Physics 432
Fall 2010

Name KEY

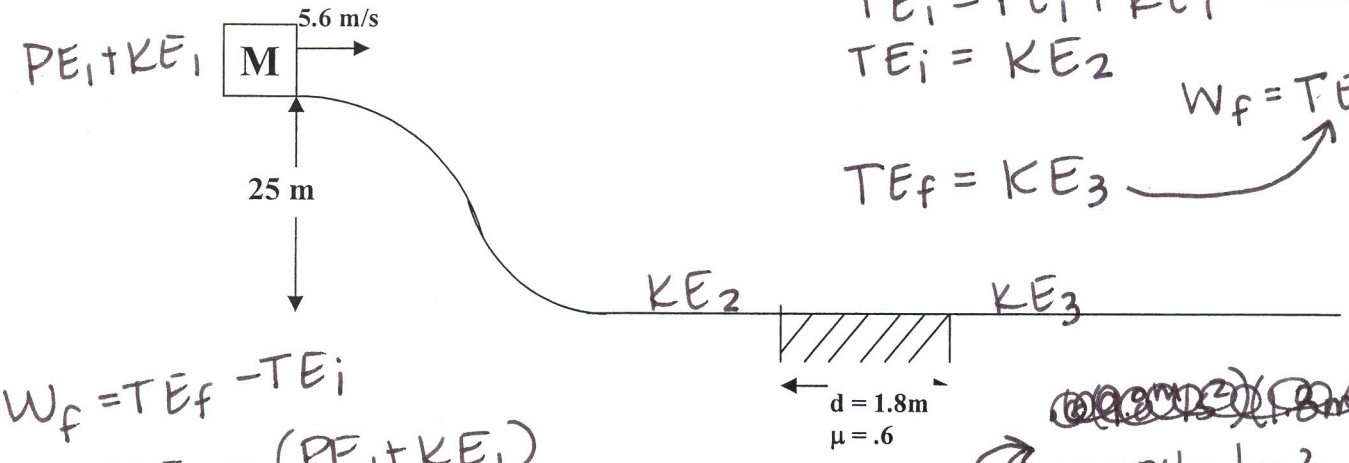
Date _____

Conservation of Energy

Review WS

Directions: Show all work, include proper units, and box your final answer.

1. A mass on the top of the hill slides down and encounters a frictional patch. The mass travels over a 1.8 m patch of friction that has a coefficient of .6. What is the speed of the box after the friction patch? **(Answer: 22.4 m/s)**



$TE_i = PE_1 + KE_1$

$TE_i = KE_2$

$TE_f = KE_3$

$W_f = TE_f - TE_i$

$W_f = TE_f - TE_i$

$W_f = KE_3 - (PE_1 + KE_1)$

$W_f = KE_3 - PE_1 - KE_1$

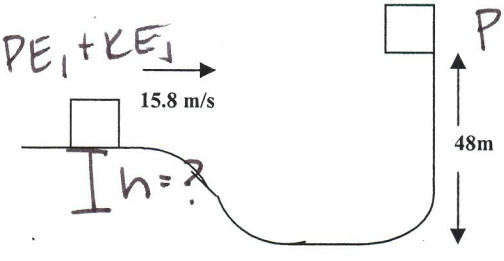
$-\mu_k m g d = \frac{1}{2} m v_3^2 - m g h_1 - \frac{1}{2} m v_1^2$

$(.6)(9.8 m/s^2)(1.8m) = \frac{1}{2} v_3^2 - (9.8 m/s^2)(25m) - \frac{1}{2}(5.6 m/s)^2$

$-10.584 = \frac{1}{2} v_3^2 - 245 - 15.6$

$v_3 = 22.36 m/s$

2. A box is moving 15.8 m/s on a surface and travels to a height of 48 meters. How high was the box before the decline? **(Answer: 35.3 m)**



$TE = PE_1 + KE_1$

$PE_2 = TE$

$TE_1 = TE_2$

$PE_1 + KE_1 = PE_2$

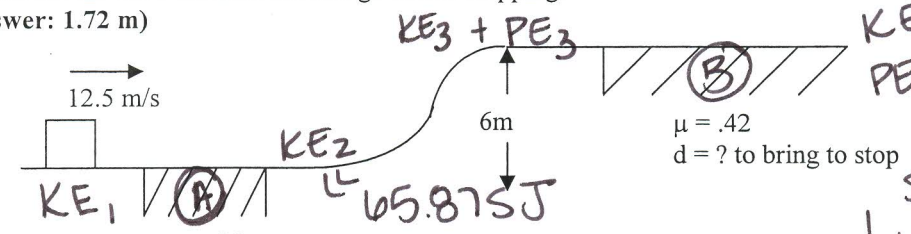
$m g h_1 + \frac{1}{2} m v_1^2 = m g h_2$

