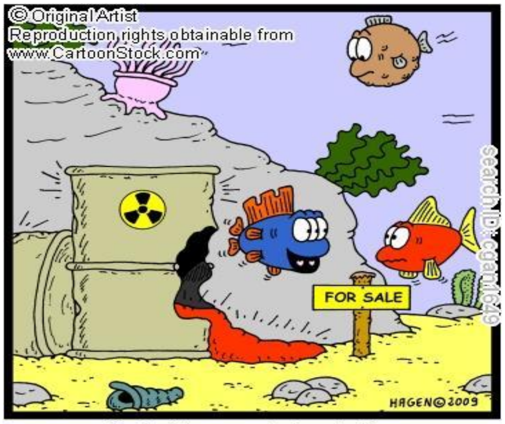

Yeah, it's a great place to live:
Nice and hot the whole year round...

Lab – Half–life of Pennium

Objective- the student will understand radiation of a radioisotope.
Procedure-

<u>Part A collect data</u>

1. Count all of your Pennium atoms and record the number on data table.
2. Put all the pennies back into the cup and gently shake for 10 seconds. Assume each decay process takes this same amount of time, **so keep adding on this number of seconds to the last time in the table.**
3. Dump all the atoms out of the bag onto the box lid.
4. Count the number of Pennium atoms with the **<u>head-side facing up</u>**<u>; record these as</u> **<u>decayed</u>** <u>atoms.</u>
5. Return only the Pennium atoms with the **<u>tails up (Undecayed)</u>** to the cup. Put the decayed atoms <u>aside into the bag</u>. <u>Record the # of Undecayed atoms on the data table</u>.
6. Gently shake the cup for 10 seconds.
7. Repeat steps 3 – 6 until all the atoms have decayed.

Half-life	Total Time	# of Undecayed atoms	# of decayed atoms
0	0	50	0
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			

Part B Graph data

1. Graph your data. Place the time on the X-axis and the number of Undecayed atoms on the Y-axis.
2. Be sure to label the X and Y-axis. Give your graph a title. Use the entire graph. Draw a smooth line of best-fit curve through the points.

Part C Summary Questions: Answer AFTER you finish your graph.

1. Define half-life.

2. What is the half-life of Pennium in your experiment?

3. Define fission: ____

4. Define fusion: ____

Part D Concept overview:

Fill in the missing radioactive particle and place the proper decay symbol over the arrow.

1. ${}^{69}_{31}Ga \longrightarrow {}^{69}_{31}Ga +$

2. ${}^{69}_{31}Ga \longrightarrow {}^{65}_{29}Cu +$

3. ${}^{69}_{31}Ga \longrightarrow {}^{69}_{32}Ge +$

4. ${}^{12}_{5}B \longrightarrow {}^{12}_{6}C +$

5. ${}^{204}_{82}Pb \longrightarrow {}^{200}_{80}Hg +$

Fill in the blank spaces with the correct radioactive particle first, then the correct isotope.

6. ${}^{241}_{95}Am \xrightarrow{a}$ ________ + ________

7. ${}^{211}_{87}Fr \xrightarrow{a}$ ________ + ________

8. ${}^{19}_{8}O \xrightarrow{b-}$ ________ + ________

9. Alpha rays can be stopped by ______
A) several millimeters of aluminum.
B) air only.
C) a piece of paper.
D) several centimeters of lead.

10. Beta rays can be stopped by ______
A) several centimeters of lead.
B) air only.
C) a piece of paper.
D) several millimeters of aluminum.

11. Gamma rays can be stopped by ______
A) a piece of paper.
B) several millimeters of aluminum.
C) several centimeters of lead.
D) air only.

12. An α particle is also known as ______
A) an electron.
B) a photon.
C.) a positron.
D) a helium nucleus.

13. During [illegible] decay __________
A) a neutron is ejected from the nucleus.
B) a neutron is transformed to a proton.
C) a proton is transformed to a neutron.
D) a proton is ejected from the nucleus.

14. A β^- particle is also known as ___
A) an electron.
B) a helium nucleus.
C) a positron.
D) a photon.

15. Alpha particles have an atomic mass equal to ________
A) 2.
B) 1.
C) 4.
D) 6.

16. An element with atomic number 6 undergoes [illegible] decay. Its atomic number is now _________
A.) 6. C.) 5.
B.) 2. D.) 7.

Part E: Fission Vs Fusion - Nuclear Weapons

Fission, simply put, is a nuclear reaction in which an atomic nucleus splits into fragments, usually two fragments of comparable mass, emitting 100 million to several hundred million volts of energy. This energy is expelled explosively and violently in the atomic bomb. A fusion reaction is usually started with a fission reaction, but unlike the fission (atomic) bomb, the **fusion** (hydrogen) bomb derives its power from the fusing of nuclei of various hydrogen isotopes into helium nuclei.
The massive power behind the reaction in an atomic bomb arises from the forces that hold the atom together. These forces are akin to, but not quite the same as, magnetism.

There are two main types of nuclear weapons: atomic bombs, which are powered by **fission reactions** similar to those in nuclear reactors [power plants], and hydrogen bombs, which derive their explosive power from **fusion reactions**.

An **atomic bomb** slams together two pieces of fissionable material, usually uranium-235 or plutonium-239, creating **critical mass**. This releases its energy instantaneously as atoms inside it split in an uncontrolled **chain reaction**. In this chain reaction, "some of the neutrons produced react with other fissionable atoms, producing more neutrons which react with still more fissionable atoms"
On August 6, 1945, an atomic bomb called Little Boy was dropped on the Japanese City of Hiroshima, followed three days later by another, called Fat Man, on Nagasaki.

Fusion is when two nuclei combine in order to create a nucleus with a greater mass then the two nuclei. An example of this fusion would be the sun's energy that is released.
Hydrogen bombs fuse together hydrogen atoms to form heavier helium atoms, releasing far more energy than a fission bomb. Two **isotopes** of hydrogen are used – deuterium (2 neutrons) and tritium (3 neutrons). Hydrogen bombs have never been used in war and are thousands of times more powerful than atomic bombs.

Directions: Identify each as a **fusion** , **fission** , or **both** kinds of reactions:

1. Used in nuclear power plants: ________________

2. Occurs on the sun: ___________________________________

3. More power per gram: _______________________

4. Release energy by converting mass to energy ________________________________

5. A larger nucleus divides to make a smaller nucleus: ______________________________________

6. Two hydrogen atoms fuse to make a helium atom: ___________________________

7. A critical mass is necessary to explode: _____________________________

8. An atomic bomb: ________________________________