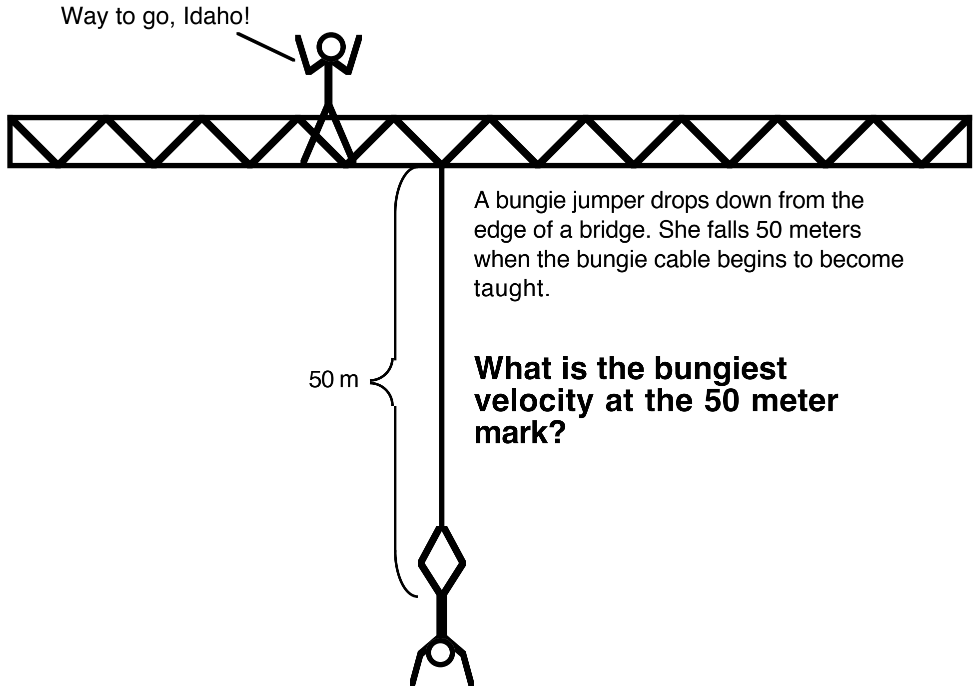
Use energy relationships to set up the problems below. When you're ready to use your calculator, stop.

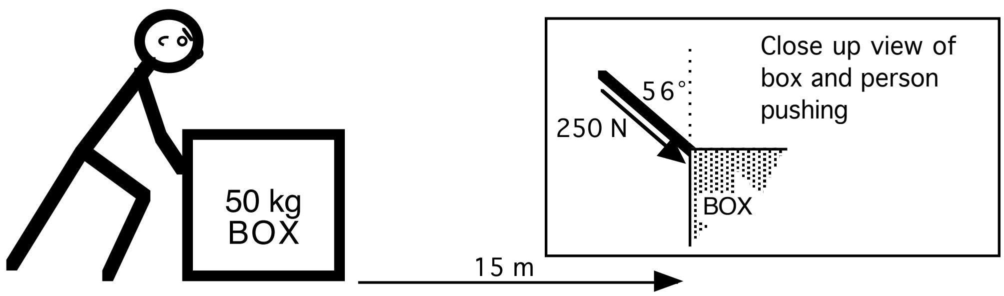
1



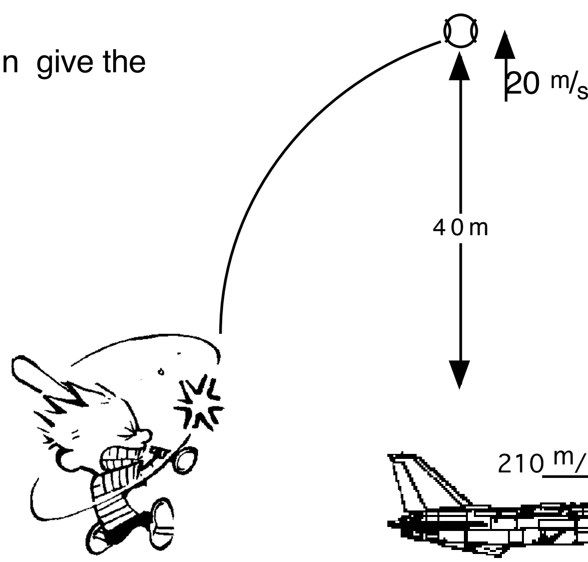
A bungie jumper drops down from the edge of a bridge. She falls 50 meters when the bungie cable begins to become taught.

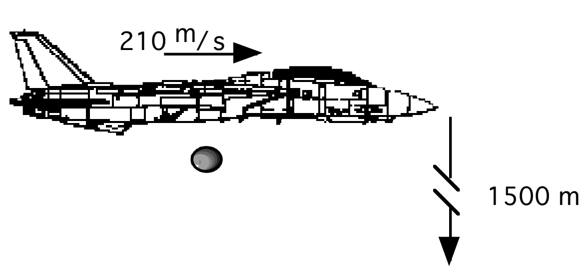
What is the bungiest velocity at the 50 meter mark?

