AP Physics C – Class Notes

Jayden Li

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1 Introduction

1.1 Jumping Monsters

See Figure 1.1 in Notebook.

We investigate the relationship between the mass of the toy m and the change in height Δh. Equipment:

- Meter stick (not ruler, since ruler is only 30cm long)
- Phone (to record video)
- Balance (to measure mass in grams and kilograms, a scale measures weight in Newtons)
- Washers, paper clips and tape (to increase mass of toy)

We collect many data points. We will collect 5 data points, which is 5 conditions, which is 5 different masses to test. We want to repeat every mass a few times too; we will test every mass 3 times ("3 trials"). In total, the toy will jump $5 \cdot 3 = 15$ times. Trial means that conditions/masses are the same.

Results/data are in Table 1.2 in Notebook.

Based on conservation of energy:

$$\mathrm{PE_s} = \mathrm{PE_g} \implies \frac{1}{2}kx^2 = mgh \implies h = \frac{kx^2}{2mg} = \frac{kx^2}{2g} \cdot \frac{1}{m}$$

If we graph mass m against height Δh, this is an inverse relationship, as $kx^2/2g$ is a constant (the spring distance x does not change for one toy, k is spring constant, and g is acceleration due to gravity).

Because we want a linear relationship, we can graph inverse mass $1/m$ against height Δh. This becomes a line with slope $kx^2/2g$.