

Polymer Rockets

Title: Polymer Rockets

Objective: Students will design, create and test a polymer rocket.
Students compete in a polymer rocket blast off competition.

Materials: foam plumbing pipe insulation(P10xB6), cable ties, rubber bands, foam food trays and/or craft foam sheets 8.5"x11, scissors, wire cutters, low temperature glue gun, glue sticks, paper, pencils, sticky notes, clear tape, meter tapes, zip lock bags, and items for engagement.

Materials suggestion: Cable ties and pipe insulation can be purchased at low cost from building supply companies. Use two different kinds of cable ties. The ties with an eye or plastic hole at the base are great for inside the rocket to secure the rubber band from being pulled out during launching of the rocket. The basic cable tie is used on the outside of the rocket. Ties with extra parts will hurt the hands when launched.

Preparation: Cut foam plumbing pipe insulation into 12 inch pieces. Cut craft foam into halves of approximately 8.5" x 6". Into a zip lock bag put one piece of foam plumbing pipe insulation, two cable ties – one of each kind as described above, one rubber band, and a piece of craft foam. Prior to launching the rockets, one should tape down 6 or more meter tapes along the floor.

Video Demonstration and Printable Directions: A step-by-step video demonstration on how to build a polymer rocket is available for you to watch at:
<http://agpa.uakron.edu/p16/video-polymerrocket.php>. You will also find a printable direction sheet there.

Safety: Hang Caution sign above glue guns. The presenter discusses safety concerns when using the glue gun such as do not touch the metal tip with hands, only use the glue gun if an adult is there to help and show caution around the electric cords.
Discuss rules for launching: All rockets launched in the same direction and not at a person. Rockets are only launched when signaled. Rockets are only retrieved when the all clear signal is given.

Activity: Get the students excited by giving a hint about what they are going to do.
Suggestions: show some rocket pictures or other kinds of toy rockets, present a video clip of a rocket launch or have students act out launching into space in a rocket. Discuss with the students that today they will design, build, and their own rockets made from all polymer materials. At the end of the activity there will be a blast off competition to see which rocket will go the farthest.

Directions for assembly of the rocket:

1. Attach the cable tie with the eye to the rubber band and tighten loosely.

2. Drop the tie and part of the rubber band inside the foam tube.
3. Secure the rubber band inside the tube by wrapping the basic cable tie around the top of the tube and pull extremely tight.
4. Cut off the cable tail with the wire cutters.
5. Using the sheet of foam, or meat tray students experiment with creating wings or fins in various sizes, shapes and materials.
6. With adult supervision, students glue wings and fins to the rocket. For younger students, an adult should operate the glue gun. Be careful as glue may cause burns and an adult should handle the gun.
7. Practice launching the rockets using the meter tapes as a flight path and a measurement tool. Let students change or improve rocket as time allows.

In a classroom setting, Depending on grade level and time many other concepts could be incorporated.

- Measurement practice
- Charting on histogram
- Averaging three trials
- Finding the mean, median and mode of trials from a small group
- Potential and kinetic energy
- Journal writing about what it would be like to fly in a rocket

After all of the students are done with creating and testing rockets it is time for the blast off competition. All contestants line up behind the starting line. The rockets are launched simultaneously upon command of the mission control director (adult supervisor). Students measure the distance of the flight of their rockets down the flight path. The student whose rocket went farthest distance marks that spot with a sticky note with name. The teacher and/or class decide the number of trials and if there are to be semifinals for the big blast off winner.

Activity suggestion: During the trials and blast offs have an adult helper present to help the students repair rockets as needed. Plan on having time for the students to enjoy and practice with the rockets. Fun is sure to be had by all.