate an electron from rest to a speed of $2.0x10^{7}$ ms^{-1} in a distance of 0.50 cm? ($3.6x10^{-14}$ N)

7. A 3.0 kg mass starts at rest at the top of a 37^{o} incline which is 5.0 m long. Its speed as it reaches the bottom is 2.0 ms^{-1}. Calculate the average frictional force that retarded its motion. (16.4 N)

8. Suppose a 300 g mass is dropped from a height of 40 cm onto a spring with a spring constant of 200 Nm^{-1}. How far does the spring compress? (0.1 m)

9. A 2000 kg car starts to coast up a hill 10 m high. Its original speed is 20 ms^{-1}. If its speed at the top of the hill is 5.0 ms^{-1}, how large an average frictional force retarded its motion? The distance the car traveled is 40 m. (4000 N)

10. A rubber ball is dropped onto a cement floor from a height of 2.0 m. It rebounds to a height of 1.6 m. What fraction of its energy did it lose in the process of striking the floor? Where did most of this energy go? (0.20)

11. Two adjacent hills along the path of a roller coaster have heights of 20. m and 30. m. If a cart is moving at a speed of 10. ms^{-1} as it coasts over the lower hill, can it reach the top of the other hill? If not, how high does it get? (no, 25 m)

12. A block and spring (k = 30 Nm^{-1}) are placed on a flat table. The block is pushed against the spring, compressing it 20 cm. When released the block moves 70 cm before coming to rest. How large is the friction force between the block and the table? (0.9 N)