RUBBER BAND FOAM ROCKET

Modified from the Fresno Community Science Workshops for the EAA

Concepts Illustrated:

(1) Newton's Laws of motion
(2) Three forces of rocket flight
(3) Elastic energy in a rubber band catapult

Time Requirements: 60 Minutes

Grade Level of Audience: This activity is primarily suited for kids in grades 5-8.

I. Materials and Equipment Utilized

(Materials needed for a group of 20 students)

1. A heavy rubber band
2. 20 cm of foam insulation tube – you can buy this cheaply from hardware stores
3. A cable-tie
4. Stiff cardboard
5. scissors
6. sticky tape

II. Description of Set-up and/or Construction of Apparatus

1. With the scissors, cut about two centimeters from the end of the foam insulation tube. Put this aside for the time being - this small band will add a bit of weight to the nose of your rocket and softens its impact.
2. Tie the cable-tie around the foam tube about one centimeter in from an end, making sure the rubber band is looped inside. Pull the cable-tie as tight as possible (maybe you could get somebody with a strong arm to help you with this).

3. Clip off the loose end of the cable-tie.
4. Slip the small piece of foam tubing you cut off in step 1 over the cable-tie to hide any sharp edges.
5. Now for the fins! Cut three slits in the other end of the rocket, running about a quarter of the length of the tube. Each slit should be evenly placed around the rocket tube.
6. To make the tail fins, cut three right angled triangles from a piece of card with one straight side about 12 cm in length.
7. Sticky-tape all three fins together by their 12 cm straight sides so they are able to stand up on their own.
8. Trim the corners from the fins, then cover the outer edges with sticky tape for added strength and to smooth the edges.

9. Slot the fins into the end of the rocket; one fin into each slot. When you're happy with the positioning, hold it in place with sticky tape.
10. Your rocket is ready to launch! Find an open space away from people or objects that could be broken. Hold the end of the rocket with one hand and slip the loop of the rubber band over the end of your thumb on the other (giving the ‘thumbs up' before you launch).

11. Stretch the rubber band while holding the rocket steady and close to your body as your arm extends away from you.
12. Let go of the rocket.
13. Practice and see how far you can get your rocket to launch by stretching the rubber band more or less – this determines how much energy you give the rocket

III. Details of Student Implementation

How does the simple elastic band work? The rubber is made of plastic. All plastics are polymers, from the Greek words ‘poly' for many and ‘meros' for unit. As the name implies, plastics are made up of long chains of repeating chemical units, each bound together.

In some plastics, these chains are stuck to one another, making the plastic stiff and hard. In others, the chains are free to slide about, allowing the substance to flow and change shape.

In rubber, the chains of units are coiled tight and the bonds between them are loose and can be separated over a distance .

Stretching a rubber band uncoils the polymer chains. Feel a rubber band after stretching it about ten times. Does it feel warm? Uncoiling the chains makes them produce heat energy. When you let go of a stretched rubber band, the bonds pull the chains back into coils and the band returns to its original shape.

This is all a matter of energy!

Energy is something like Cosmic Currency. It makes things happen. We see it work in different forms; such as light radiation, sound, and heat. Kinetic energy is the type we see when objects move, such as your rubber band rocket in flight.

Where does the energy come from? The Law of Conservation of Energy says energy cannot be created or destroyed, however it can be transferred and often changes forms in the transferal. It can also be stored as elastic energy, as in rubber bands.

The more stretched a rubber band is, the more elastic energy it has. When it is let go, the elastic energy rapidly turns back into kinetic (moving) energy, launching the rocket. You'll notice the more stretched the band is, the further the rocket travels; more elastic energy means more kinetic energy.