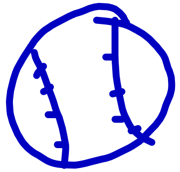
P. 151 # 14, 15, 19

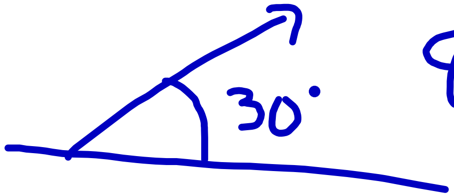
14.

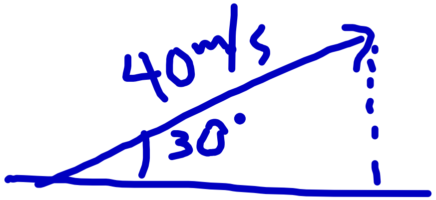


$m = 0.150\,kg$

$v = 40\,m/s$

$\theta = 30°$





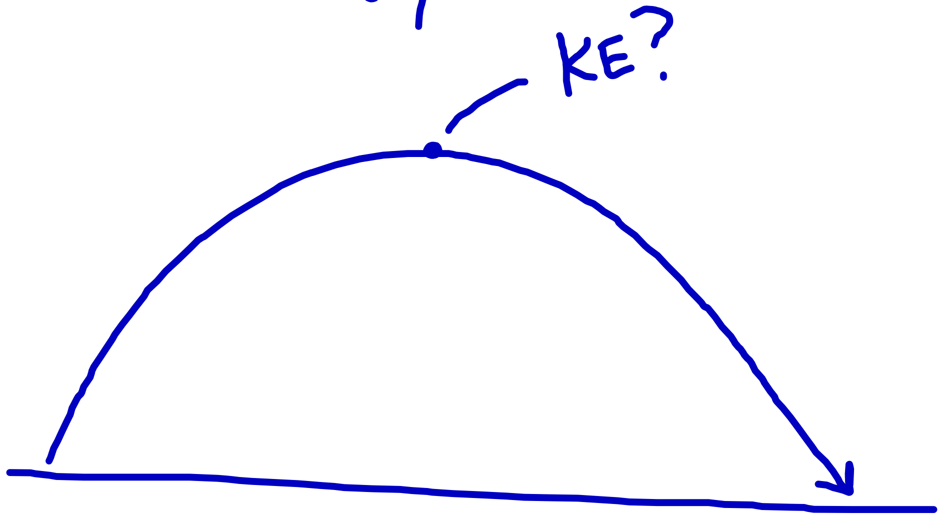
$v_x = v \cos 30°$

$= 40\,m/s \cos 30°$

$= 34.6\,m/s$

$v_x = 34.6\,m/s$

$v_y = 0$

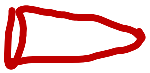


$KE = \frac{1}{2} m v_x^2$

$= \frac{1}{2}(.15\,kg)(34.6\,\frac{m}{s})^2$

$KE = 89.8\,J$

$Nm \cdot J = kg\frac{m^2}{s^2}$

15.  $m = 2g$ $v_f = 300 m/s$ KE? F=?

$d_x = 50 cm$

$= .5 m$

$m = .002 kg$

$KE = \frac{1}{2} m v^2$

$= \frac{1}{2}(.002 kg)(300 m/s)^2$

$KE = 90 J$

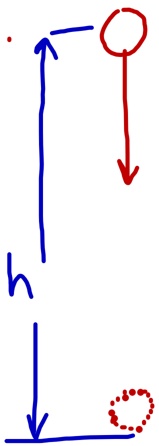
work done = $\Delta KE = Fd$

$\therefore Fd = \Delta KE$

$F = \frac{\Delta KE}{d}$

$F = \frac{90 J}{.5 m} = 180 N$

19. $v_i = 0\ m/s$ $PE = mgh$ 100%



$v_f = 9\ m/s$ $KE = \frac{1}{2}mv^2$ 100%

$$\Delta PE = \Delta KE$$

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

$$h = \frac{1}{2}\frac{v^2}{g}$$

$$= \frac{1}{2}\left(\frac{(9\ m/s)^2}{9.8\ m/s^2}\right)$$

$$h = 4.1\ m$$

OR

$$v_f^2 = v_i^2 + 2ad \quad (v_i^2 \to 0)$$

$$v_f^2 = 2ad$$

$$d = \frac{v_f^2}{2a}$$

P. 151 #13 Handouts

A 70kg base runner begins his slide into second base when he is moving at 4.0 m/s. The coefficient of friction between his clothes and the earth is 0.70. He slides so that his speed is zero just as he reaches the base.