2 A 100 kg dock worker pushes a 50 kg box across a floor. He pushes the box such that his arms are at an angle as shown below. If the initial velocity of the box is 2 m/s then what is the final velocity? (ignore friction)



3 How much velocity did Calvin give the ball when he hit it?

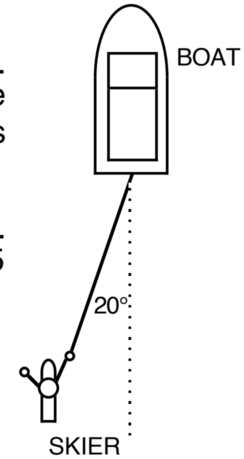




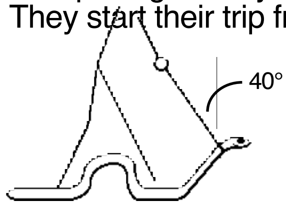
4. What is the velocity of the dropped package after falling 1500 m?

Use energy relationships to set up the problems below. When you're ready to use your calculator, stop.

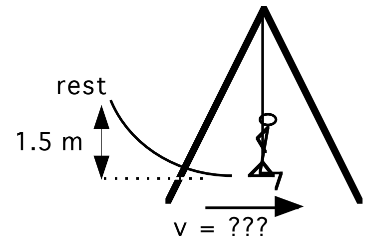
5. A 80 kg water skier is being towed behind a speed boat as shown to the right. The 600 kg boat travels 400 m to reach 25 m/s. At the beginning of the run the boat is traveling 5 m/s. The boat travels with a net force of 4000 N. what force is exerted by the tether on the skier?



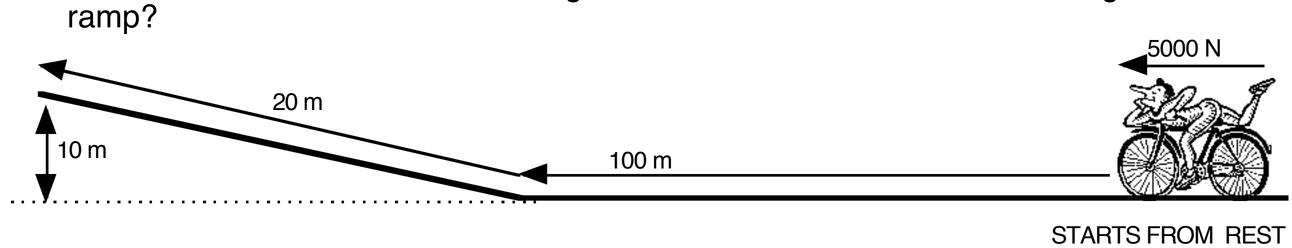
6. Sidney, 60 kg, on a walk-about with his pet snake Cecil. Cecil's weight is 5 kg. Cecil is pulling Sidney with 40 N force. The two travel a across a distance of 125 m. They start their trip from rest. How much work is done by Cecil?



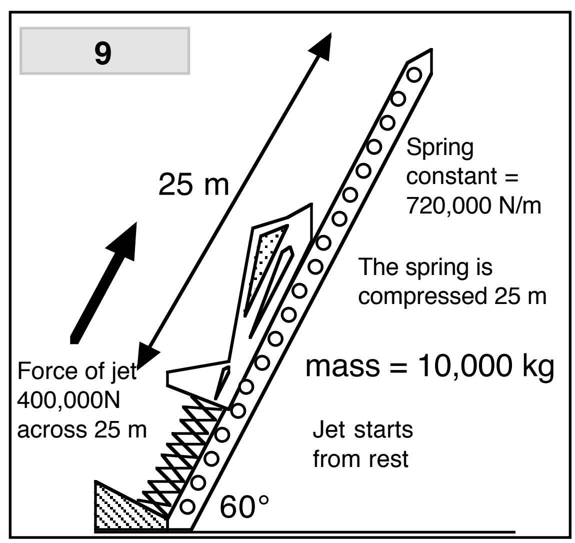
7. What is the velocity of the rider at the bottom of the swing?

