

## Appendix E

### **FOAM ATOM MODEL**

The “atom” is made of about three-quarter inch of foam tubing with a metallic insert or a nonmetallic insert representing the atomic mass and VELCOIN ® on the ends, which represented the bonding properties. One end on each atom was made inert by placing glue on the end, thereby making the end nonbonding. With these variables there are four possible atoms that can be created to represent four elements: heavy-loop, light-loop, heavy-fuzz, and light-fuzz. The inexpensive cost to make the foam atom models and apparatuses was a benefit to the activities.



<b>Heavy - Loop</b>	<b>Light - Loop</b>
<b>Heavy - Fuzz</b>	<b>Light - Fuzz</b>

Figure E3 – Sample of periodic table.

Figure E1 – Foam Atom Parts

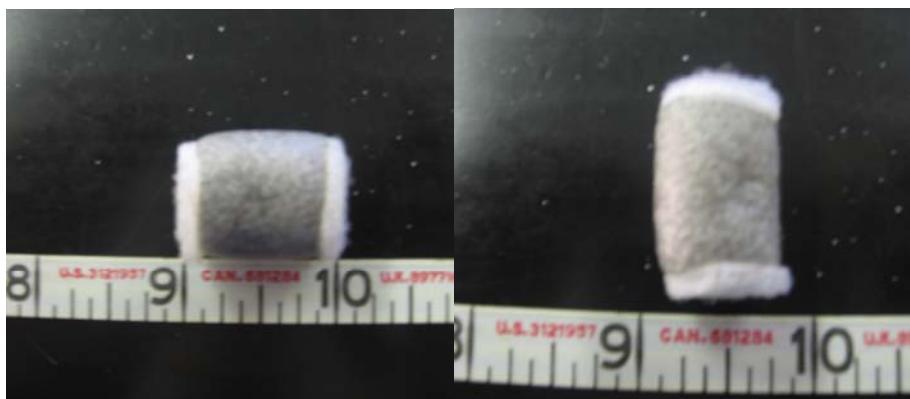


Figure E2 – Foam Atom

## **XANADU UNIDENTIFIED SUBSTANCE GROUP**

Dear Colleagues,

It has come to our attention that they have found an unidentified substance(s) on Planet Xanadu.

We have not been able to determine the safety of the substance and therefore stored it in the safety substance bag. We are requesting your assistance in identifying the substance(s) and determining the associated properties. We have been very impressed with periodic table that you have created for the elements on Earth and request that you provide Xanadu with a similar table for this substance(s). We have taken time to set forth a safety protocol for your scientists to follow.

**Thank you for your expertise,**

*XUSG*

### **Safety Guidelines**

- ❖ Manipulate substances through bag without opening to determine if safe to touch.
- ❖ Manipulate substances with hands inside of bag, but with **NO** visual contact, to determine if substance is safe to be removed from bag.
- ❖ Cautiously observe substances only after they have been deemed safe for touch and visual inspection.

## **ATOMIC FORCE MACROSCOPE**

The “Atomic Force Macroscope” was built by placing felt on the bottom of a copy paper box. A larger version of the “atom” was created and placed in the box so that the Velcro ® ends held the atom in place. A black garbage bag was placed over the box with a probe made of rigid foam stuck through a small hole in the bag. A rubber band secured the bag around the probe.



Figure E4 – Atomic Force Macroscope showing probe and black garbage bag covering the box.



Figure E5 – Bottom of paper box (Atomic Force Macroscope) showing the design pattern attached to the felt.

**XANADU INSTRUMENT TESTING GROUP**

Dear Testers,

Please find that we have shipped ten Atomic Force Macroscopes to your laboratory for verification testing. We have placed a pattern in the bottom of the instrument. Please identify the pattern and send your results as soon as possible.

Thank you in advance,

Xanadu Instrument Testing Group, *XITG*

Identification\_\_\_\_\_

## **MASS SPECTROMETER**

The instrument was built by making a “U” shape out of three-quarter inch PVC pipe with stabilizing pipes being perpendicular to the “U”. Five rubber bands looped together to form a cord and attached to the top of the “U”-shaped piece with a paperclip attached to the opposite end of the rubber band cord and taped to a side of a little cup.

