Name: KEY

Date:

Section C D F

The Masters School
Mr. Alex Rawson
Physics

# *Mechanical Energy I*

1. One of the two Olympic weightlifting events is called the "Clean and Jerk," shown below. As of Athens 2004, the record for Clean and Jerk is 262.5 kg (578.7 pounds).
   a. What is the change in potential energy of this exercise if the weights are lifted 2.2 meters?
   b. What would the change in potential energy be on the moon, where the acceleration of gravity is 1/6th that of Earth's?


a) $PE = mgh$

$PE = (262.5)(9.81)(2.2)$

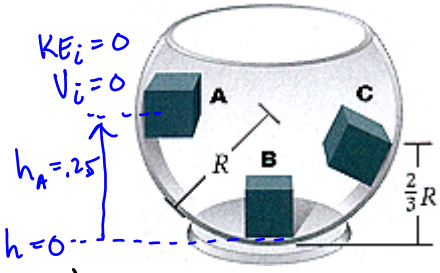
$PE = 5665\ J$

b) $PE = m\left(\frac{g}{6}\right)h$

$PE = (262.5)\left(\frac{9.81}{6}\right)(2.2)$

$PE = 944\ J$

2. A 185 g particle is released from rest at point **A** inside a smooth hemispherical bowl of radius 25.0 cm, as shown in the figure to the right.
   a. Calculate the gravitational potential energy at **A** relative to **B.**
   b. Calculate the particle's kinetic energy at **B.**
   c. Calculate the particle's speed at **B.**
   d. Calculate the kinetic energy and potential energy at **C.**




a) $PE_A = mgh_A = (.185)(9.81)(.25) = .454\ J$

(A) (B)

Initial Energy = Final Energy

3. $KE_i + PE_i = KE_f + PE_f$

$KE_i + PE_{grav,i} = KE_f + PE_{grav,f}$

$\frac{1}{2}mv_i^2 + mgh_i = \frac{1}{2}mv_f^2 + mgh_f$

b) $PE_A = KE_B = .454\ J$

c) $KE_B = \frac{1}{2}mV_B^2$

$.454 = \frac{1}{2}(.185)V_B^2$

$2.215\ m/s = V_B$

d) (B) (C)

Initial Energy = Final Energy

$KE_i + PE_i = KE_f + PE_f$

$KE_i + PE_{grav,i} = KE_f + PE_{grav,f}$

$\frac{1}{2}mv_i^2 + mgh_i = \frac{1}{2}mv_f^2 + mgh_f$

$KE_B = .454\ J$

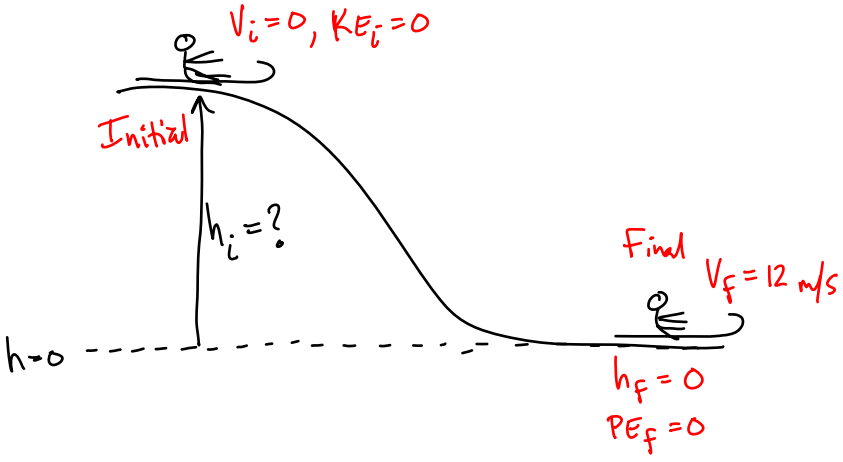
$.454 = \frac{1}{2}mV_C^2 + mgh_C$

$PE_C = mgh_C = (.185)(9.81)\left(\frac{2}{3}\cdot .25\right)$

$PE_C = .302\ J$

$KE_C = .152\ J$

A child and sled with a combined mass of 40.0 kg slide down a frictionless hill. If the sled starts from rest and has a speed of 12.0 m/s at the bottom, what is the height of the hill? (*Remember that energy is conserved here*)




Initial Energy = Final Energy

$KE_i + PE_i = KE_f + PE_f$

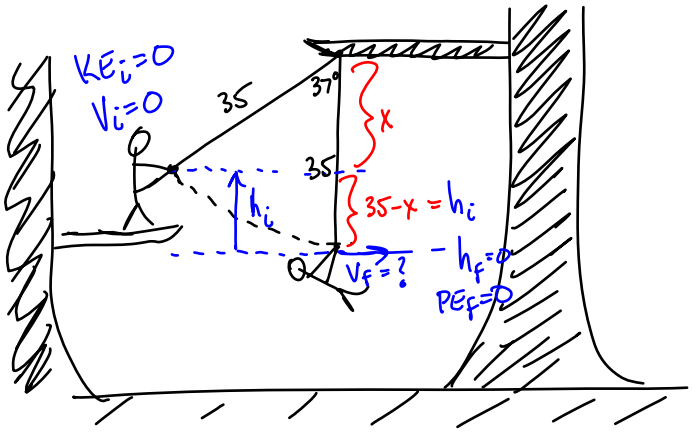
$KE_i + PE_{grav,i} = KE_f + PE_{grav,f}$

$\frac{1}{2}mv_i^2 + mgh_i = \frac{1}{2}mv_f^2 + mgh_f$

$mgh_i = \frac{1}{2}mV_f^2$

$h_i = \frac{12^2}{2(9.81)} = 7.34$ m

4. Tarzan swings on a 35.0 m long vine initially inclined at an angle of 37.0° with the vertical. What is his speed at the bottom of the swing if he starts from rest?




$\cos 37 = \frac{X}{35}$

$X = 35 \cos 37 = 27.95$ m

$35 - X = 7.05$ m $= h_i$

Initial Energy = Final Energy

$KE_i + PE_i = KE_f + PE_f$

$KE_i + PE_{grav,i} = KE_f + PE_{grav,f}$

$\frac{1}{2}mv_i^2 + mgh_i = \frac{1}{2}mv_f^2 + mgh_f$

$mgh_i = \frac{1}{2}mV_f^2$

$V_f = \sqrt{2gh}$

$V_f = \sqrt{2(9.81)(7.05}$

$V_f = 11.76$ m/s