

## Industrial Strength Rocket Launcher

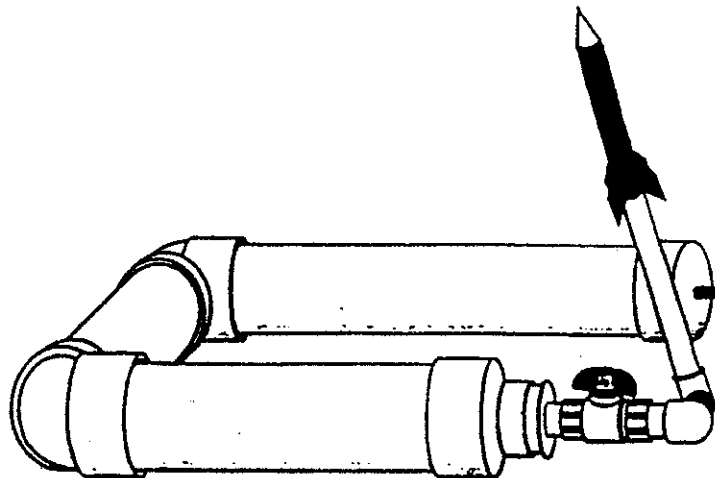
**Description:** Instructions for the construction of an industrial strength rocket launcher for use with paper rockets.

### Materials:

- Schedule 40 PVC piping and bushings from a plumber supply store. Specific lengths and sizes are given in illustrations on the following pages.  
(Note: schedule 40 pressure-rated piping not generally available at a typical hardware store. For safety you need PVC intended to hold water under pressure).
- Snap-in tire valve (available at auto supply stores)
- PVC purple primer
- PVC cement
- Ground/table cover (primer stains!)
- Sand paper
- Hand saw
- Drill and bit for tire valve hole

### Time Frame for Activities

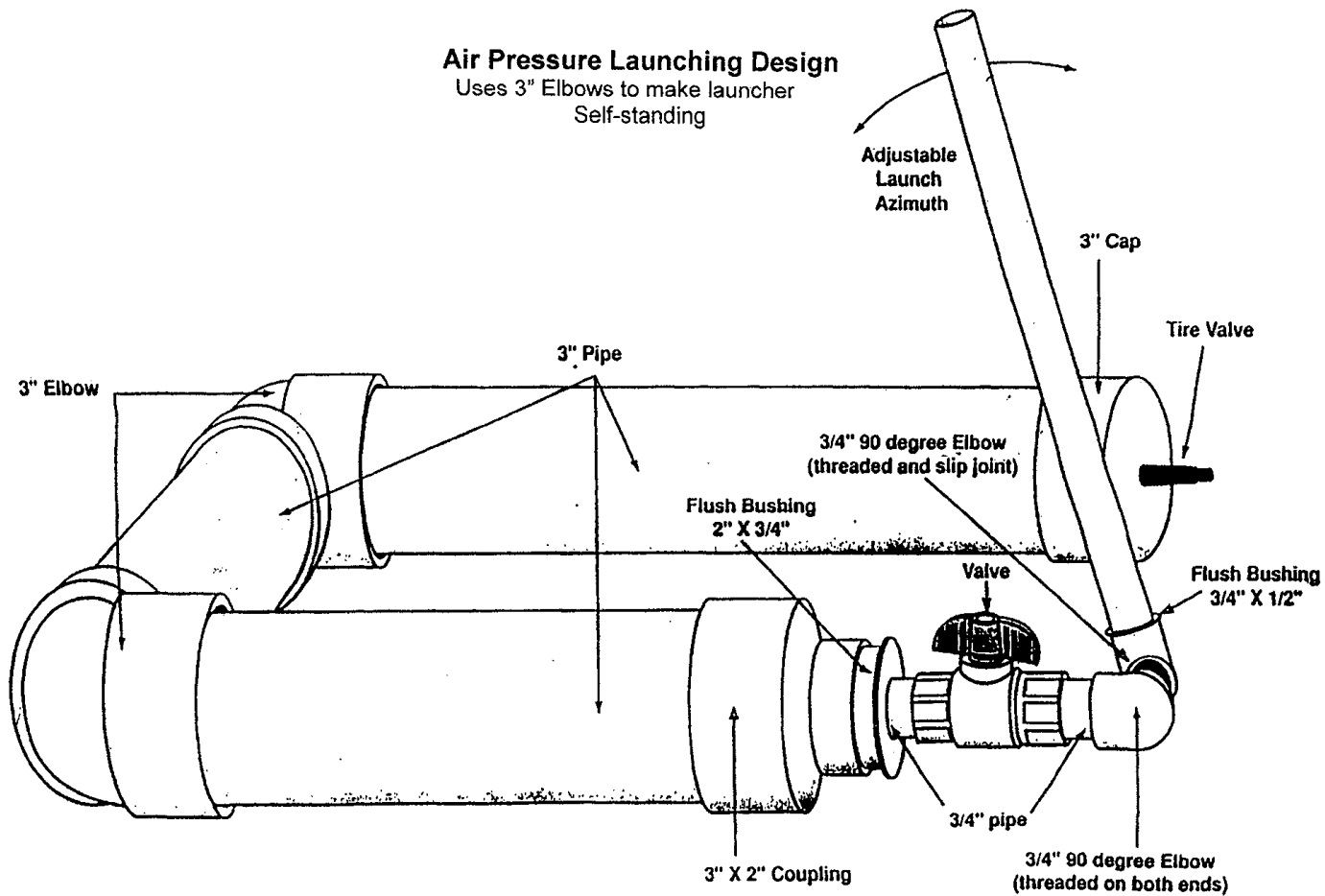
**Construction of Launcher:** will need to be built and tested before students have rocket lab. Construction time to build launcher is 1 to 2 hours. Time to acquire necessary parts can be significantly greater.



