Additional Conservation of Energy Practice

1. A 40 kg child starts from rest at the top of a slide that is 4 meters tall. What is her velocity at the bottom if friction does 1 kJ (1000 J) of work on her during her time on the slide?

Energy

Bar Chart

1600J - 1000J = 600J

COE Equation $PE_g + W = KE$

5.48 m/s

2. A block of mass 0.25 kg is placed against a horizontal spring of constant k = 5000 N/m and is pushed until the spring is compressed by 0.1 m. If the spring is then released, how far along a wood table will the block travel before coming to a rest? The coefficient of friction is 0.3.

Energy

Bar Chart

$W = Fd$

$d = \frac{W}{F} = \frac{25\,J}{.75N}$

$F_K = \mu F_n = .75N$

25J

COE Equation $PE_g + W = 0$

or $PE_g = KE$ and $KE + W = 0$

33.3 m

3. In a circus performance, a monkey on a sled 10 meters above the ground is given an initial velocity of 4 m / s down a slide. The combined mass of the monkey and sled is 20 kg. If the monkey is moving 10 m/s at the bottom of the slide, how much work was done by friction?

Energy

Bar Chart

COE Equation $KE_i + PE_g + W = KE_f$

-1160J

160J + 2000J + W = 1000J

W = -1160 J

4. A pendulum (mass = 2.0 kg) has a speed of 3.0 m/s at its lowest point. Find the speed when the pendulum is at a height of 0.3 m.

Energy

Bar Chart

$V = \sqrt{\frac{2KE}{m}}$

$9J = 6J + 3J$

COE Equation $KE_i = PE_{g_f} + KE_f$

1.73 m/s

5. A 75.5 kg diver has an initial upward speed of 2.0 m/s as he jumps from a board 10.0 m above the water's surface. Find the diver's speed when he reaches the water's surface.

Energy

Bar Chart

$V = \sqrt{\frac{2KE}{m}}$

$151J + 7550J = 7701J$

COE Equation $KE_i + PE_{g_i} = KE_f$

14.3 m/s

6. A 2000 kg car accelerates from rest under the actions of 2 forces. One is a forward force of 1140 N provided by traction between the wheels and the road. The other is a 950 N resistive force due to various frictional forces. Find how far the car must travel to reach a speed of 2.0 m/s.

$W_a + W_f = KE_f$

$(F_a - F_k)d = 4000J$

$(1140N - 950N)\,d = 4000J$

$d = \frac{4000J}{190N} = 21\,m$