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LOOP DE LOOP

ROLLER

COASTER

JOURNEY

Dec.7 2024

Dec.7 24

Loop de loop Elevation to energy rollar coaster journey

Overall description of my project idea:

This project is targetting to find the elevation of the start track for a toy car to provide enough kientic energy so that the stored potential energy to complete one loop de loop.

Problem:

What height of the start track should provide enough energy to complete one 360° circular track.

Hypothesis:

The higher elevation will genrate enough kientic energy so that the stored potential energy to complete a loop.

Dec. 14
2019

Manipulated varible:

Elevation of the start track / dimeter of Loop.

Responding varible:

Toy car completing the loop de loop.

Controlled varible:

Toy car (weight, size), angle of start track, matireal of track,

Experimental procedure:

First step of the experiment is to find a height required to complete one loop. Next step would be to increase height of loop & simaller incerase in heights, means results in successful completions of loop de loop.

Dec. 19
2024

In order to complete a loop you need enough kinetic energy converted into potential energy to complete a loop de loop. Also to complete a loop de loop you need a good amount momentum so that the train/cart won't fall of the tracks. The to come back down from the second fall gravity will pull it down, and Centripetal force helps finish the loop de loop and friction stops the remaining energy.

Dec. 21
2024

To find out how much Kientic energy is used
We use this formula:
Kientic energy = $\frac{1}{2}$ mass x velocity^2

To find out how much potential energy is used
we use this formala:
Potential energy = mass x gravity x height.

$$\text{Velocity} = \sqrt{2 \times 9.81 \times 50} = 31.3$$

$$\text{Velocity} = \sqrt{2 \times 9.81 \times 92} = 42.4$$

$$\text{Velocity} = \sqrt{2 \times 9.81 \times 127} = 49.9$$

Dec. 22
2024

1.) The velocity of the car when it reaches the bottom of ramp:

$$PE_0 + \cancel{KE_0} = \cancel{PE_f} + KE_f \qquad PE_0 = KE_f$$

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

2.) The normal force at the car at bottom of ramp:

$$\Sigma F = F_n - mg = ma_c \leftarrow a_c = \frac{v^2}{R}$$

$$F_n - Mg = \frac{Mv^2}{R} \qquad F_n = \frac{Mv^2}{R} + Mg$$

$$F_n = \frac{M(\sqrt{2gh})^2}{R} + mg = \frac{2mgh}{R} + mg$$

$$F_n = mg\left(\frac{2h}{r} + 1\right)$$

3.) The minimum velocity need at top of the loop:

$$\Sigma F = M_g + \cancel{F_n} = MA_c \qquad \cancel{M}g = \frac{\cancel{M}v^2}{R}$$

$$Mg = MA_c \leftarrow A_c = \frac{V2}{R}$$

Mg

Dec. 22
2024

4.) The minimum vertical height (h) the ball must start with to make it through the loop and stay in track:

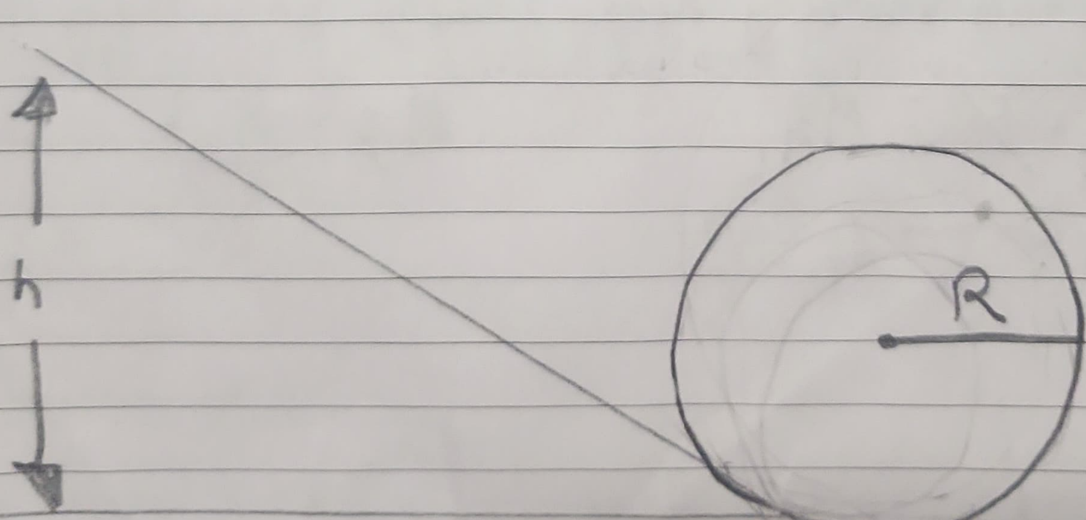
$PE_0 + \cancel{KE_0} = PE_f + KE_f$

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

$gh = 2gr + \frac{(\sqrt{gr})^2}{2}$

$gh = 2gr + \frac{gr}{2}$

$h = 2.5R$



Dec 23
2024

I decided to verify if the formula ($h = 2.5R$) works for my hotwheels track.

