Lesson Plan Karen Davis

PAN 2013

Lesson Objectives:

1)Students will understand that there are fundamental particles that make up protons and neutrons and be able to name them.

2)Students will be able to name the specific particles that make up protons and neutrons and perform both mass and charge balances.

3) Students will be able to identify the three types of radioactive decay: alpha, beta minus, and gamma and write balanced chemical equations that balance the number of protons and neutrons for these three types.

Standards Addressed:

Next Gen Standards

HS-PS1-8. **Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay. [Clarification Statement: Emphasis is on simple qualitative models, such as pictures or diagrams, and on the scale of energy released in nuclear processes relative to other kinds of transformations.] [Assessment Boundary: Assessment does not include quantitative calculation of energy released. Assessment is limited to alpha, beta, and gamma radioactive decays.]**

New AP physics 2 (2014 curriculum)

Essential Knowledge 1.A.2: Fundamental particles have no internal structure.
Essential Knowledge 1.A.3: Nuclei have internal structures that determine their properties.
Essential Knowledge 1.A.4: Atoms have internal structures that determine their properties.
Essential Knowledge 1.A.5: Systems have properties determined by the properties and interactions of their constituent atomic and molecular substructures. In AP Physics, when the properties of the constituent parts are not important in modeling the behavior of the macroscopic system, the system itself may be referred to as an *object*.

Essential Knowledge 3.G.3: The strong force is exerted at nuclear scales and dominates the interactions

of nucleons.

Essential Knowledge 4.C.4: Mass can be converted into energy and energy can be converted into mass.

Essential Knowledge 5.C.1: Electric charge is conserved in nuclear and elementary particle reactions, even when elementary particles are produced or destroyed. Examples should include equations representing nuclear decay.

Essential Knowledge 5.G.1: The possible nuclear reactions are constrained by the law of conservation of nucleon number.

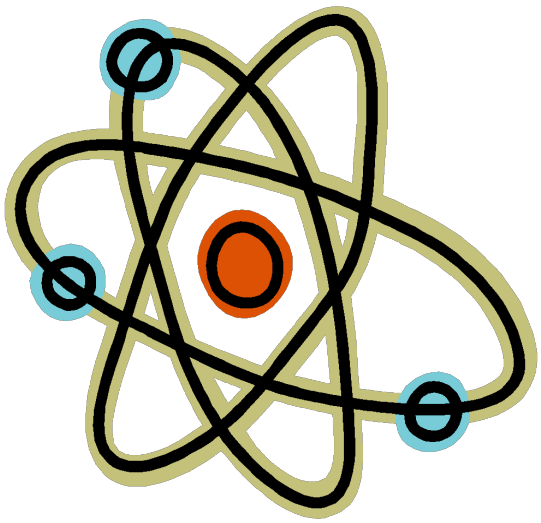
Materials: Computers, internet access, worksheets, magnetic marbles.

Lesson Activities:

1. Website Activity- use website http://particleadventure.org/
Students will fill in the attached worksheet as they go through the website.

2. Alpha, Beta minus, Gamma decay. Students will need to use the textbook to find example equations of these decay types and complete a few examples.

3. Formative Assessment- Students will complete the attached quiz on the topics.



Fundamental Particles Website Investigation Name_____

AP Physics Davis

1. Go to the website http://particleadventure.org

2. Click on the “Standard Model” Then click on the left side of the screen under the standard model and go through the “What is fundamental” topics one at a time. Find the answers to these questions as you go.

2A) Are protons and neutrons the smallest particles in the atom? If not, what are the fundamental particles in the Standard Model and how many of each type are there?

2B) How much of an atom is empty space?

2C) What is a hadron? Look in the glossary or search the site for this if needed.

2D)Take the quiz at the end of this section. When did scientists find out about these fundamental particles?

3. Now go to the “What is the World Made Of? Link and go through the topics. We will not do all of them. Start with the “Quarks” tab. What are the names and the pairings of the six quarks? How did they get their names?

3A) Now find out what baryons and mesons are. Define it here.

3B) Take the quiz at the end of this section. What quarks make up protons, neutrons and electrons?

4. Now click on the “What holds it all together” link on the left side. Find the answers to these questions:

4A) What are the four fundamental interactions between particles?

4B) What force holds a nucleus together with nothing but positive protons and neutral neutrons in it?

4C) What is a gluon? Why is it named that?

4D) What is a fermion and a boson?

5. Now go the the “Particle Decays and Annihilations” link on the left. Find the answers to these questions.

5A) What is decay?

5B) What is an alpha particle, a beta particle, and gamma radiation?

5C) Look up in your textbook example equations for alpha, beta minus, and gamma decay. Write an example of each type below. Notice how the number of protons and neutrons balance on both sides of the equation.

6. Complete the attached worksheet on radioactive decay.

Quiz on Fundamental Particles

Name_____

AP Physics Davis

1. List the 6 types of quarks.

2. What is a proton made of?

3. What is a neutron made of?

4. What is the force that holds the nucleus together?

5. $^{238}_{92}U$ undergoes alpha decay, write the equation for this process below.

6. $^{234}_{\quad}Th$ undergoes Beta minus decay. Use your periodic table to complete the equation for this process.

7. Write the equation for the gamma decay of $_{56}Ba^{137}$?