Activity #1

Fusion: Why Can't We Just Get Together?

Fission: Breaking Up is Hard to Do

Questions:
Motivation for Learning

What is the difference between fission and fusion? What type of reaction is currently used in nuclear power plants? What type of reaction is used by a star? Are all nuclear reactions dangerous?

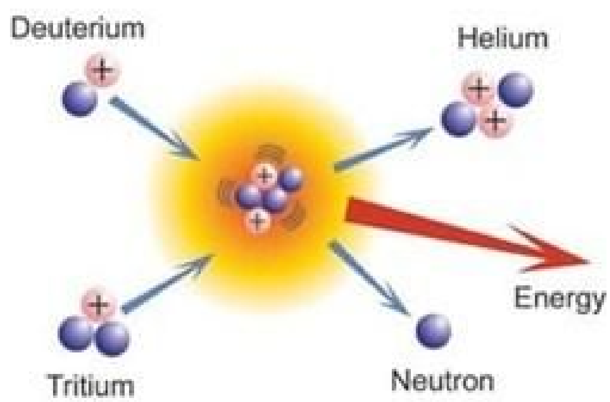
Objectives: Students will

visualize the process of nuclear fusion;
visualize the process of nuclear fission;
identify the products of fusion and fission;
relate nuclear reactions to the Law of Conservation of Matter and Energy.

Background Information

Fusion

Fusion is the joining of two light nuclei to produce a heavier one. Fusion is the process that powers the sun and the stars. To make fusion occur, the atoms must be heated to very high temperatures to have sufficient energy to fuse. Scientists are trying to develop practical ways to use fusion for electric power generation. If successful, the energy source would be environmentally friendly, producing no combustion products or greenhouse gases. While fusion is a nuclear process, the main products of the fusion reaction (helium and a neutron) are not radioactive.



Materials

Chocolate flavored cereal puffs

Corn flavored cereal puffs

Small paper cups to hold cereal

Paper plates to place cereal pieces on during fusion/fission process

Procedure

Fusion Model

1. Take 2 protons (chocolate puffs), and bring them together. In the process of fusing, one proton decays into a neutron and gives off energy.

2. Take 1 proton away and change it into a neutron and energy by eating the chocolate puff (energy for you!) and placing a corn puff neutron next to the chocolate puff proton. This is an isotope of hydrogen called deuterium.

3. Make another atom of deuterium by the fusion process in step 1.

Each deuterium nucleus now fuses with another proton (add a chocolate puff to each nuclei). The result is an isotope of Helium called He-3.

4. Now fuse the two He-3 nuclei together (you should have 4 protons and 2 neutrons in your model). This is beryllium-6, but it is unstable and disintegrates into two individual protons and a He-4 nucleus which has 2 protons and 2 neutrons and is known as an alpha particle (represented by the Greek letter alpha: α). Energy in the form of gamma rays (represented by the Greek letter gamma: γ) is also given off in the process.

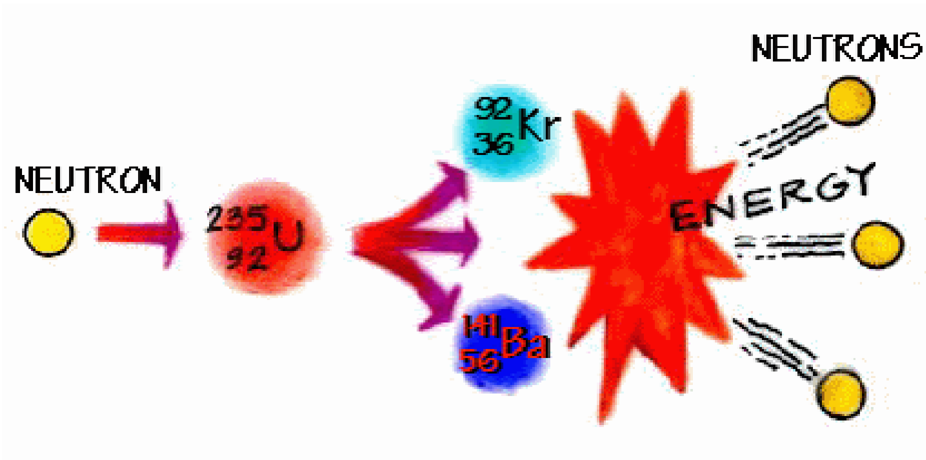
5. See if you can demonstrate the whole fusion process to your lab partner(s).

6. Demonstrate to your teacher that you can model this fusion process then have your teacher stamp or initial your Assessment page.

Background Information

Fission

Isotopes of elements having atomic numbers greater than 80 are capable of undergoing fission. In nuclear fission, the nucleus splits apart generating enormous amounts of energy. When uranium 235 absorbs a neutron, fission can occur and it breaks apart to produce two smaller nuclei, several neutrons, and a great amount of energy. A chain reaction is produced as fission continues and the neutrons emitted bombard more uranium 235 nuclei. Fission is utilized in nuclear power plants and weapons.



Procedure

Fission Model

1. Begin by making a model of a Uranium-235 nucleus. You will need 92 protons (chocolate puffs) and 143 neutrons (corn puffs). Compare the size of this nucleus to the size of the nuclei used in the fusion process. Only very large atoms are able to undergo fission.

2. Take an additional neutron and allow it to be absorbed by the U-235 nucleus. Now the nucleus will split apart. The result of this fission is Krypton-92 and Barium-141and 3 neutrons and lots of energy.

3. Split your U-235 into a nucleus with 36 protons and 56 neutrons to form the Kr-92 and a nucleus with 56 protons and 85 neutrons to form the Ba-141. You should have 3 neutrons left. In a nuclear reaction, the remaining 3 neutrons would trigger 3 more fission events, setting off a chain reaction.

1. Demonstrate to your teacher that you can model this fission process then have your teacher stamp or initial your Assessment page.

Chemistry | **Name** ______________________________
Assessment | **Per** ____ **Date** ___________________
Activity #1

Fusion model
Teacher:

Fission model
Teacher:

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Assessment:

1. Write out a step by step explanation of the process of **fission**.

2. Write out a step by step explanation of the process of **fusion**.

3. What are the products of the fission of U-235?

4. Where does **fusion** naturally occur?

5. Where does the energy that is released come from in a nuclear reaction?

6. How does the Law of Conservation of Matter and Energy apply to nuclear reactions?