Name: KEY

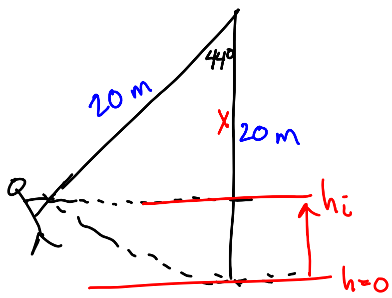
Date:

Section C D F

The Masters School
Mr. Alex Rawson
Physics

Mechanical Energy II

1. Tarzan swings on a 20.0 m long vine initially inclined at an angle of 44.0° with the vertical. What is his speed at the bottom of the swing if he does the following?
   a. He starts from rest.
   b. He pushes off with a speed of 4.00 m/s.



$\underline{\underline{h_i}}$

$x = 20\cos 44$

$x = 14.39$ m

$h_i = 20 - x = \boxed{5.61\ m}$

a) $\boxed{V_i = 0}$

$ME_i = ME_f$

$PE_i + \cancel{KE_i} = \cancel{PE_f} + KE_f$

$\cancel{m}gh_i = \frac{1}{2}\cancel{m}v^2$

$v = \sqrt{2gh_i}$

$v = \sqrt{2(9.81)5.61}$

$\boxed{v = 10.5\ m/s}$

b) $\boxed{V_i = 4.0\ m/s}$

$ME_i = ME_f$

$PE_i + KE_i = \cancel{PE_f} + KE_f$

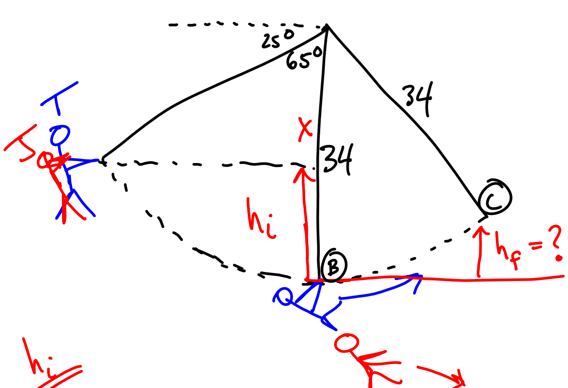
$\cancel{m}gh_i + \frac{1}{2}\cancel{m}v_i^2 = \frac{1}{2}\cancel{m}v_f^2$

$55.03 + 8 = \frac{1}{2}v_f^2$

$v = \sqrt{2(63.03)}$

$\boxed{v = 11.23\ m/s}$

2. Tarzan and Jane, whose total mass is 110.0 kg, start their swing (at rest) on a 34.0 m long vine when the vine is at an angle of 25.0° with the horizontal. At the bottom of the arc, Jane, whose mass is 50.0 kg, releases and jumps off. If Tarzan holds on to the vine, and rises on the other side of the pendulum swing, what is the maximum height at which Tarzan can land on a branch? (*Hint: Find the velocity at the bottom, then find the height Tarzan can gain with that velocity*)



$\underline{\underline{h_i}}$

$x = 34\cos 25°$

$x = 14.37$ m

$h_i = 34 - x = \boxed{19.631\ m}$

Long way

$PE_A = KE_B$

$\cancel{(m_{T+J})}gh_A = \frac{1}{2}\cancel{(m_{T+J})}v_B^2$

$v_B = \sqrt{2gh_A}$

$v_B = \sqrt{2(9.81)(19.631)}$

$\boxed{v_B = 19.625\ m/s}$

$\frac{1}{2}\cancel{m_T}v_B^2 = \cancel{m_T}gh_c$

$h_c = \frac{v_B^2}{2g} = \boxed{19.631\ m}$

Short way

$PE_A = KE_B$

$\cancel{m}gh_A = \frac{1}{2}\cancel{m}v_B^2$

(mass doesn't matter)

