Phys 2110-3 10/13/10

Note Title 10/13/2010

Chapter 7

Conservation of Energy

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

Conservative forces

$$U_{grav} = mgy \qquad U_{spr} = \frac{1}{2}kx^2$$

k = spring constant

x = amount of squish, ext.

$$W_{non\_cons} = \int F_x \, dx$$

often $\vec{F} \cdot \Delta\vec{r}$

$E = K + U$ Kinetic + Stored

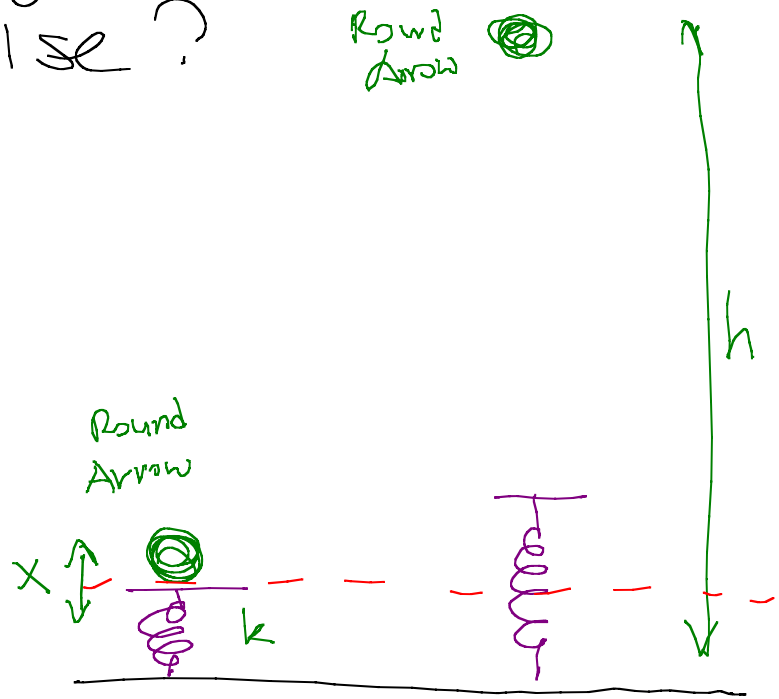
$\Delta E = W_{non-cons}$

If no non-cons (or misc) forces

$\Delta E = 0$ Conservation of energy.

Solve lotsa problems!

7.22 A 120 g – arrow is shot vertically from a bow whose eff. Spr. constant is $430\ \frac{N}{m}$. If bow is drawn 71 cm before shooting arrow, to what height arrow rise?



