HW C

HW1

(1) Energy Conservation : $E_k + E_p + E_L = \text{const}$

kinetic potential loss.

This amount is determined by the initial state. In the beginning, the coaster was at rest at 35 m high. Therefore Const = mgh $(h=35)$

$mg(35) = E_k + E_p + E_L$

The highest E_p is achieved when $E_k = 0$ and $E_L = 0$.

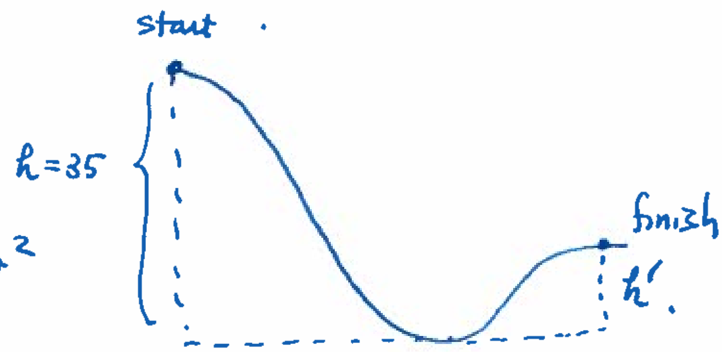
Therefore the highest hight is 35 m.

(2) Energy at "Start"

$E = E_p = mgh \quad (h=35)$

Energy at "Finish"

$E = E_p + E_k = mgh' + \frac{1}{2}mv^2$



By E. conservation.

$mgh = mgh' + \frac{1}{2}mv^2 \Rightarrow \cancel{m}v^2 = 2\cancel{m}gh - 2\cancel{m}gh'$

$\therefore v^2 = 2g(h-h') \Rightarrow$ doesnot depend on the mass!

(3) They arrive at the same time! Without friction.

If You drop two diff masses from the same height, which one reaches the bottom first?

(4) Energy Conservation

~~HW2~~

$mgh = E_L + mgh'$

E_L is positive. Therefore $mgh' = mgh - E_L \rightarrow h' = h - \frac{E_L}{mg}$.

~~The final~~ The finish height has to be lower than the h' above.

If the height is higher, the coaster can not reach the finish!

The properly elevated finish will make the coaster approach the finish with not ~~too~~ high speed!

HW2

For (A), we do not have to worry about pot. energy. $h=0$.
Before and after collision the speed remains the same. Therefore, the kinetic energy before and after collision are the same $\Rightarrow$ no loss!

HW3

Only mechanical energy $=$ kinetic energy $= \frac{1}{2}mv^2$.
v should remain const. Const. speed motion forever!

HW4

Now consider friction (loss energy).

$$E_k + E_L = \text{const}.$$

The block will slow down and eventually stop. At this point, the initial kinetic energy is totally lost through friction.

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

$\downarrow$

This is ~~wo~~ negative work done by friction f.

Therefore, $W = f \cdot d$

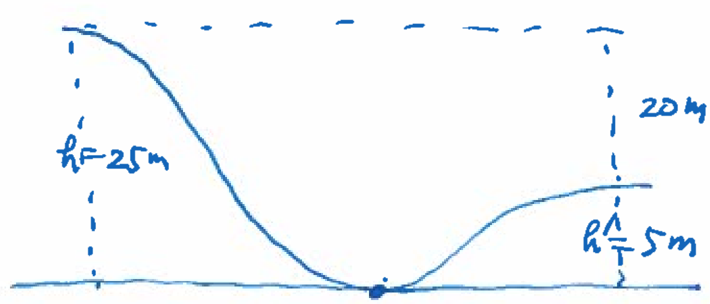
$$f \cdot d = \frac{1}{2}mv^2 \qquad f \cdot 10 = \frac{1}{2} \cdot 2 \cdot (0.1)^2 \Rightarrow \underline{f = 0.001\ N}\,!$$

HW5

$E_p = mgh$: Start

$E_p = mgh'$, $E_k = \frac{1}{2}mv^2$: Finish.

$E_k = \frac{1}{2}mv^2$, $E_p = 0$: Lowest.



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

$$\therefore v^2 = \sqrt{2gh} = \sqrt{500} \approx 22.4\ m/s.$$

HW6

They should have the same speed as far as no energy is lost through friction.

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

$$\therefore v^2 = 2g(h-h') = 2 \cdot 10 \cdot 20 = 400$$

$$\therefore v = 20 \ m/s$$

HW7

Now we have loss.

$$mgh = mgh' + \frac{1}{2}mv^2 + E_L :$$

$$E_L = mg(h-h') - \frac{1}{2}mv^2$$

$$= 500 \cdot 10 \cdot (25-\cancel{10}5) - \frac{1}{2}500 \cdot 1^2$$

$$= 100{,}000 - 250 = 99750 \ (J)$$