Bottle Rocket Activity

Instructor's Handout

1 Educational Objective

- Fun first activity to pique interest of children
- Illustrate kinematics concepts/terms in a real life example
- Introduce force concepts to children, also in a visual medium..

2 Materials

2-Liter bottles (coke-brand seems to work best) for each student, construction paper for fins/nose cone, duct tape to attach design to bottle, scissors, a launcher, a launch retainer pin, an air pump, a few metal stakes, and an ample supply of water.

3 Preparation

- Design Preparation Be sure to have all materials laid out for children. Be prepared to give children direction in what their design may look like (show the fins and nose cone, but do not hinder their creativity).
- Launching Preparation The bottle rocket, when pressurized to 60 psig, can be a very dangerous object, capable of causing severe injury. Several safety precautions must be taken before and during your launches.
  1. Go to an open area, clear of people, cars, etc.
  2. After filling the bottle with water (not too much, not too little) and attaching it to the launcher, stake the launcher to the ground.
  3. Make sure that the bottle is completely seated on the o-ring at the base of the launch rod.
  4. Insert the launch retainer pin, making sure it will restrain the bottle by passing over the bottles neck ring.

5. Carefully pressurize the bottle. At no time should you stand above the bottle. Assume it could blast off at any moment. Do not pressurize the bottle beyond 60 psig.

6. When fully pressurized, make sure that nothing is in the way of the rocket, stay clear, and pullout the launch retainer pin.

7. You will need a partner to record the altitude of the rocket if you are using an inclinometer. Be sure to measure or estimate the distance that your partner is standing from the launch pad so that you can compute the rocket's altitude given its angle above the horizon.

4 Important Concepts to Cover

- Kinematics Concepts

  1. Position

  2. Velocity, speed

  3. Acceleration

- Overview of Forces

  1. 1st law- gravity and drag slowed the object in motion.

  2. 2nd law- rocket had obvious accelerations at take off and at apex, but also always had the acceleration due to gravity.

  3. 3rd law- water sprayed downward, equal reaction force to the rocket propelling upward.

5 References

- www.physics.montana.edu/ret/sflentie/PDF/BottleRocketLab.pdf

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Student Handout

1 Bottle Rockets!

Today we will be building and launching our very own rockets!

The first step is to design your rocket. Be creative with your design- do you want big or small fins? What shape do you want your fins? What about your nose cone? Long and skinny or short and fat? It's all up to you!

Once you have finished designing your rockets, we will go outside and launch them! We will see whose rocket goes the highest, flies with the most style, and sticks the best landing!

Here is an example of what a bottle rocket might look like:

2 Design Tips

- Try to make your fins evenly spaced around your bottle. This will ensure the best flight!
- Make sure your fins and nose cone are sealed tight on the bottle. You wouldn't want your precious design to fall apart when the rocket is launched with lots of force.
- Try to not to make one side heavier than the other- your bottle won't go straight up if it is lopsided.

3 Launch Information

Your bottle rocket, when pressurized to 60 psig, can be a very dangerous object, capable of causing severe injury. Several safety precautions must be taken before and during your launches.

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2. After filling the bottle with water (not too much, not too little) and attaching it to the launcher, stake the launcher to the ground.

3. Make sure that the bottle is completely seated on the o-ring at the base of the launch rod.

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4 References

- www.physics.montana.edu/ret/sflentie/PDF/BottleRocketLab.pdf

- ocw.mit.edu/courses/aeronautics-and-astronautics/16-01-unified-engineering-i-ii-iii-iv-fall-2005-spring-2006/system labs-06/sysprob4.pdf

- http://www.google.com/images