Energy is conserved

$$K_1 + U_1 = K_2 + U_2$$

$$0 + \frac{1}{2}kx^2 = 0 + mgh$$

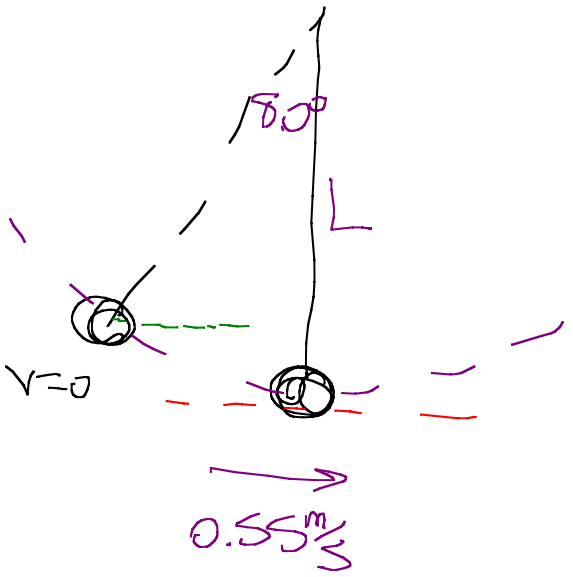
$$\frac{1}{2}kx^2 = mgh$$

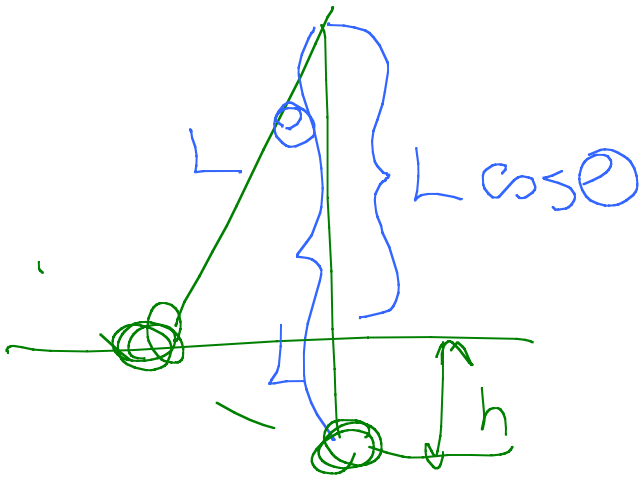
$$h = \frac{kx^2}{2mg} = \frac{\left(430\,\frac{N}{m}\right)(0.71\,m)^2}{2(0.120\,kg)\left(9.8\,\frac{m}{s^2}\right)}$$

$$= 92.2\,m$$

7.47 The maximum speed of the pendulum bob in grandfather clock is $0.55\,\frac{m}{s}$. If the pendulum makes a max angle of 8.0°, what is length?