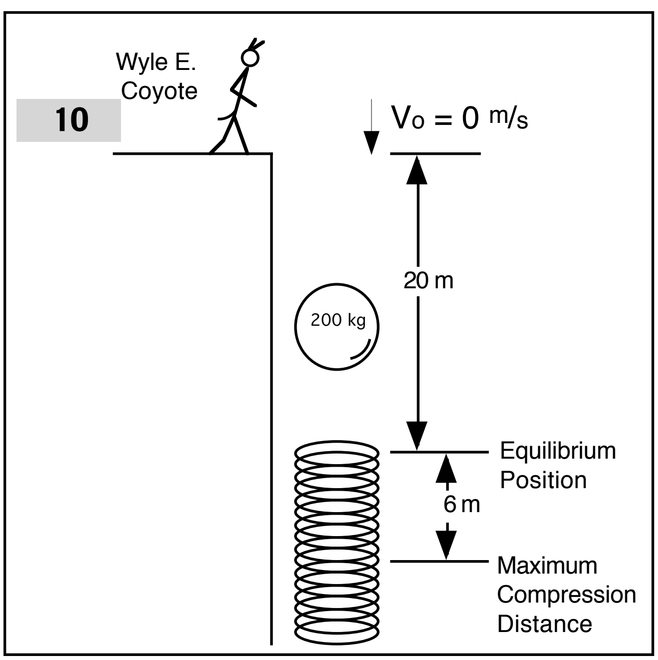


8 A bicycle stunt rider, 100.00 kg, is about to make a great jump over some busses. His bicycle exerts a force of 5,000 N in the direction of motion. He pedals along the entire distance shown. Given the diagram below, how fast will he be traveling when he leaves the ramp?



9 What is the velocity of the glider at the top of the launch tower?





In an experiment, the coyote drops the ball onto a spring that compresses 6 meters.
10. What is this spring's spring constant?

ANSWERS

$$[1]$$

$$E_{Bridge} = E_{Bungie\ at\ the\ end}$$

$$PE_g = KE$$

$$mgh = \frac{1}{2}mv^2$$

$$\left(9.80\frac{m}{s^2}\right)(50m) = \frac{1}{2}v^2$$

$$[2]$$

$$W = E_{final} - E_{initial}$$

$$W = KE_f - KE_o$$

$$Fd\cos(\theta) = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_o^2$$

$$250N(15m)\cos\left(90^\circ - 56^\circ\right) = \frac{1}{2}(50kg)v_f^2 - \frac{1}{2}(50kg)\left(2\frac{m}{s}\right)^2$$

$$[3]$$

$$E_{@\ the\ bat} = E_{when\ h\ =40m}$$

$$KE = PE_g + KE$$

$$\frac{1}{2}mv^2 = mgh + \frac{1}{2}mv^2$$

$$\frac{1}{2}v^2 = \left(9.80\frac{m}{s^2}\right)(40m) + \frac{1}{2}\left(20\frac{m}{s}\right)^2$$

$$[4]$$

$$E_{on\ the\ gnd} = E_{above\ the\ Earth}$$

$$KE = PE_g + KE$$

$$\frac{1}{2}mv^2 = mgh + \frac{1}{2}mv^2$$

$$\frac{1}{2}v^2 = \left(9.80\frac{m}{s^2}\right)(1500m) + \frac{1}{2}\left(210\frac{m}{s}\right)^2$$

ANSWERS

[5]

$$W = E_{final} - E_{initial}$$
$$W = KE_f - KE_o$$
$$Fd\cos(\theta) = \frac{1}{2}mv_f^{\,2} - \frac{1}{2}mv_o^{\,2}$$
$$F(400m)\cos\left(20^\circ\right) = \frac{1}{2}(80kg)\left(25\frac{m}{s}\right)^2 - \frac{1}{2}(80kg)\left(5\frac{m}{s}\right)^2$$

[6]

$$W = Fd\cos(\theta)$$
$$W = 40N(125m)\cos\left(90^\circ - 40^\circ\right)$$

[7]

$$E_{lowest\ point} = E_{highest\ point}$$
$$KE = PE_g$$
$$\frac{1}{2}mv^2 = mgh$$
$$\frac{1}{2}v^2 = \left(9.80\frac{m}{s^2}\right)(1.5m)$$

[8]

$$W = E_{final} - E_{initial}$$
$$W = \left(KE_f + PE_g\right)$$
$$Fd\cos(\theta) = \frac{1}{2}mv_f^{\,2} + mgh$$
$$\left(5000N\right)(100m + 20m)\cos(0^\circ) = \frac{1}{2}(100kg)\left(v_f\right)^2 + 100kg\left(9.80\frac{m}{s^2}\right)10m$$

[9]

$$W = E_{final} - E_{initial}$$
$$W = \left(KE_f + PE_g\right) - \left(PE_s\right)$$
$$Fd\cos(\theta) = \frac{1}{2}mv_f^{\,2} + mgh - \frac{1}{2}kx^2$$
$$\left(400{,}000N\right)(25m)\cos(0^\circ) = \frac{1}{2}(10{,}000kg)\left(v_f\right)^2 + 10{,}000kg\left(9.80\frac{m}{s^2}\right)\left((25m)\sin(60^o)\right) + -\frac{1}{2}\left(720{,}000\frac{N}{m}\right)25m^2$$

Note: $h = 25m\sin(60^o)$ because this is the vertical height of the ramp

ANSWERS

[10]

$$E_{\text{lowest point (max compresison)}} = E_{\text{highest point}}$$

$$PE_s + = PE_g$$

$$\frac{1}{2}kx^2 = mgh$$

$$\frac{1}{2}k\left(6\text{m}\right)^2 = (200\text{kg})\left(9.80\,\frac{\text{m}}{\text{s}^2}\right)(20\text{m} + 6\text{m})$$

Note: The spring compresses 6 m but the ball drops 26 meters and comes to a rest at the bottom; (maximum compression)