Yes, this rocket science! (Or plumbing...)

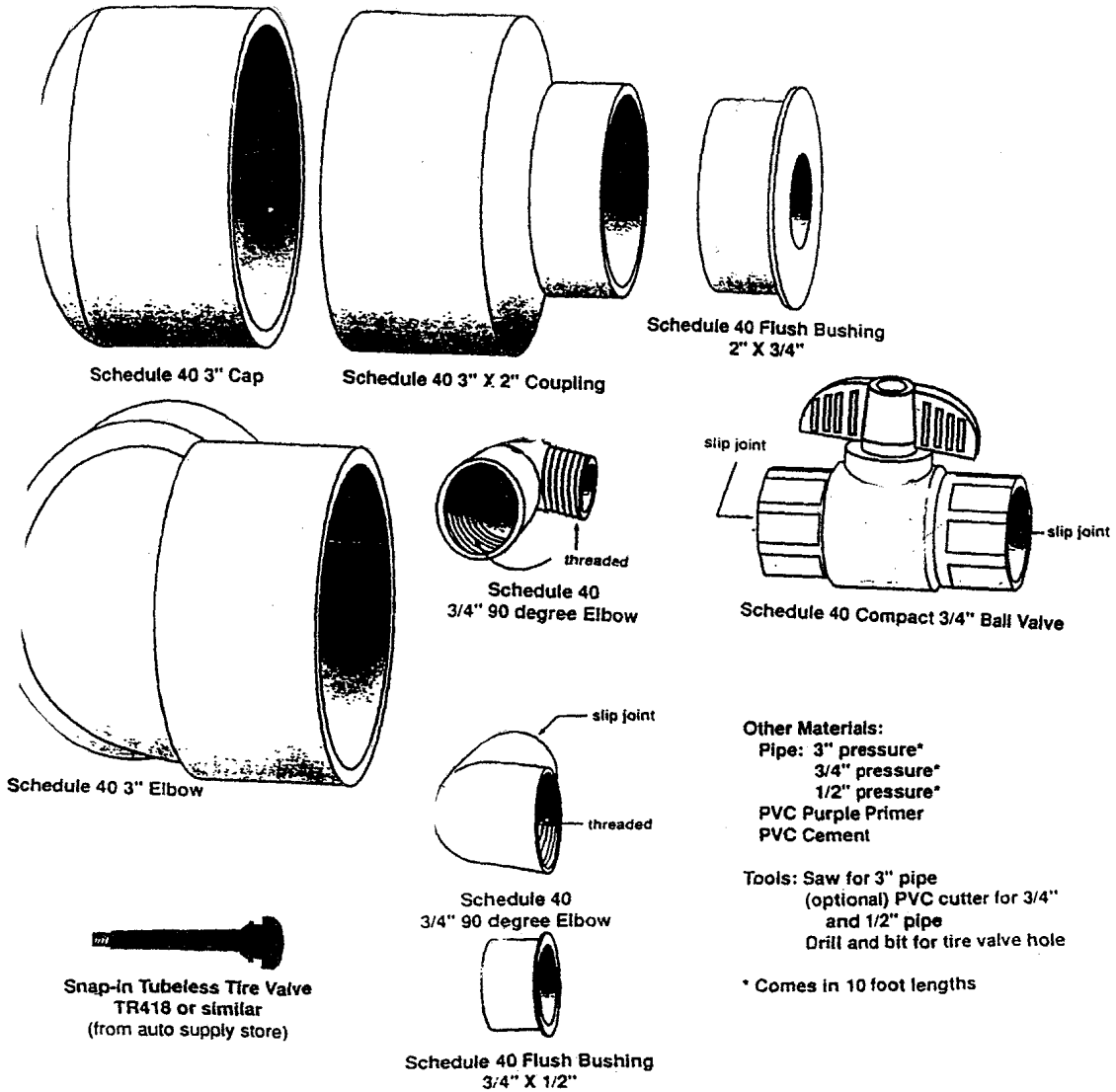
# Air Pressure Launching Design

Uses 3" Elbows to make launcher  
Self-standing



# Air Pressure Rocket Launcher Parts

## Air Pressure Rocket Launcher Parts



## Constructing the Air Pressure Launcher

The air pressure launcher is made from Schedule-40 PVC plumbing parts available from plumbing supply stores. Refer to the diagrams for the specific parts needed. Clerks at the plumbing stores can help select the parts for you from the diagrams. Some hardware stores may pre-cut parts that are needed. **Be sure to get pressure pipes for the PVC tubing.**

Using a saw cut three pieces from the 3" pipe. The pieces should be 17, 6, and 5 inches long. PVC cuts very easily. Remove any burrs from the cut by lightly sanding. Be sure to clean the pipe if it is dirty.

Using drill and bit, drill a hole into center of the 3" end cap. The size of the hole will depend upon the diameter of the tire valve-stem. The hole should be just smaller than the diameter of the rubber stem so that the stem seals itself to the cap when it is pushed through the hole from the inside out.

Join the end cap to the 17-inch long 3" pipe segment. First clean both joining surfaces with **PVC Purple Primer Cleaner**. Make sure you are working in a well-ventilated area away from open flame. When the primer is dry, coat the surfaces with PVC Cement and push the parts together immediately.

***Note:** make sure that when you are cementing parts together that you have them aligned the way you want, as the cement works almost immediately!*

Following the same cementing procedure join one elbow to the other end of the pipe. Next, join the 5-inch long 3" pipe to the elbow. Join the remaining large elbow to the other end of this pipe segment. Be sure that both elbows are aimed in the same direction. The large tubes will serve as the launcher base and the pieces must not be twisted or launcher will rock when it is being used. To ensure proper alignment set the base on the floor before the glue has set and press the second elbow until it is properly aligned.

Cement the 6-inch long 3" pipe to the elbow. Attach the 3" x 2" coupling and the 2" x 3/4" flush bushing with cement to the end of the tube.

Cut two 2" long pieces of 3/4" tube and prepare them for cementing, as above, using **PVC Purple Primer Cleaner**. Join one to the flush bushing on one end and to the valve on the other end. Cement the second tube to the other end of the valve.

