

Rocket Nose Cones - Notes & Lesson Plans K-12

A. Woodbridge
3D Modeling

3D Design Challenge 2

Grover Cleveland HS
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Rockets:

I use the AirRocketWorks.com launcher and template. They are great people to work with, and their launcher is easy to use and robust. My suggestions for materials:

Materials for Rocket Build:

- 1 PDF Template/Student (available from AirRocketWorks.com Website's instructions page)
- 1 Roll Masking Tape/4 students
- 1 Pair of Scissors/2 Students
- 1 14" section of 1/2" PVC Pipe/student

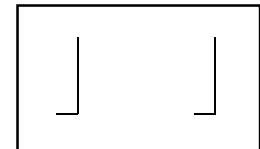
Materials for Rocket Launch:

- 1 Launcher & Bicycle Pump (if you can get it to work with an air compressor it will be easier)
- 2 Estes Altitrackers or create your own hypsometers with straws, washers, and protractors
- 1 50' or 100' measuring tape. I usually use 100' as the distance, since you just have to move the decimal on the tangent table
- 1 Tangent Table

3D modeling adaptations:

My students work in Autodesk Inventor, but this is adaptable to any 3D modeling package (SketchUp, TinkerCAD, Fusion 360 etc).

You can also go without 3D modeling software, I have given students index cards with 2 @ L shapes (11mm x 40 mm), and have them draw in the design they would like to revolve, then I help them do the revolve on my computer. With this method, you need one computer and one 3D printer.



3D printing adaptations:

I usually do the slicing for my students, but you can have them do the printing if that's common practice in your class.

I usually print 9 nose cones at a time, and it takes about 20 minutes a cycle. If possible try and use the "Sprilize" or "Vase" Setting, this won't work with every student design though. If you have bed adhesion problems, print one at a time.

Title	Day 1 - Brainstorming
Objectives	SWBAT hypothesize how their nose cone will work
Materials	Student handout packet Access to the internet (1 device/pair) Pens/Pencils for brainstorming and writing
Engage	Show students a finished paper and tape rocket as well as the launcher. I usually launch a rocket into the ceiling or to the back of the room (it will generally get destroyed), but it's a lot of fun.
Discover/ Explain	Review the project with the students. Especially the constraints. Tell students you expect them to complete the brainstorming and first reflection during class
Practice	Students should use the internet, and their own creativity to create their nose cone designs. Once they have finished their six ideas, they should complete the brainstorming reflection questions.
Check for Understanding	Review students designs as they finish, go over their chosen design, and point out any large issues, but leave smaller issues for them to discover in the prototyping stage.
Summary	Have students work in larger groups 6-8 and share their chosen design and their hypothesis about its flight characteristics.

Title	Day 2 - 3D Modeling
Objectives	SWBAT create a 3D model of their nosecone
Materials	Student handout packet from packet Access to 3D modeling software
Engage	Discuss the revolve tool and it's uses, also describe the pitfalls of intersecting curves
Discover/ Explain	Review the steps of nose cone creation with the students
Practice	Students should work in inventor to create their nose cones, and the drawing sheet. When they are finished, and you have accepted their STL files for printing, they should complete the prototyping reflection.
Check for Understanding	Have students submit their STL files for printing. If there are any issues, send them back with corrections

Title	Day 3 - Rocket Building
Objectives	SWBAT create a paper and tape rocket
Materials	Rocket building supplies 3D printed Nose Cones
Engage	Discuss with students the factors that will impact the flight profiles of their designs, weight, the amount of tape, fins etc will affect the flight of their rockets.
Discover/ Explain	Review the rocket building directions. Stress the importance of step 4, and that they should skip steps 5 and 8 since we will be adding our own nose cones.

Practice	Students should work in pairs/quartets to build their rockets. They should attach their nose cones.
Check for Understanding	Check over student rocket designs, make the tube is removed from each rocket.
Summary	Use the summary time to go over calculating altitude based on an angle measurement.

Title	Day 4 - Launch Day
Objectives	SWBAT calculate the altitude of their rocket launch
Materials	Rocket Launcher Student rockets Data collection form (on the rubric)
Engage	Review the launch operation, and safety procedures.
Discover/ Explain	Review the angle measurement procedure and flow 2 students at the launcher (one to pump and one to flick), 1 data collector, 4 students at the altitude station, a recovery team, and the rest nearby. Students will rotate through the positions as they go.
Practice	Each student should launch their rocket and fill in the data table as needed. When finished, students should complete their final reflection.
Check for Understanding	Students should be able to turn in all the deliverables for grading
Summary	Have students discuss their experiences, whether their hypothesis were correct, and talk about what they might change if they had a chance to do it again.