

Predicting the Landing Spot of a Projectile

Aim

To accurately determine the landing spot of a pendulum bob using the laws of motion and conservation of energy.

Equipment

pendulum bob
2 iron rods (eg rods from retort stands)
2 boss heads
fine thread
C-clamp
meter rule
razor blade or scalpel blade
masking tape
carbon paper

Method

CAUTION: Double-edged razor blades are very sharp. Handle with *extreme* care.

1. Review the equations involved with the conservation of energy and projectile motion. Derive an equation to calculate the landing point of the pendulum bob when the string is cut as the pendulum reaches its rest position. The final equation should involve only h_1 and h_2 (See Figure 1)

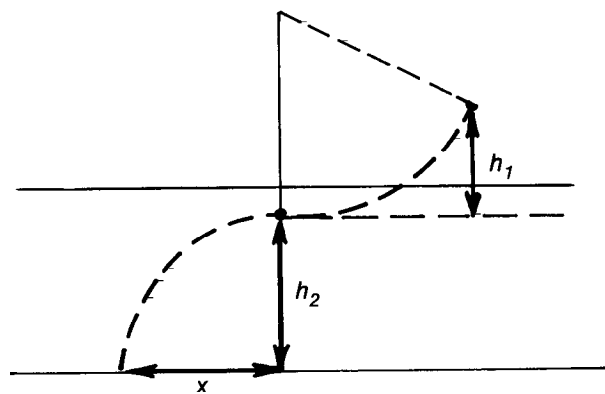
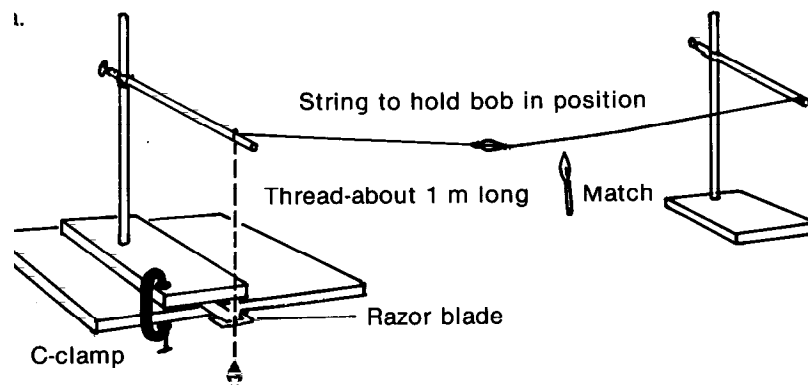


Figure 1: Path of Motion of Pendulum Bob

2. Assemble the apparatus as shown in Figure 2. Be sure the ring stand and stick are anchored securely so they will not move. The correct positioning of the razor blade is very important. The cutting edge must be precisely at the rest position of the pendulum.

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- Carefully measure and record the distances h_1 and h_2 .
- Calculate the expected landing position of the pendulum bob.
- Prepare a "bullseye" target.
- Tape the carbon paper, face up, and the target paper, face down, over the bob's predicted landing spot. Be sure the center of the bullseye is directly over the spot.
- Release the pendulum bob by burning the supporting string so that the bob will not be given any external acceleration.

Interpretation:

- Show the derivation of the equation for the landing point of the bob.
- Calculate the expected landing position of the bob.
- Evaluate the observed results with the expected results.
- Suggest legitimate causes for any variation that may have occurred, and explain how the variation would have affected the results.