Cons. of energy, $E_1 = E_2$





$$h = L - L\cos\theta$$
$$= L(1-\cos\theta)$$

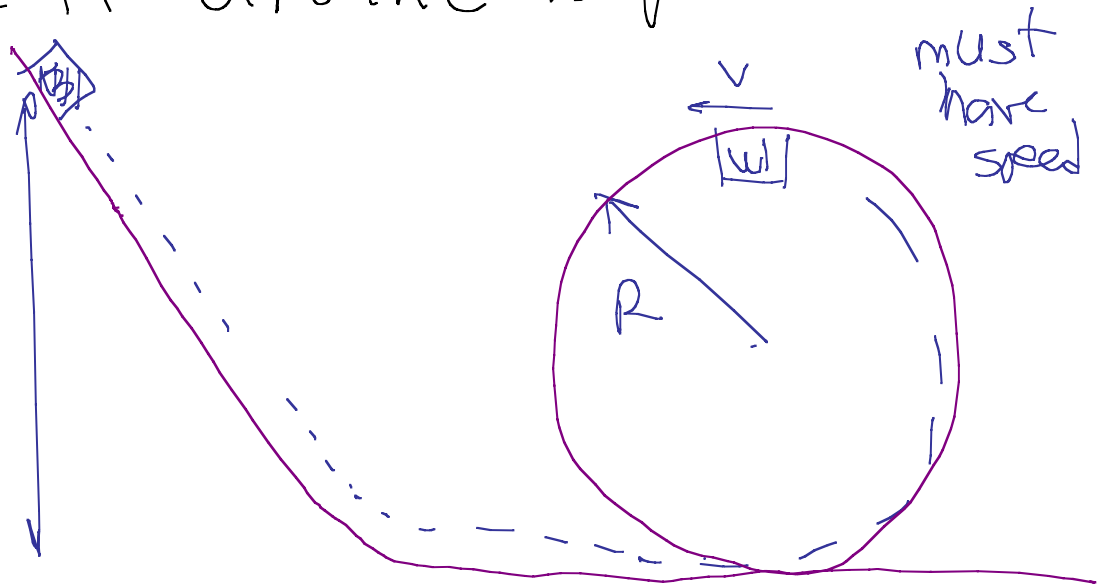
$\theta = 8.0°$

$$E_1 = E_2$$

$$mgL(1-\cos\theta) = \frac{1}{2}mv^2$$

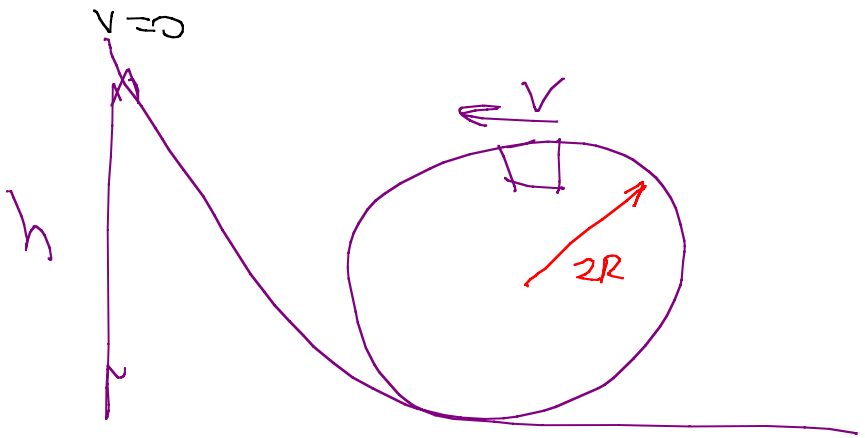
$$L = 1.59\ m$$

7.46 Block slides on fric'less loop-the-loop track. What is minimum height h at which it can start from rest & still make it around loop?



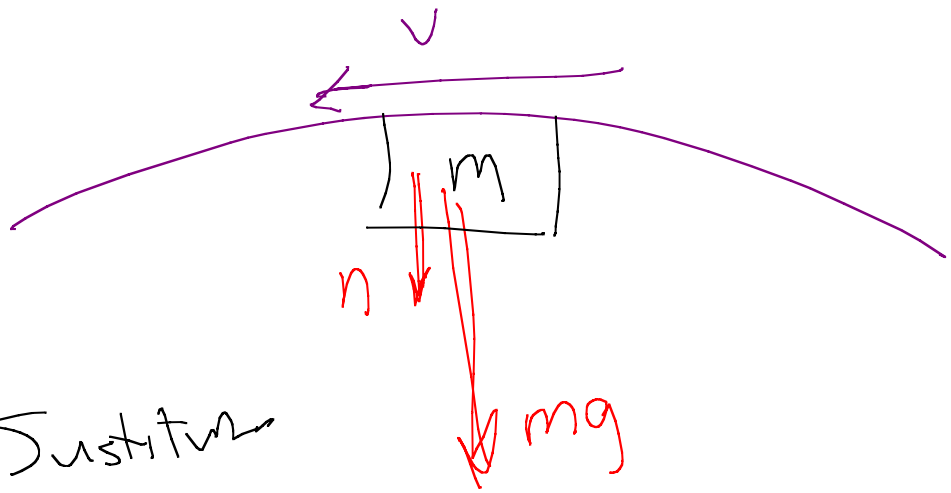
Naive:
$h = 2R$

Must have speed at top, circ motion.



Cons of energy

$$mgh = mg(2R) + \frac{1}{2}mv^2$$



$$mg + n = \frac{mv^2}{R}$$

at min vel.

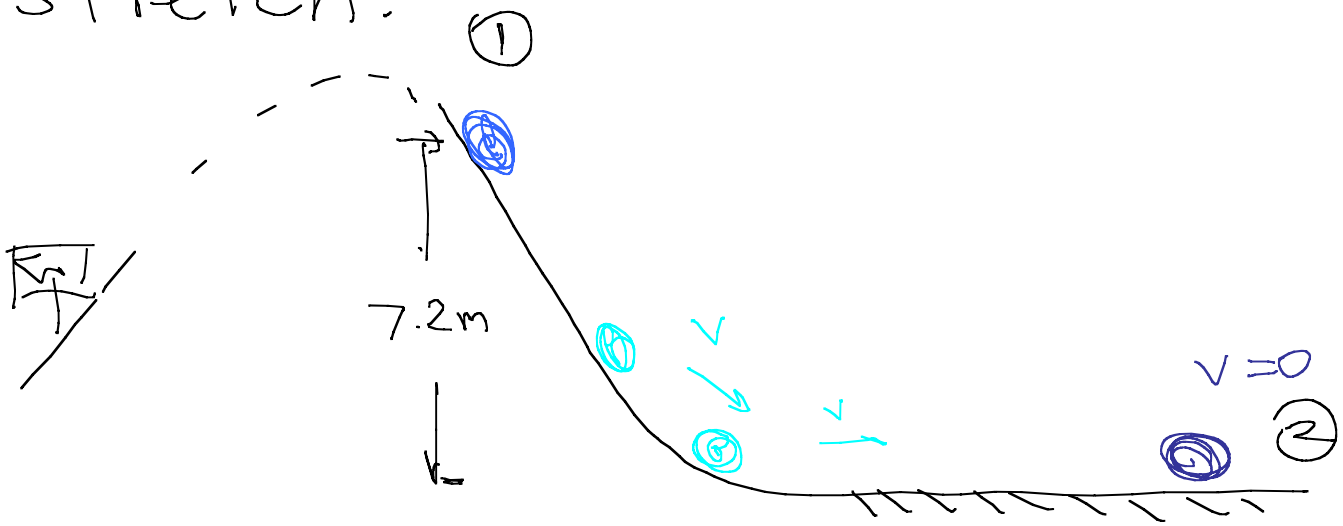
$$g = \frac{v^2}{R} \qquad R = \frac{v^2}{g}$$

