Homework Solutions
9/18/2007

Conceptual

1. No work is done unless an object is displaced by that force. Therefore, no work is done on the rope, the pullers or the ground. No work is done on anything because nothing has been displaced.

2. The chicken is doing work on the ground because some earth is being displaced. A person studying does no work because nothing is being displaced. A crane lifting a bucket of concrete does work to move the bucket so work is being done. Gravity is doing negative work on the bucket. The leg muscles are doing work on the person.

3. The work to get the furniture into the truck is the same regardless of the path it takes to get there because the furniture would have the same potential energy in the truck. The trade-off is that the workers would need to apply less force through a greater distance to do the same amount of work.

4. Kinetic energy cannot be negative because mass can't be negative and velocity is squared so a negative velocity would become positive after squared. GPE can't be negative because height, mass and the acceleration due to gravity are all positive (assuming positive is downward in this case).

5. Switchbacks require the same amount of work for a car to get to the top of a mountain. The difference is that the car will need to apply less force through a larger distance.

6. Kinetic energy is quadrupled when velocity is doubled. If the net work on a particle is zero than and object is moving at a constant velocity.

7. All of these forces do work on the pendulum because the pendulum is moving (displacing). Air resistance is the only force to do negative work at ALL times because it slows the pendulum down (opposes the direction of movement). The work done by the force of gravity is positive as the pendulum travels from its highest points to the lowest point and negative as it travels from the lowest point to the highest point.

8. The demonstrator is safe because energy is conserved. As the balls loses height and the PE decreases the KE is increasing. Once the pendulum travels past its lowest point, the PE increases and the KE decreases. Together, PE + KE is constant. If pushed, the pendulum would swing higher than it was released.

Problems

2.

$$W = Fd\cos\theta$$

$$6000J = \left(20kg \bullet 9.8\frac{m}{s^2}\right)d\cos 0°$$

$$d = 30.6m$$

3.

$$W = Fd\cos\theta$$

$$W = 5000N \bullet 3000m \bullet \cos 0°$$

$$w = 1.5 \bullet 10^7 J$$

9. a.

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

$$5000J = \frac{1}{2}(2500kg)v^2$$

$$v = 2.0\frac{m}{s}$$

b.

$$W = Fd\cos\theta$$

$$5000J = F(25m)\cos 0°$$

$$F = 200N$$

13. a.

$$K_{lost} = \frac{1}{2}(70kg)\left(4.0\frac{m}{s}\right)^2$$

$$K = 560J$$

$$W_{friction} = F_{friction}d\cos\theta$$

$$560J = \mu_k \eta d \cos 0°$$

$$560J = (0.70)\left(70kg \bullet 9.8\frac{m}{s^2}\right)d$$

$$d = 1.2m$$

16. a.

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

$$K = \frac{1}{2}(0.60kg)\left(2.0\frac{m}{s}\right)^2$$

$$K = 1.2J$$

b.

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

$$7.5J = \frac{1}{2}(0.60kg)v^2$$

$$v = 5.0\frac{m}{s}$$

c.

$$W = \Delta K$$

$$W = K_f - K_i$$

$$W = 7.5J - 1.2J = 6.3J$$