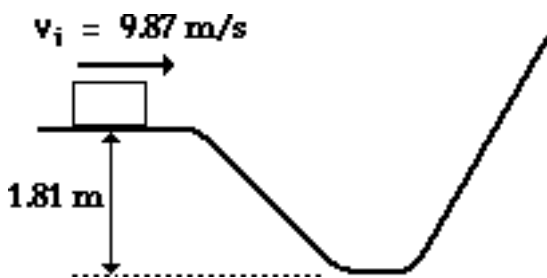## Work-Energy Calculations

Begin with the work-energy equation, cancel terms, substitute and solve.

1. A glider is gliding through the air at a height of 421 meters with a speed of 49.2 m/s. The glider dives to a height of 309 meters. Determine the glider's new speed.

$$\textbf{KE}_i \quad + \quad \textbf{PE}_i \quad + \quad \textbf{W}_{nc} \quad = \quad \textbf{KE}_f \quad + \quad \textbf{PE}_f$$

$v_i = 9.87$ m/s

1.81 m

2. A box with mass **m** is sliding along on a friction-free surface at 9.87 m/s at a height of 1.81 m. It travels down the hill and then up another hill.
   a. Find the speed at the bottom of the hill.

$$\textbf{KE}_i \; + \; \textbf{PE}_i \; + \; \textbf{W}_{nc} \; = \; \textbf{KE}_f \; + \; \textbf{PE}_f$$

   b. Find the maximum vertical height to which the box will rise on the opposite hill.

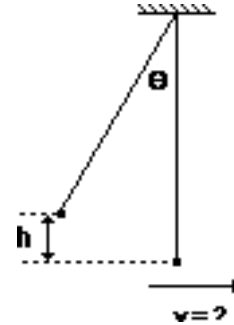$$\textbf{KE}_i \quad + \quad \textbf{PE}_i \quad + \quad \textbf{W}_{nc} \quad = \quad \textbf{KE}_f \quad + \quad \textbf{PE}_f$$

3. A 1544-kg car is moving along a level highway with a speed of 23.4 m/s. The driver takes the foot off the accelerator and the car experiences a retarding force of 859-N over a distance of 112 m. Determine the speed of the car after traveling this distance.

$$\textbf{KE}_i \quad + \quad \textbf{PE}_i \quad + \quad \textbf{W}_{nc} \quad = \quad \textbf{KE}_f \quad + \quad \textbf{PE}_f$$

4.  A swing is pulled back until its 2.3-meter long chain makes a 23-degree angle with the vertical.  The swing is released.  Find its speed at its lowest position.  **PSYW**

$$KE_i \ + \ PE_i \ + \ W_{nc} \ = \ KE_f \ + \ PE_f$$

5.  A ball is thrown with a velocity of 10.0 m/s from a height of 30.0 m.  Determine how fast it is going when it strikes the ground if it is thrown ...
    a.  ... upward at 10.0 m/s.

$$KE_i \ + \ PE_i \ + \ W_{nc} \ = \ KE_f \ + \ PE_f$$

    b.  ... horizontally at 10.0 m/s.

$$KE_i \ + \ PE_i \ + \ W_{nc} \ = \ KE_f \ + \ PE_f$$

    c.  ... downward at 10.0 m/s.

$$KE_i \ + \ PE_i \ + \ W_{nc} \ = \ KE_f \ + \ PE_f$$

6.  A 4560-kg roller coaster train full of rider approaches the loading dock at a speed of 19.5 m/s.  It is abruptly decelerated to a speed of 2.5 m/s over a distance of 11.6 m.  Determine the retarding force which acts upon the roller coaster cars.

$$KE_i \ + \ PE_i \ + \ W_{nc} \ = \ KE_f \ + \ PE_f$$

7.  A catcher's mitt recoils a distance of 14.9 cm in bringing a 139-gram baseball to a stop.  If the applied force is 621 N, then what was the speed of the baseball at the moment of contact with the catcher's mitt?

$$KE_i \quad + \quad PE_i \quad + \quad W_{nc} \quad = \quad KE_f \quad + \quad PE_f$$

8.  A force is applied to a 2.4-kg cart to raise it up an inclined plane at a constant speed to a height of 0.881 m.  The incline angle is 25.1 degrees and the force is applied parallel to the incline.  Determine the work done by the applied force.

$$KE_i \quad + \quad PE_i \quad + \quad W_{nc} \quad = \quad KE_f \quad + \quad PE_f$$

9.  A 2.1-kg disk is sliding at 3.3 m/s into an incline sloped at 23 degrees with the horizontal and having a coefficient of friction of 0.128.  Determine the height to which the disk will slide.

$$KE_i \quad + \quad PE_i \quad + \quad W_{nc} \quad = \quad KE_f \quad + \quad PE_f$$

10. Starting from rest, a 1.3-kg box slides from an initial height of 68 cm along a 22-degree incline and then across a level surface. The coefficient of friction along each surface is 0.178. Determine the distance which the box will slide along the level surface before stopping.

$$KE_i \quad + \quad PE_i \quad + \quad W_{nc} \quad = \quad KE_f \quad + \quad PE_f$$

11. An unknown force is applied to a 15 kg mass. The force acts at an angle of 30 degrees above the horizontal. Determine the force acting if the force acts for a horizontal displacement of 25 meters and increases the 15 kg mass's speed from 12 m/s to 32 m/s.

$$KE_i \quad + \quad PE_i \quad + \quad W_{nc} \quad = \quad KE_f \quad + \quad PE_f$$

12. A 5.2-kg box slides a distance down a 2.3-meter long ramp inclined at 39 degrees and then across a level surface. The coefficient of friction along the ramp and the level plane is 0.210. Determine the speed of the box after sliding a distance of 82 cm along the level surface.

$$KE_i \quad + \quad PE_i \quad + \quad W_{nc} \quad = \quad KE_f \quad + \quad PE_f$$