From my hotwheel sets I collected a small sized loop, a stand to hold the loop de loop, tracks used as a ramp, and connecters to hold the tracks together.

I will verify small LDL results with two bigger LDL. Hence, I gathered 2 LDLs to verify small LDL results, longer tracks for ramp, more connecters.

Dec. 29
2024

Experiment 1:

Finding height of track for smallest LDL.

Q: Is start ramp height 3R (1.5 D) enough to
Complete LDL.

Ramp height = LDL dia 25cm x1.5 = 37.5

U = cm

Height	Distance	Length tr.	Succsuss	
37.5	50 cm	65 cm	NO	Can't reach the top
37.5	40 cm	65 cm	NO	Too steep ramp
37.5	54 cm	65 cm	NO	Can't reach top

Ramp height = LDL dia 25 cm x1.7 = 42.5

U = cm

Height	Distance	Length tr.	Succsuss	
42.5	60	80	NO	Can't reach top
42.5	55	80	NO	Can't reach top
42.5	64	80	NO	Made a jump

Dec. 29
2019

U cm

RH = LDL dia $25 \times 1.8 = 45$

Height	distance	Length tr.	Succsus	
45	80	95	NO	Made a jump
45	75	95	NO	Can't reach top
45	84	95	NO	made a jump

RH = LDL dia $25 \times 2 = 50$ cm

U = cm

Height	distance	Length tr.	Succsus	
50	80	95	NO	
50	75	95	NO	Made a jump
50	78	95	NO	
50	80	100	No	Made a jump
50	85	100	NO	
50	87	100	yes	

Dec. 25
2024

Based on the calculation minimum ramp height is 2.5R.

I started at 3R (1.5 D) instead of 2.5R because of friction loss, still the car was unable to complete the entire loop de loop. Hence, I kept increasing the height (1.7 D, 1.8 D, 2.0 D). The experiment was succsusful at 4.0R (2.0D).

I noticed keeping the ramp straight gives a better chances of succsus, but keeping it curved its less chances of being succsusful.

Dec.27
2025

RH = LDL dia 40x2 = 80

Height	distance	angll try	succsus	
80	135	160	NO	Can't reach top
80	130	160	NO	Can't reach top
80	120	160	NO	Can't reach top

RH = LDL dia 40x2.1 = 84 cm

84	130	160	NO	Can't reach top
84	120	160	NO	Can't reach top
84	125	160	NO	Can't reach top

RH = LDL dia 40x2.2 = 88 cm

88	125	160	Yes	
88	120	160	NO	Made a jump
88	115	160	NO	Can't reach top

Dec. 27
2024

RH = L DL dia = 40 x 2,3 = 92 cm

Height	Distance	Length to	Success	
92	125	160	yes	
92	120	160	yes	
92	115	160	NO	Made a Jump

Dec. 28
2023

First thing that I noticed in the medium Loop de Loop is when I started at 2.0 D it didn't work, because of the Longer tracks there was way more friction loss in the medium loop de loop than the small Loop de loop. For ramp height I did 2.1 D, and 2.2 D. 2.1 D occured in a failure. The first experiment for 2.2 D was succsusful, but the other two experiments also occured in a failure. In my earlier observations for the small loop de loop straight tracks were better for succsus for medium LDL.

Dec. 29
2024

RH = LDL dia 51 x 2.4 = 122 cm

Height	distance	length tube	succsus	
122	150	200	yes	
122	140	200	NO	Made a jump
122	135	200	NO	Can't reach top

RH = LDL dia 51 x 2.3 = 117

117	155	200	NO	Can't reach top
117	145	200	NO	Can't reach top
117	140	200	NO	Can't reach top

RH = LDL dia 51 x 2.5 = 127

127	150	200	yes	
127	145	200	NO	Made a jump
127	140	200	NO	Can't reach top

Dec. 30
2024

As observed in the medium loop that 2.0 D won't work because of friction. I started at 2.4 D instead of 2.2 D. Because of starting at 2.4 D istead of 2.2 D the first experiment at 2.4 D height was succsussful. I tried the experiment at 2.3 D height, but it was a failure. I also tried the experiment at 2.5 D height. The first experiment was only a succsus at 2.5 D height.