$$v^2 = Rg$$

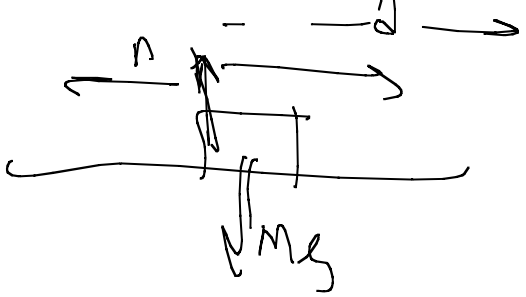
Sustitu

$$gh = g(2R) + \frac{1}{2}Rg \Rightarrow \text{cancel } g \quad h = \frac{5}{2}R$$

7.61 A child sleds down fricless hill whose vertical drop is 7.2 m At the bottom is a level but rough stretch where coeff of fric is 0.51 How far does she slide across level stretch.



$$\Delta E = W_{fric}$$



$$0 - mgh = F_{fric} d \,(-1)$$

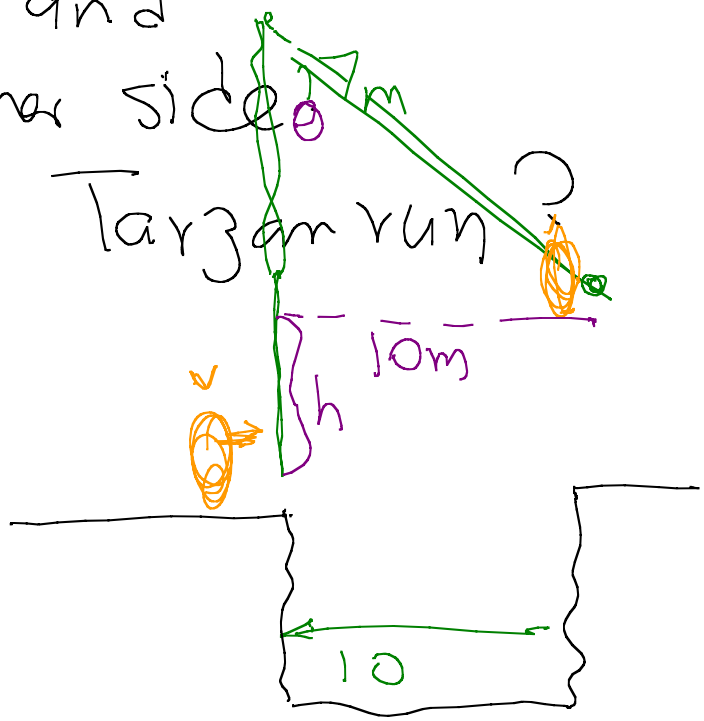
$$n = mg$$

$$= -\mu_k (mg) d$$

Cancel - sigh cancel g

$$d = \frac{h}{\mu_k} = \frac{7.2\ m}{0.51} = 14\ m$$

7.64 A 17-m long vine hangs vertically from tree on one side of 10-m-wide gorge. Tarzan run up, grab vine, swing over gorge and drop vertically on other side. At what min. speed Tarzan run?



$\sin\theta = 10/17$ $\theta = 36°$

Find h