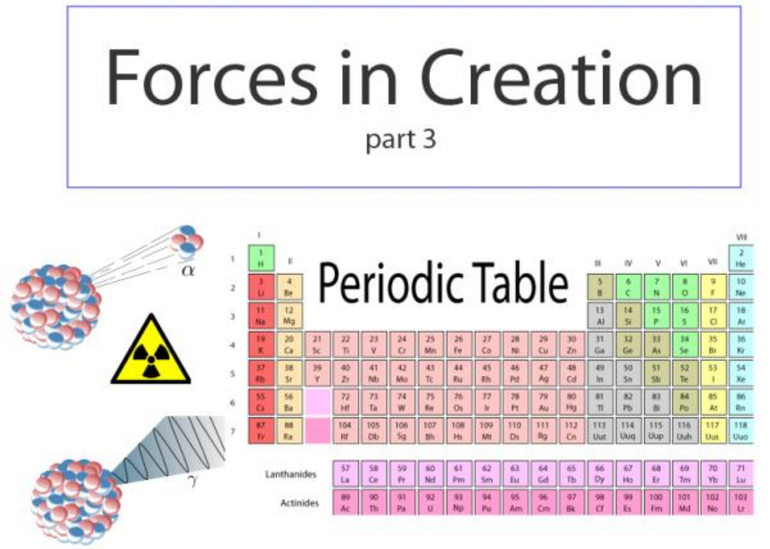
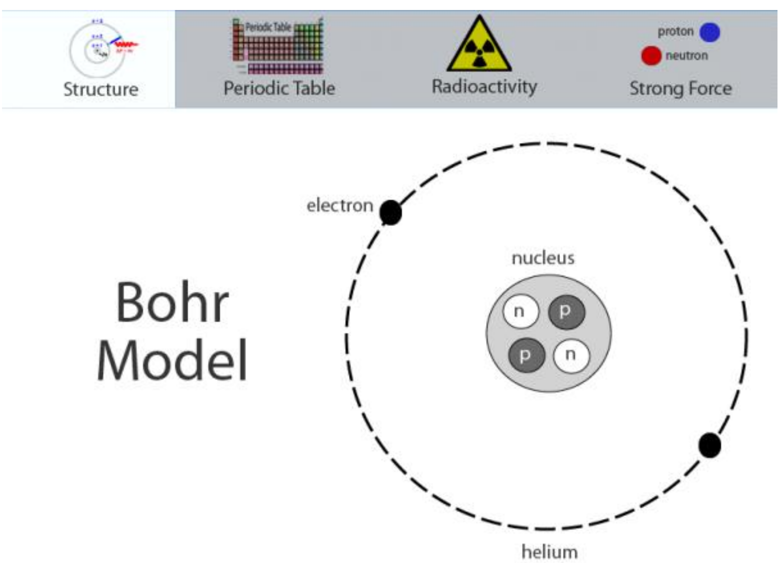
M13 Remake

Monday, March 21, 2011
2:25 PM

VoiceThread	http://voicethread.com/share/1862080/

<table>
<tr><th>Slide</th><th>Notes</th></tr>
<tr><td>
</td><td>n01 Title

In the past two modules, you learned about the gravitational force and the electromagnetic force.

Now it is time to learn about the other two forces in Creation, the weak force and the strong force.</td></tr>
<tr><td>
</td><td>n02 Structure of the Atom

In module 1 we talked about the structure of the atom, now we are going to get a little more detail. Our theories come from indirect observation because we cannot actually see them.

The Bohr Model of the atom isn't very accurate to what we now believe, but it is useful for understanding at this level. When you get to chemistry, you will learn more about the quantum-mechanical model of the atom.

The atom is made up of three smaller particles: protons, neutrons, and electrons. The electron is extremely tiny and nearly has no mass at all by comparison. It orbits the nucleus and has a negative charge. Inside the nucleus are the protons and neutrons. The neutron is only slightly heavier than the proton. The proton has a positive charge.

