



NUCLEAR REACTION DEMO

MONROE

MOUSETRAP EXPERIMENT

Time Frame:	Standards:
Construction: 4 hours Demonstration: As needed or wanted	Idaho Standard 8-9 PS 2.4.2
Objectives:	
Students will understand the concept of a controlled nuclear decay, and how this decay is controlled.	
Background Information:	
<p>Nuclear fission is the splitting of one atom of a radioactive element into two or more atoms of elements that may, or may not, be radioactive. Many elements are radioactive. Some are naturally occurring but many are synthetic, or man-made.</p> <p>One element that is often used when studying nuclear fission is Uranium-235. The reaction is initiated by bombarding a mass of U-235 with slow moving neutrons. An atom of U-235 may be hit one of these neutrons, and split into two or more daughter elements. This fission process it will also release more neutrons. These neutrons then will collide with more atoms of U-235, and the process continues.</p> <p>If the neutrons are moving too fast they will not cause the U-235 to split, and the reaction will not proceed apace. It is for this reason that a moderator is used. A common moderator is water, which will slow the expelled neutrons enough for them to cause the U-235 to split</p> <p>If too many neutrons are freed, then the reaction will proceed too quickly for civilian purposes. In order for reactions to be slowed enough for safe and controlled power production, control rods are lowered into the radioactive fuel. The control rods absorb neutrons, and will not release them, thereby slowing the reaction to a manageable pace. See http://hyperphysics.phy-astr.gsu.edu/HBASE/nucene/fission.html</p>	
Product Needed:	
<p>A Nuclear Experiment Box and Reactor (NEBR) must be made. Construction is not hard, but it is also not fast. A person making this box needs to be aware of the need and use of the box to insure a working example despite inadvertent alterations of the construction procedures. The objective is to have a working NEBR, and not to follow the directions closely.</p> <p>After completion the NEBR can be used for other things when it is not being used to demonstrate nuclear reactions. If care and cleanliness are used and observed the NEBR can be used as an observation platform, snake containment or rodent cage. If no damage is done, it can always be used to demonstrate nuclear reactions again.</p>	

Energy for Educators

Bringing Energy into the Classroom

MOUSETRAP EXPERIMENT

Procedure of Experiment:

The procedure for this demonstration is quite straightforward. The experiment is set up three times, with a variable changed for each demonstration.

First, the experiment is set up with one ping-pong ball on each mousetrap. The reaction will be self sustaining, and should proceed quite quickly. This demonstration would be an example of a reaction with few neutrons released with each atom's decay.

Second, the experiment is repeated with two ping-pong balls set on each mousetrap. The reaction will be self sustaining, and will proceed at a much faster rate. This demonstration would be an example of a reaction that releases many neutrons with each atom's decay.

Finally, the experiment is concluded by introducing control rods. They will slow or stop the ping pong balls from moving about the chamber. This demonstration will be an example of a nuclear reaction, slowed to that of a nuclear reactor. The control rods used in this variation of the experiment are strips of duct tape.

Construction:

Construction Procedure

1. Cut two 1" x 2" x 8' pieces of lumber into (4) 1" x 2" x 48" sections.
2. Cut two 1" x 2" x 8' pieces of lumber into (8) 1" x 2" x 21" sections.
3. Cut two 1" x 2" x 8' pieces of lumber into (8) 1" x 2" x 22 ½" sections.
4. Using the wood described in sections 1 and 2 above, make two rectangles measuring 24" x 48". The wood should be lying "flat". See diagram number one.
 - a. Using a 1/8" drill bit, drill pilot holes through all contact points, leaving enough wood undisturbed for wood screws to gain traction.
 - b. Place a small dollop of glue on all contact points.
 - c. Carefully, screw all wood together, using the 3" drywall screws. Different wood will react differently. Try not to crack wood, but the screws should tighten. Do not tighten the screws to the point of stripping threads of wood.
 - d. Let the glue dry.
5. Using braces of some sort, stand the 24" x 48" frames upright, and close to 24" apart from each other. See diagram number two.
 - a. Drill another pilot hole, as done above. This will be a bit more challenging, because there is already one hole in the wood.
 - b. Place another dollop of glue on all contact points.
 - c. Carefully, screw all wood together, using 3" drywall screws. Try not to crack wood, and do not tighten to the point of stripping wood threads.
 - d. Let the glue dry.
6. You now have the frame completed. You must decide how you want to be able to gain access to the NEBR. A hinge should be placed at the top of any side that you want to be able to move aside. A hinge can be as easy as duct tape, or as

MOUSETRAP EXPERIMENT

- complicated as a full length piano hinge. The decision is yours, depending upon your needs and specific conditions.
- a. These procedures will continue as if one of the 24" x 48" plastic sections will be on a hinge.
 - b. There are many different kinds of hinges, and many different ways to install them.
 - c. The key is to have a smooth action in movement.
7. Using a plastic drill bit (a drill bit made for plastic and not of plastic) with a diameter of about $\frac{3}{16}$ ", make a hole in the corners of all of the plastic pieces, except that which will be on a hinge.
 8. Place the plastic pieces on the frame. The frame will have to be adjusted somewhat, because it is probably not exactly square. The square plastic pieces will make it squarer.
 9. Screw the plastic pieces on with $\frac{1}{2}$ " utility screws.
 10. If the NEBR is square, drill more holes in the plastic, and add more screws, until you feel that the structure is solid.
 11. Attach your hinged pieces, using hinges or a material of your choosing.
 12. Take the housing, and turn it upside down. Place the 24" x 48" piece of plywood on it (bottom of unit).
 13. Using about 10 – 1" utility screws, secure the floor onto the unit.
 14. Return the unit to an upright position, and make sure it is solid, and the hinges all work correctly.

