Memo: Cinema Consultant Job Requisition

From: Idaho Jones Production Associates

Movie: "Curse of the Lost Temple"

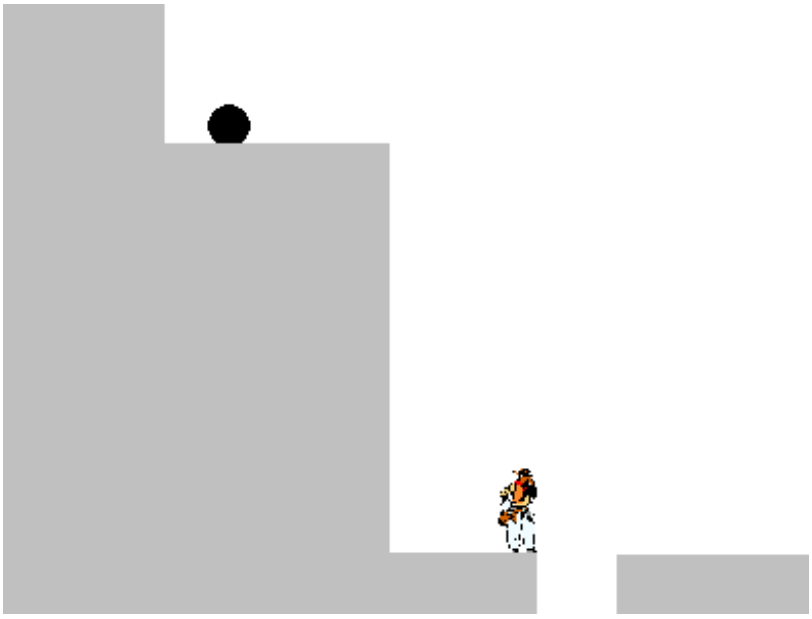
Scene: 2B175-25

Background

This is a sequel to the successful series of Idaho Jones movies. Jones is an adventuresome treasure hunter who works for the National Museum. The location of a hidden chamber in an ancient temple has just become known through a recently translated papyrus scroll. Jones and his crew are sent to Abada to examine the chamber, which is thought to contain the worlds largest emerald.

Scene Description

The critical scene takes place in the secret chamber within the temple. Jones thinks the emerald is at the bottom of a narrow shaft.



By standing at the edge of the shaft Jones unknowingly triggers a booby trap. The trap consists of a one-meter diameter spherical stone boulder activated by a nonlinear spring. Initially the spring is compressed from its natural length by two meters. As Jones looks down the shaft the spring expands to its natural length while pushing on the boulder, which starts rolling along a horizontal cliff above the shaft. Our set construction staff has determined that the boulder loses 15% of its energy while it's rolling.

Critical information:

- Height of cliff = 10 m
- Location of near edge of shaft = 3.6 m from base of cliff
- Width of shaft = 2.0 m
- Depth of shaft = 10 m
- Density of the rock in the boulder = 2500 kg/m^3

Spring characteristics:

This is a special spring that can be adjusted by adding or subtracting filaments. Each filament contributes 20 N to F_0. The natural length of the spring is 4 m. The force needed to compress it to a length L (in meters) is

$$F(L) \;=\; F_0 \cos\left(\frac{\pi}{4}(L-2)\right)$$

Requirement

Our Director wants the boulder to sail right into the middle of the open shaft. We're asking you to specify the number of filaments in the spring system that activates the booby trap so that happens.

Report Format

Submit **one** report for your team. Your report should include a narrative about the main steps involved in your team's solution. Identify the basic physics principles that justify each of the steps. In addition to the narrative, your report should also show the mathematical steps that were used in the solution. You can use a drawing tool to create both mathematical equations and technical sketches that help to illustrate your solution. Or, you can use ordinary characters to develop the necessary equations. You can upload your report by going to the OUT box in the course work room. This will send you to the LON-CAPA communication tools.