$(9.8 m/s^2) h_1 + \frac{1}{2}(15.8 m/s)^2 = (9.8 m/s^2)(48m)$

$h_1 = 35.26m$

Let $m = 1\ kg$

3. A box moving 12.5 m/s travels over a patch of friction. The coefficient of friction is .25 and the patch is 5 meters long. The box goes up a 6 meter vertically to another patch of friction with a coefficient of friction of .42. How far does the box go before stopping?
(Answer: 1.72 m)



$W_B = KE_4 - KE_3$

Step 1:

$KE_1 = \frac{1}{2}mv^2$

$= \frac{1}{2}(1kg)(12.5m/s)^2$

$= 78.125\ J$

$W_{fA} = -\mu_k mgd = KE_2 - KE_1$

$-(.25)(1kg)(9.8m/s^2)(5m) = KE_2 - 78.125J$

Step 2:

$KE_2 = KE_3 + PE_3$

$65.875 = KE_3 + mgh_3$

$65.875 = KE_3 + (1kg)(9.8m/s^2)(6m)$

$KE_3 = 7.075\ J$

Step 3:

$W_B = KE_4 - KE_3$

$-\mu_k mgd = 0 - 7.075J$

$-.42(1kg)(9.8m/s^2)(d) = -7.075$

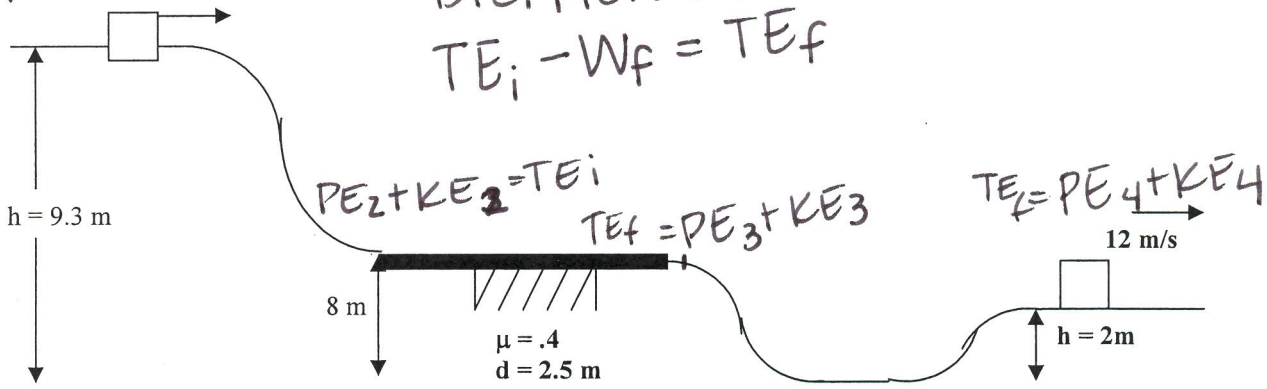
$d = 1.7189\ m$

4. A box is moving at some unknown speed on a 9.3 meter shelf falls on to a second shelf with a patch of friction on it. The patch of friction is 2.5 meters long with a coefficient of .4. The box continues down and up a third shelf that is 2 meters high. If the block is moving 12 m/s on the third shelf than
   a. What was the speed on the first shelf? **(Answer: 4.53 m/s)**
   b. What was the speed on the second shelf? (before the friction)
(Answer: 6.78 m/s)

$TE_1 = PE_1 + KE_1$

BIG Picture

$TE_i - W_f = TE_f$



a. $W = \Delta E$

$W = TE_f - TE_i$

$-\mu_k mgd = TE_f - TE_i$

$-\mu_k mgd = (PE_4 + KE_4) - (PE_1 + KE_1)$

$-\mu_k mgd = mgh_4 + \frac{1}{2}mv_4^2 - mgh_1 - \frac{1}{2}mv_1^2$

$-.4 \cdot 9.8m/s^2 \cdot 2.5 = (9.8m/s^2)(2m) + \frac{1}{2}(12m/s)^2 - 9.8m/s^2 \cdot 9.3m - \frac{1}{2}v_1^2$

$-9.8 = 19.6 + 72 - 91.14 - \frac{1}{2}v_1^2$

$v_1 = 4.53\ m/s$

$PE_1 + KE_1 = PE_2 + KE_2$

$mgh_1 + \frac{1}{2}mv_1^2 = mgh_2 + \frac{1}{2}mv_2^2$

$(9.8)(9.3) + \frac{1}{2}(4.53)^2 = (9.8)(8) + \frac{1}{2}v_2^2$

$91.14 + 10.26 = 78.4 + \frac{1}{2}v_2^2$

$v_2 = 6.78\ m/s$