Mousetraps

1. You are going to need about 150 of them.
 - a. Some people like to glue the mousetraps to the floor of the NEBR.
 - b. Some people like to leave the mousetraps free to bounce around, adding to the energy in the box.
 - c. There are advantages to each, but it should be remembered that if they are not glued down they can be set by people and then put back into the NEBR. This often times saves time.
 - d. "Victor" mousetraps work best. The kinds that have a plastic piece that is supposed to look like cheese are not nearly as effective. Expect a 5% waste rate on mousetraps.

Ping Pong Balls

1. You are going to need twice as many ping pong balls as mousetraps.
 - a. Get them in bulk
 - b. Quality does NOT matter
 - c. You will find yourself using them for other things throughout the year, so buy extra.



NUCLEAR REACTION DEMO

MONROE

MOUSETRAP EXPERIMENT

Trigger

1. The triggering mechanism can be a number of things.
 - a. Some units have been built with a hole in the top, and a ball is dropped in. This can be challenging, because it is hard to get a hole in the plastic without cracking it.
 - b. I have had good luck by cutting a ping pong ball in half, and inserting a small magnet or piece of iron. The ball is taped back together, and held onto the underside of the NEBR with a magnet on the top. When the upper magnet is removed, the ball falls, and the reaction starts.

Materials Needed:

Supplies list

1. Six, 1" x 1 1/2" good quality wood pieces	\$3.00 ea	\$18.00 total
2. Four, 24" x 48" pieces of Plexiglas	\$20.00 ea	\$60.00 total
3. One box 3" utility screws	\$3.00 ea	\$ 3.00 total
4. One box 1" utility screws	\$3.00 ea	\$ 3.00 total
5. Bottle of glue	\$3.00 ea	\$ 3.00 total
6. 24" x 48" piece of wood material	\$5.00 ea	\$ 5.00 total
7. 150 mousetraps	\$0.50 ea	\$75.00 total
8. Ping Pong balls	\$0.20 ea	\$30.00 total

Total for all materials \$197.00 total

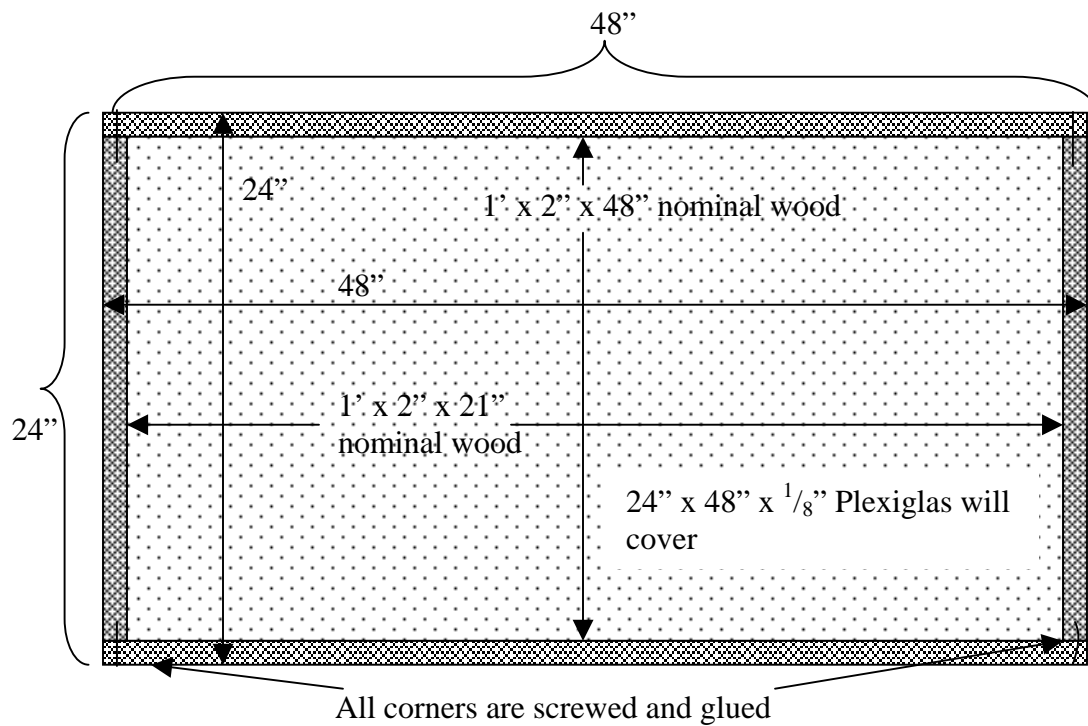
This is a good time to write for a micro-grant, scrounge or scrape things together.

Energy for Educators

Bringing Energy into the Classroom

Construction Diagrams:

Diagram One



MOUSETRAP EXPERIMENT

Diagram Two