A.) How much mechanical energy is lost due to friction acting on the runner?

B.) How far does he slide?

$KE = \frac{1}{2}mv^2 = 560\,J$

KE is transformed into thermal E + sound + KE of dirt

$Fd = \Delta KE$

$F_{net} = F_f = \mu F_N$

$F_N = F_g = 70kg(9.8\,m/s^2) = 686\,N$

$= .7(686N)$

$F_f = 480.2\,N$

$F_f d = \Delta KE$

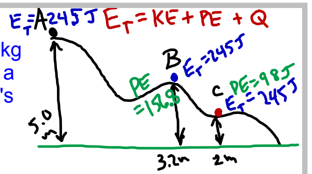
$d = 1.16\,m$

$F_{net} = F_f$

$F_{net}\, d = \Delta KE$

$d = 560J / 480.2N = 1.16m$

P. 152 # 30. A bead of mass m=5.00kg is released from point A and slides on a frictionless track. Determine the bead's speed at points B and C AND the net work done by the force of gravity in moving the bead from A to C.



$PE = mgh$

At pt. A $PE = 5\,kg(9.8\frac{m}{s^2})(5m) = 245\ J$

At pt. B $PE = 5\,kg(9.8\frac{m}{s^2})(3.2m) = 156.8\ J$

$\Delta PE = ?$ $88.2\ J = \Delta KE$

At pt. C $PE = 5\,kg(9.8\frac{m}{s^2})(2m) = 98\ J$

From A to B $\Delta KE = \Delta PE$

$= 245\ J - 156.8\ J$

$\Delta KE = 88.2\ J$

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

$v = \sqrt{\frac{2KE}{m}} = \sqrt{\frac{2(88.2\ J)}{5\ kg}}$

$v = 5.9\ m/s$ at pt B

From A to C $\Delta KE = \Delta PE$

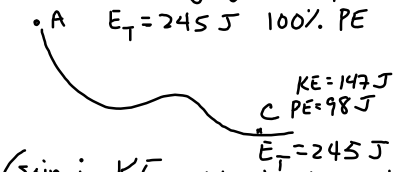
$\Delta KE = 245\ J - 98\ J = 147\ J$

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

$v = \sqrt{\frac{2KE}{m}} = \sqrt{\frac{2(147\ J)}{5\ kg}}$

$v = 7.7\ m/s$ at p C

Net work done by gravity from A to C?



Gain in KE = work done by Gravity.

$\Delta KE_{AC} = 147\ J$

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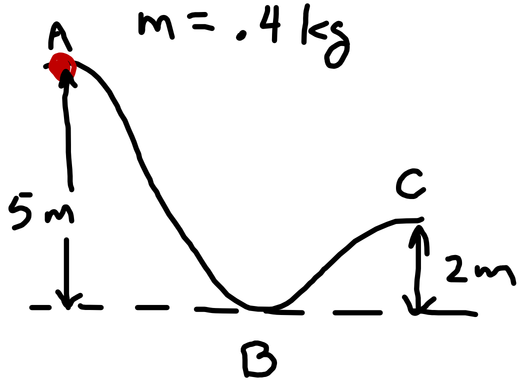
P.152 #28

m = .4 kg



Speed at B ?

$$PE = KE$$

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

$$v = \sqrt{2gh}$$

$$= \sqrt{2(9.8)(5)}$$

$$V_B = 9.9 \, m/s$$

speed at C ?

$$\Delta PE_{AC} = \Delta KE_{AC}$$

$$\cancel{m}g(\Delta h) = \frac{1}{2}\cancel{m}v^2$$

$$V_c = \sqrt{2g\Delta h}$$

$$= \sqrt{2(9.8)(3m)}$$

$$V_c = 7.7 \, m/s$$