In the Bohr model, the electrons orbit the nucleus because their negative charge is attracted to the positive charge of the proton. Centripetal force of the orbit keeps it from falling to the center.

This isn't drawn to scale because the electron would end up so small that you couldn't see it, much like a marble would be as a nucleus and 1.5 miles away you would have the electrons in their orbit. That also demonstrates that it all is mostly nothing - empty space.

The center of an atom, containing the proton and neutrons — nucleus</td></tr>
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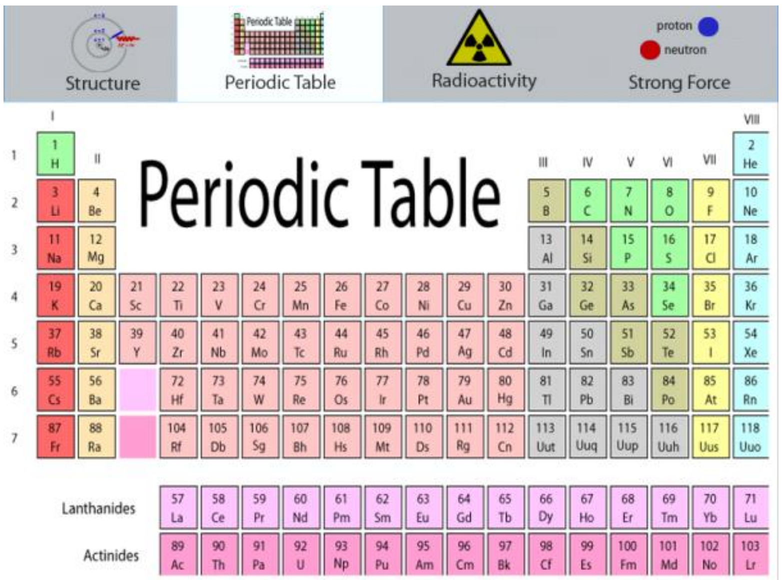
Which is larger ...

Choose one answer.

- (•) a. a proton
- ( ) b. an electron

n03 Periodic Table



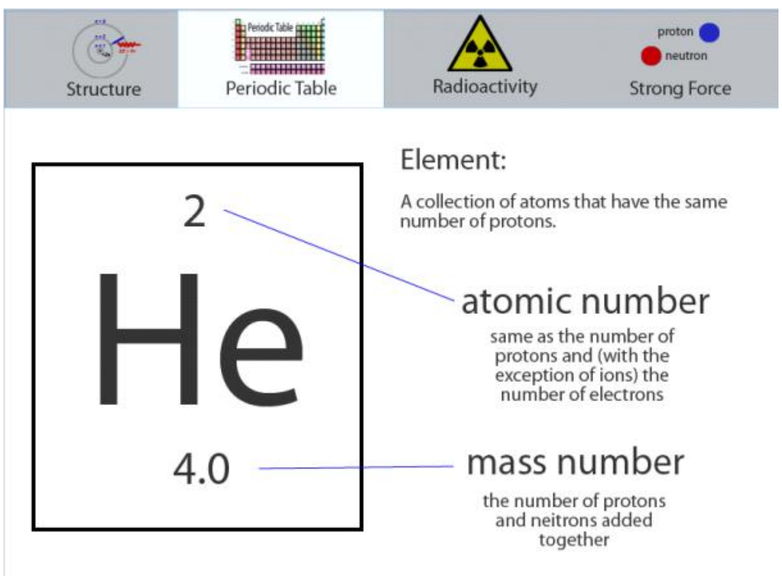
A periodic table is a way to organize the elements based upon their properties.

Hydrogen is the simplest of all the elements and you will find it listed as the first one.

All those letters are the element symbols. Most of the time they are the first letter or two of the elements name. Some of those names are Latin names which complicates things such as potassium once being called kalium so its symbol is a K instead of a P. There is a P on the table though. That is phosphorous.