Cement the 3/4" elbow (**with outside threads on one end**) to the end of the second small tube. Screw the second elbow on to the first. Do not cement this elbow. It needs to be able to be rotated.

Cement the 3/4" x 1/2" Flushing bushing into the open end of the second elbow.

Cut an 18" long piece of 1/2" pipe and push it into the elbow. It can be cemented if you wish. This is the launch tube.

For extra strength you can wrap the tube with nylon filament tape. This is optional but recommended.

**Tip:** To make it easier to slip rockets on the launch tube use a file or sandpaper to taper the upper end of the launch tube.

## Rocket Construction

Use the directions on the construction sheet for constructing the paper rockets. Have students roll paper around the short lengths of 1/2" PCV tube. The tubes serve as forms for constructing the paper rockets. For best performance the paper should be snug on the form but able to slide easily. Make sure students firmly attach the fins and nose cone for their rockets.

**Note:** *Poorly attached nose cones will blow off the rocket leaving the rocket behind or allowing air to escape when trying to build pressure for launch. Rocket bodies that are made poorly may explode into confetti while on launch pad.*

## Launch Procedures

Follow the instructions for constructing paper rockets. When the rockets are ready follow these instructions for launch:

1. Select a clear area field for launch. Although the rockets are constructed of paper they can still cause injury if they strike someone.
2. Set up the launcher and orient the base so that the launch tube can point straight upward. If the wind is blowing you will want to aim the angle of the tube slightly into the wind.
3. Connect the air compressor or bike pump to the tire valve on the launcher. With the valve closed, pump the launcher up to 30 pounds of pressure. Observe how far the rocket goes and in which direction. Make adjustments to the aiming and pump the launcher to 50 pounds of pressure. Again test fire the rocket and make any final aiming

### **Safety Rules**

Do not pump the launcher up to a pressure greater than half the rate pressure of the weakest part. The PVC pipes and the valve come with pressure ratings. If the lowest rating is 150 psi, do not pressurize the launcher to greater than 75 psi. This provides a significant safety margin.

Be careful in handling the launcher. PVC can crack if dropped or struck with sufficient force. Inspect the launcher before use. Discard a launcher that shows signs of cracking.

Do not lean over the launch rod at any time.

Wear eye protection for launches.