

## AP Physics Lab

### Conservation of Energy and Projectiles

#### OBJECTIVES:

1. Utilize projectile motion equations to determine the velocity required to land in a given location.
2. Utilize conservation of energy equations to determine the height at which a projectile must be dropped in order to attain a given velocity.
3. Set up and test a model situation.

#### MATERIALS:

As listed in Scenario below.

#### PROCEDURE:

Read the scenario below. Make all necessary measurements and calculations. Set up the model of Jane and while being witnessed by Mrs. Carpenter, launch "Jane" from the appropriate height so that she lands on the "island".

Scenario: There she stood on the edge of the cliff, calmly thinking back to her days as an ace physics student. Now, thousands of miles away, only physics could save her life. This is how it all began:

As a student at Newtonian University, Indiana Jane was studying to be the first archeological physicist. Her dream in life was to uncover lost physics treasures and in her research she found a very old book which was handwritten and signed by Sir Isaac Newton. Folded carefully into the book was an even older map. In the book, Newton revealed The Legend of the Lost Protractor. The map showed in detail the location of the treasure (the first known protractor and the first mechanical pencil ever invented). So on her summer break, Indiana Jane ventured to the country known as Scisyhp. Unfortunately, the map did not detail the unfriendly natives who double unfortunately for Jane were not true Physics lovers and did not understand her quest. Jane was taken prisoner and her helicopter (which was equipped with pontoons) was towed out to an island in the middle of a shark infested inlet. Indiana Jane was not to be stopped. Late one night, she broke out of the jail and followed the map to the lost protractor treasure. On her way back to the helicopter, I.J. discovered the true meaning of "lost protractor" and become totally lost. She realized her mistake, grabbed the

treasure and headed for home. The natives were getting closer, and Jane knew her only hope was to approach the helicopter island from the far cliff. Moving quickly, she threw the backpack over her shoulder and ran the last mile to the cliff. (In 5 min 12 seconds.)

Indiana Jane knew she must calculate quickly as the natives were closing the gap and she had only 40 minutes to escape. Assessing the situation, Jane made a list of all of the materials she had with her:

- 1 - collapsible/expandable slide approximately 50 m long
- 1 - clamping device
- 1 - tree climbing device
- 1 - HP 48 GX Calculator
- 1 - Mechanical Pencil with Lead
- 1 - Package of Strawberry Pop-Tarts
- 1 - Can of Diet Coke
- 1 - GPS measuring device
- 2 - pieces of notebook paper

Without hesitation, she used her GPS device and sketched out her map. On the second piece of paper, she began her calculations. Using her awesome physics knowledge, she determined the exact position she needed to set up the slide and launch herself in order to land safely on the island where her helicopter was parked. The slightest miscalculation, and Indiana Jane would be shark bait. I.J. climbed the tree, attached the slide at the top then carefully positioned herself \_\_\_\_\_ m above the ground. Bracing for impact she let go and ...

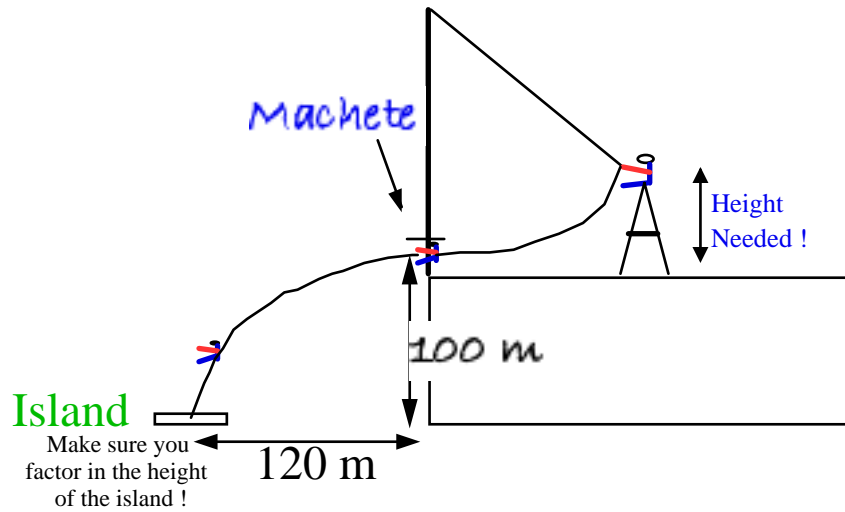
Objective: Based on the information in the scenario and the sketch made by Indiana Jane, determine the exact position where Jane must be launched to land safely on the island. First complete the information in the data chart then using the equipment provided, set up a simulation of I.J.'s predicament. The ratio of Cliff Height to Island Distance in your simulation should remain the same as in Jane's sketch. You must carefully calculate IJ's release height based on your scaled scenario. When you are ready, obtain the "island" from Mrs. C and place on the floor according to your scale. Mrs. C MUST witness your trial and scoring is as follows:

NO PRACTICE RUNS ARE PERMITTED so make careful calculations and accurate measurements.

**DATA/ANALYSIS:**

	<b>Cliff Height (m)</b>	<b>Island Distance (m)</b>	<b>Time in Air to Island (s)</b>	<b>Horizontal Velocity Needed (m/s)</b>	<b>Release Height Needed (m)</b>
<b>Jane's Sketch</b>	100 m	120 m			
<b>Simulation</b>					

**CALCULATIONS:** You must show all calculations.



**NOT DRAWN TO SCALE !!**

Jane's Sketch:

CONCLUSION:

Data	Analysis	Conclusion	Skills	Report	Total
3 2 1 0	3 2 1 0	3 2 1 0	3 2 1 0	3 2 1 0	