$KE_B = PE_C$

$\frac{1}{2}\cancel{m}v_B^2 = \cancel{m}gh_c$

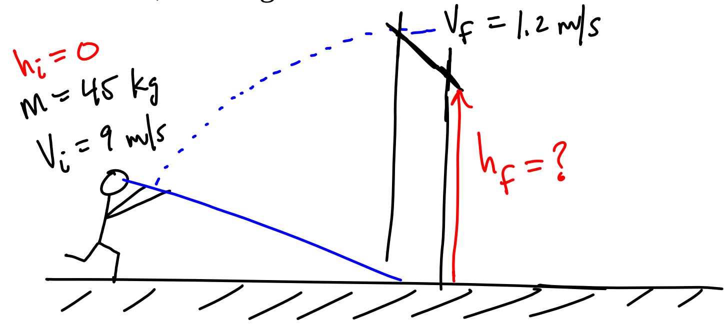
(mass doesn't matter)

$PE_A = KE_B = PE_C$

$\boxed{PE_A = PE_C}$

$\boxed{h_A = h_c}$

3. A 45.0 kg pole vaulter, attempting her personal best height, runs at 9.0 m/s towards the high bar. Assuming that she succeeds, and at the peak of her vault she retains a horizontal velocity of 1.2 m/s over the bar, how high was the bar?



Initial Energy = Final Energy

$$KE_i + \cancel{PE_i} = KE_f + PE_f$$

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

$$½mv_i^2 + \cancel{mgh_i} = ½mv_f^2 + mgh_f$$

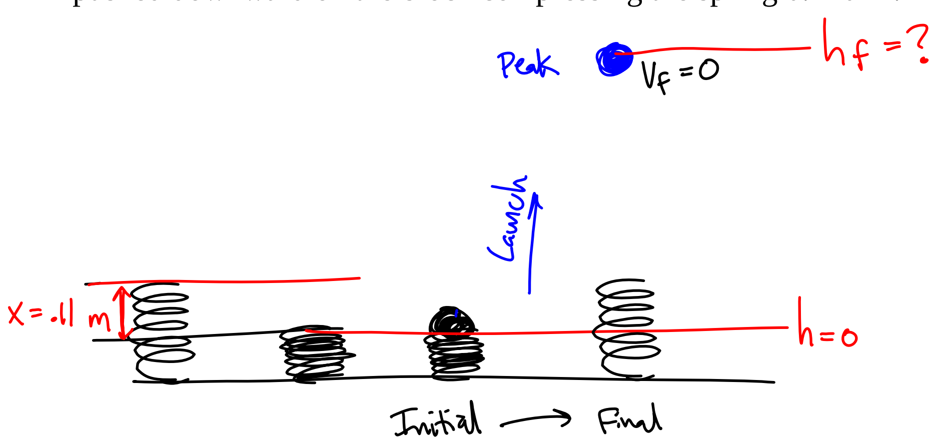
$$\frac{1}{2}\cancel{m}V_i^2 = \frac{1}{2}\cancel{m}V_f^2 + \cancel{m}gh_f$$

$$\frac{1}{2}V_i^2 - \frac{1}{2}V_f^2 = gh$$

$$40.5 - .72 = gh$$

$$\frac{39.78}{g} = \boxed{h = 4.055 \text{ m}}$$

4. How high would a .2 kg block rise if it were aligned on a vertical 5.00 x 10^3 N/m spring, and someone pushed downward on the block compressing the spring 0.110 m?



Initial Energy = Final Energy

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

$$\cancel{½mv_i^2} + \cancel{mgh_i} + ½kx_i^2 = \cancel{½mv_f^2} + mgh_f + \cancel{½kx_f^2}$$

$$PE_{i,elastic} = PE_{f,grav}$$

$$½kx_i^2 = mgh_f$$

$$\frac{1}{2}kx_i^2 = mgh_f$$

$$\frac{1}{2}(5000)(.11)^2 = (.2)(9.81)h_f$$

$$30.25 = 1.962\, h_f$$

$$\boxed{15.42 \text{ m} = h_f}$$