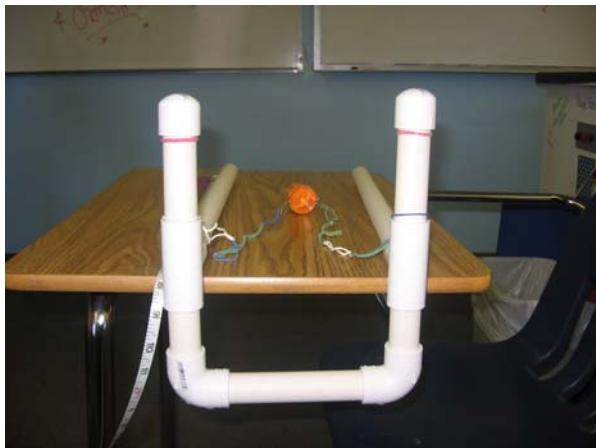


Figure E6 – ‘U’-Shaped Piping



Figure E7 – Stabilizing Pipes



Figure E8 – Cup that holds atom prior to shooting.



Figure E9 – Spectrometer ready to shoot.

## **XANADU ELEMENTAL DISCOVERY UNIT**

Dear Colleagues,

Again we need to request your assistance. There has been several substances that have been discovered recently that are proving to be similar to the ones previously identified by your expertise, however they are not identical. We understand that you have had severe weather that has disconnected your electricity so please utilize your Mass Spectrometer instrumentation and other apparatuses to determine their *apparent* properties. If, by some chance, the electrical power is replaced then we request that more sensitive instrumentation be used to discover any properties that would be helpful to identify these substances in the future.

Thank you for the cooperative effort.

*Xanadu Elemental Discovery Unit (XEDU)*

### **BONDING FOAM ATOM MODEL**

This activity used similar atoms to the Foam Atom Model. Atoms were created that represented the alkali metals (Group 1), alkaline earth metals (Group 2), chalcogens (Group 16), halogens (Group 17). The atoms were modified to have all of the metallic inserts to have the loop end of the VELCOIN ® and all of the glue stick inserts have the fuzz end of the VELCOIN ®. The noble gases all contained the glue stick insert and could have either VELCOIN ® ends because they were made inert by placing glue on the ends. This made a total of five different types of atoms. Most importantly all of the atoms still appeared similar. Each student group was given a different combination of atoms that could create two, three, or four compounds.

**XANADU COMPOUND RESEARCH GROUP**

Dear Esteemed Colleagues,

We would again like to enlist your assistance in a very critical matter. We have several atoms that show bonding properties that we are unable to ascertain. Please help us to describe the bonding properties of the atoms and also supply a list of the compounds that could possibly form from these elements.

Thank you for your expertise.

*XCRG*

## **MATERIALS LIST FOR FOAM ATOM MODEL ACTIVITIES**

### **Foam Atom Model (per atom)**

- 1 5/8" X 3/4" Foam Baker Rod
- 2 5/8" Hook or Loop VELCOIN ®
- 1 3/8" X 3/4" Socket Set Screw or 1 3/8" X 3/4" piece of glue stick\*

\* To alter the weight of the atom adjust the length of the socket set screw and glue stick inserts.

### **Atomic Force Macroscope**

- 1 ream size coy paper box
- 1 black garbage bag (cut open at both ends)
- 1 2' piece of pipe insulation (one end taped closed)  
Furry material to line bottom of paper box

### **Atomic Force Macroscope Atom**

- 1 1-1/2" X 2" Pipe Insulation
- 1 1-1/2" X 1-1/2" square Extra Strength Loop Velcro ®

### **Mass Spectrometer**

- 1 35" piece of 3/4" PVC Pipe divided as follows:
  - 2 7" pieces
  - 2 4-1/2" pieces
  - 2 3" pieces
  - 1 6" piece
- 2 3/4" elbows
- 2 3/4" tees
- 2 3/4" end caps
- 3 large paperclips
- 2 medium paperclips
- 16 medium rubber bands
- 1 small lightweight plastic cup (large enough to hold the atom comfortably)
- 1 Hand-held PVC pipe cutter (recommended for safety reasons – no leftover burring on pipe)