NUCLEAR REACTION DEMO

MONROE

MOUSETRAP EXPERIMENT (FOLDABLE)

Time Frame:	**Standards:**
Construction: 2 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:

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.

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 "catch" one of these neutrons, and become U-236. The U-236 is so radioactive that it will almost immediately split into two smaller elements, and in the process it will also release more neutrons. These neutrons then will attach themselves onto more atoms of U-235, and the process continues.

If the neutrons are moving too fast they will not attach themselves to fissile U-235, 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 be captured by the U-235.

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.

Product Needed:

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.

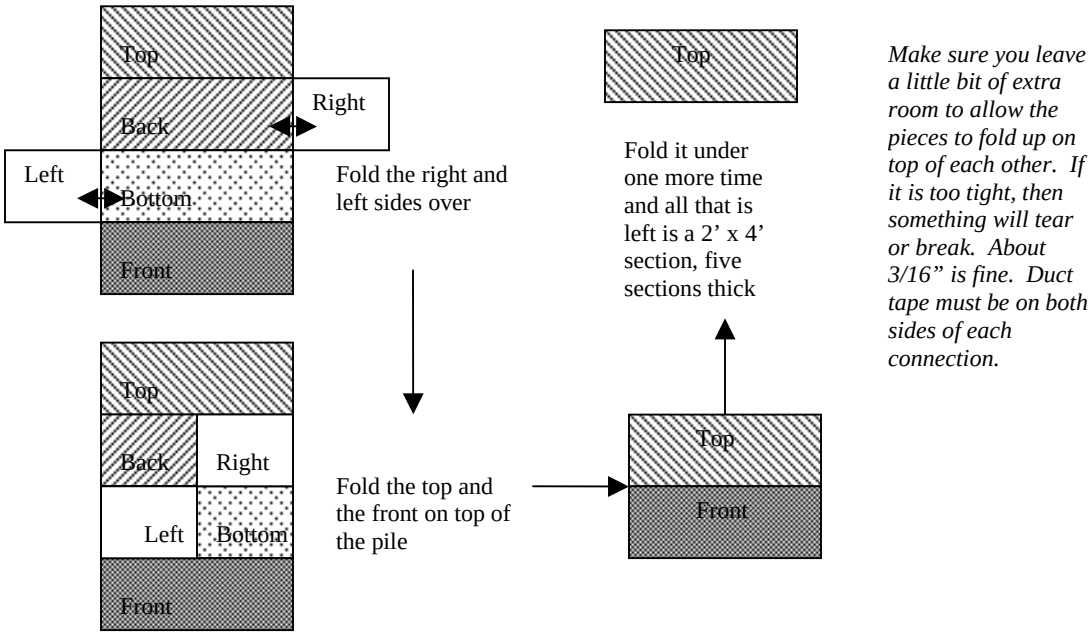
Procedure of Experiment:

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 hanging duct tape.

Construction:

Construction Procedure

1. Cut one of the 2' x 4' sections of 1/8" Plexiglas in half, so that you create 2 panels that each measure 2' x 2'.
2. Lay the Plexiglas on a carpeted or very clean floor, in the following manner. Duct tape them together along the seams, so they fold as follows.



3. Make the NEBR slowly, making test folds as you go along. The connections should be tight, but not stressed.
4. Plexiglas usually comes with a thin, protective covering. Peel it back for the duct tape, but leave the majority on to protect it until you are completed.

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.

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.	Five, 24" x 48" x 1/8" Plexiglas	$20.00 each	$100.00 total
2.	One roll of duct tape	$ 4.00 each	$4.00 total
3.	144 mousetraps	$80.00 gross.	$80.00 total
4.	288 Ping Pong balls	$20.00 gross	$40.00 total

Total for all materials $224.00 total

This total is the amount that one may expected to pay. The amount will vary upon supplier's location and purchase date.

Tricks to learn and know:

1. Go slowly, take some extra time to build the NEBR, and you will be paid back twice in time saved, by not having to make corrections later.
2. When the reaction is being set up, some people like to set the mousetraps up on a 2' x 4' section of waste cardboard, and then place the cardboard in the NEBR.
    a. the mousetraps can be glued to the cardboard, and the NEBR still folds up
    b. more people can set mousetraps, without crowding the NEBR