Instructor: Eve A. Krupka (2003 Science Teacher Workshop participant)
School District: Mount Saint Mary Academy, Watchung
Lesson Title: Nuclear Fission
Grades: 7,8,9,10
Subjects: Physical Science, Chemistry
Overview: When a nucleus of a certain fissionable isotope (U-235 or Pu-239) is hit with a neutron, it may split into two fragments of roughly equal masses. In addition, two or three additional neutrons are knocked out in the process. If other fissionable atoms are present, these too may become split by those neutrons, and the reaction may continue releasing relatively large amounts of energy. As more and more neutrons are released in each collision, more and more nuclei may be split with the corresponding release of energy. This progression is called a chain reaction. The fragments produced by the fission reaction are often unstable radioisotopes of various elements such as Ba-141, and Kr-92.

Objectives:

1. To use magnetic models to demonstrate the fission process
2. To identify the products of the fission reaction by determining the atomic number an the mass number of each resulting nucleus
3. To write a balanced nuclear equation to represent the process

Materials and Resources: Magnetic disks in two different colors representing protons and neutrons, Magnetic chalk board or white board

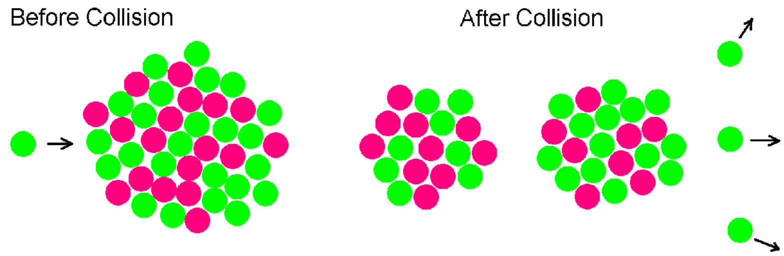
Introduction:

Please include an explanation of how to do the activity or use sample idea. Also include student materials and directions. Sketches are fine if pictures are needed to demonstrate the activity. Also include how a teacher should introduce the lesson, proceed through the lesson and evaluate student progress. Attach additional sheets or materials to this page as necessary. Please tell us if you do not wish to have your name/district placed on the web site by checking the spaces at the bottom of this page, otherwise we will assume placement of your name and photo on the internet is ok.

At the time of this lesson, students should already know that atoms are made up of protons, neutrons, and electrons. They should also know that protons and neutrons are contained in the nucleus, and that it is the number of protons that gives the atom its atomic number and its identity as an element.

To illustrate the fission process, the teacher should put together an atomic nucleus made up of protons and neutrons using magnetic models. Even though real fissionable isotopes contain hundreds of protons and neutrons, for the sake of simplicity, use a much smaller nucleus and pretend that it may be split. The students should count the number of protons and neutrons and identify its atomic number and its mass number as well as its symbol and name using the Periodic Table as a reference. Use a neutron model to “smash” into the “nucleus” on the board and divide it into two smaller parts. Remember to “release” three neutrons in three different directions. The students count the number of protons and neutrons in each fragment to determine each one’s atomic number and its mass number as well as its identity as an element. While demonstrating the process, students record their answers and pertinent information on accompanying worksheet. The teacher demonstrates the use of a nuclear equation to represent the process taking place.

Example:



$$^{1}_{0}n + {}^{42}_{18}Ar \longrightarrow {}^{18}_{10}Ne + {}^{22}_{8}O + 3\,{}^{1}_{0}n$$

Name:__________________________ **Class:**__________________________

Teacher:________________________ **Date:**___________________________

Nuclear Fission

Directions: Fill in the information in the table below as indicated.

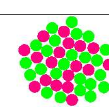
	Particles	Number of Protons	Number of Neutrons	Atomic Number	Mass Number	Symbol	Name of Particle	Diagram
Before Collision	Particle 1							
	Particle 2							

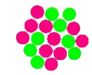
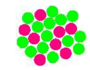
After Collision	Particle 1							
	Particle 2							
	Particle 3							
	Particle 4							
	Particle 5							
Equation								

<u>Nuclear Fission</u>

(Answer Key)

<u>Directions</u>: Fill in the information in the table below as indicated.

	Particles	Number of Protons	Number of Neutrons	Atomic Number	Mass Number	Symbol	Name of Particle	Diagram
Before Collision	Particle 1	0	1	0	1	n	Neutron	
	Particle 2	18	24	18	42	Ar	Argon	

After Collision	Particle 1	10	8	10	18	Ne	Neon	
	Particle 2	8	14	8	22	O	Oxygen	
	Particle 3	0	1	0	1	n	Neutron	
	Particle 4	o	1	0	1	n	Neutron	
	Particle 5	0	1	0	1	n	Neutron	
Equation	$^{1}_{0}n + ^{42}_{18}Ar \rightarrow ^{18}_{10}Ne + ^{22}_{8}O + ^{1}_{0}n + ^{1}_{0}n + ^{1}_{0}n$							