

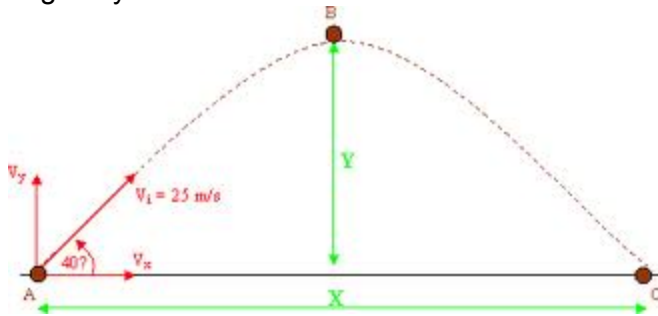
Lesson Plan: Stomp Rocket Challenge

Teaching Plan:

Introduction (5 min)

Discuss the science/design considerations/strategizing (10 min)

- Projectile motion: Anytime you drop or throw something it follows the following path due to gravity.



- Manufacturing process: For engineers its important to be able to make more than just one good product. Need to make sure every time you create another product it still works. Why do we care about quality production? What happens in the real world if one rocket works, but another fails?
- What things should you focus on when designing your rocket?
 - wings(shape, number)
 - length of the rocket
 - the weight of the rocket
 - what the tip should be like
- Strategy
 - How will you manage your time?
 - What will each team member work on?

Build the Rockets (20 mins)

Test the Rockets (15 mins)

Conclusion (10 mins)

Mentors Scientific Background

- Engineering design process: Ask, Imagine, Plan, Create, Improve
- Projectile motion: "A projectile is an object upon which the only force acting is gravity. There are a variety of examples of projectiles. An object dropped from rest is a projectile (provided that the influence of air resistance is negligible). An object that is thrown vertically upward is also a projectile (provided that the influence of air resistance is negligible). And an object which is thrown upward at an angle to the horizontal is also a projectile (provided that the influence of air resistance is negligible). A projectile is any object that once *projected* or dropped continues in motion by its own inertia and is influenced only by the downward force of gravity."
- Gravity and horizontal forces: "Gravity acts to influence the vertical motion of the projectile, thus causing a vertical acceleration. The horizontal motion of the projectile is the result of the tendency of any object in motion to remain in motion at constant velocity. Due to the absence of horizontal forces, a projectile remains in motion with a constant horizontal velocity. Horizontal forces are not required to keep a projectile moving horizontally. The only force acting upon a projectile is gravity!"
- Reliability engineering: "Try to identify and get rid of most likely failures, the ability of

a system or component to perform its required functions under stated conditions for a specified period of time. It is often reported as a probability.”

Introduction for the Mentees.

- Icebreakers
- Today’s topic: Hitting targets over again with several different rockets Show demonstration/Introduce challenge (5 min)
- Launch a demo rocket
- Challenge: Come up with a rocket design and create 4 rockets. Try to make all 4 rockets hit the same target.
- In the real world its important to build a reliable product design. Today’s focus is on designing a good rocket and being able to reproduce the same design.

Modules/Demos, or Project

Building the Rockets:

1. Wrap paper loosely around the PVC pipe
2. Slide the tube off and tape the seam
3. Flatten the tube at one end, use scissors to cut the flat edge into a sharp point
4. Tightly tape the point so air does not escape

Adding Fins:

1. Fold a 3 x 6 index card in half, open at fold and cut along the fold
2. Cut along the diagonals of the half cards
3. Tape the fins on the rocket, spaced equally apart from each other

Flying the Rocket:

1. Slide the rocket halfway down the pvc pipe
2. Put the bottle on the ground
3. Point the pvc pipe away from people
4. Step on the bottle

Closing Activity and Discussion.

- What were some problems you ran into when designing your rockets? (Building Techniques)
- What did you do to make sure all your rockets were the same? (Quality control)
- How did you manage your time? (Time Management)
- How did each team member contribute to each project? (Delegating tasks/working as a team)

Connecting to engineers (more topics to discuss)

- Modeling and simulation: In “real life” engineers use computers to design models to test their designs. *Show pictures of CAD drawings, fluid simulations etc.* Why would you want to test your designs before building them?

Worksheet

At the bottom of the page.

Materials

- Index Cards
- Paper
- Soda Bottle

- Tape
- PVC pipe
- Vinyl tube

References/Citations

Projectiles, gravity: <http://www.physicsclassroom.com/class/vectors/u3l2a.cfm>

Reliability: http://en.wikipedia.org/wiki/Reliability_engineering

Building the Rockets: The Exploratorium Stomp Rocket lesson plan guide

CAD drawing: http://www.google.com/imgres?imgurl=http://www.neseth.com/gcross6.jpg&imgrefurl=http://www.neseth.com/convert2.htm&usq=__2i_wbM7GWJcfZBeY0d7eHK_ZV60=&h=400&w=516&sz=34&hl=en&start=2&zoom=1&tbnid=FnzvY9mWRcxkRM:&tbnh=102&tbnw=131&prev=/images%3Fq%3DCAD%2Bdrawing%26um%3D1%26hl%3Den%26sa%3DN%26biw%3D1366%26bih%3D651%26tbs%3Disch:1&um=1&itbs=1

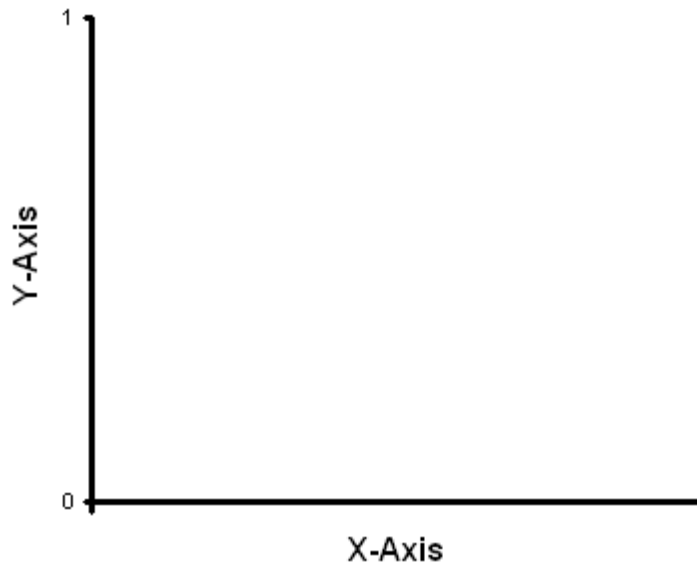
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Worksheet

Name _____

Stomp Rockets

1. Draw a projectile motion graph for the two objects.



2. _____ process is important because engineers need to make many good products.

3. What will you focus on when you build your rocket?

Pictures (for modeling)