Notice that only the first letters are capitalized.

n04 Chart Details



The definition of an element is a collection of atoms that all have the same number of protons.

The number at the top of each box on the periodic table shows what the atomic number is. It holds information as to how many protons and electrons the element has.

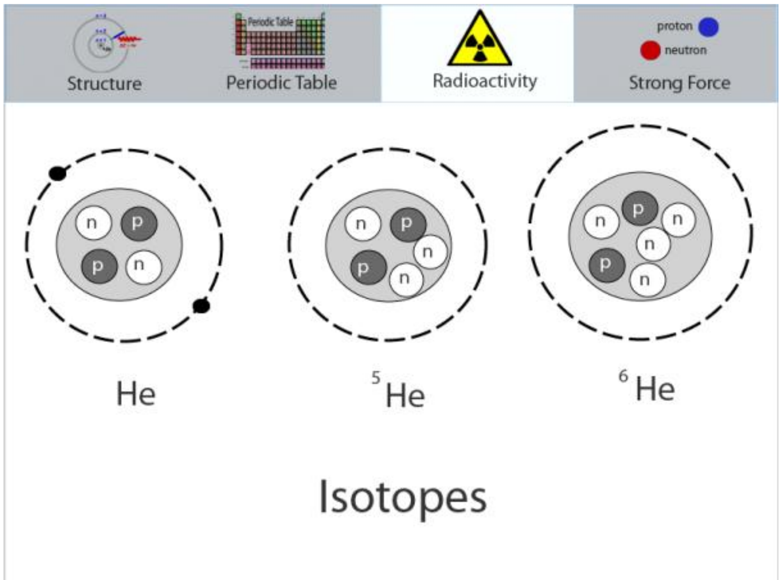
The number at the bottom is the atomic mass. It is an average of how heavy the element is when you add the proton and neutron's masses together.

The number of the electrons determines most of the properties that the element will have.

The letters in the middle are the symbols for the element's name. This one is helium.

A collection of atoms that all have the same number of protons.	element
The sum of the number of neutrons and protons in the nucleus of an atom.	atomic mass
The number of protons in an atom.	atomic number

n05 Isotopes



To be ready for a discussion about what radiation is, we need to understand what an isotope is first.

When you look on a periodic table, you are seeing an average for the atomic mass, than number there at the bottom of the squares. Most of the elements have the same mass, but a few are too heavy or too light due to having too many or too few neutrons.

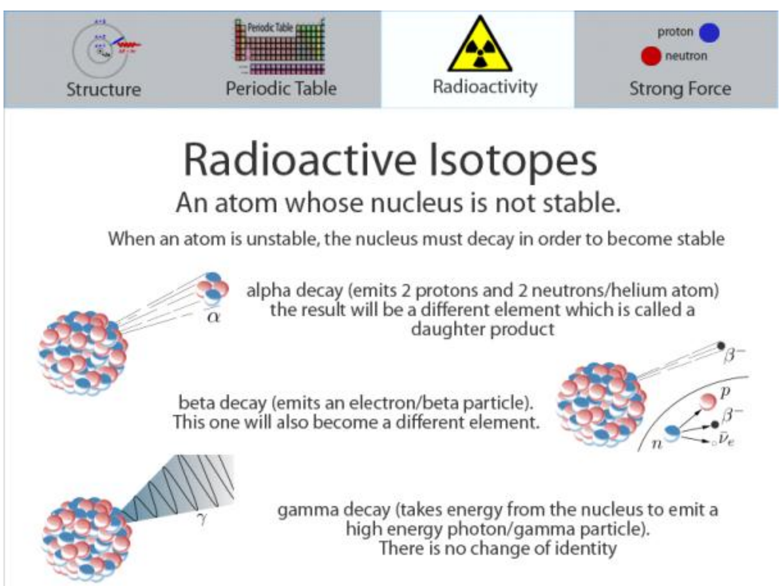
Let's take a look at how we will show the difference. The first helium listed here is a normal one. What would its atomic mass be? (2 protons + 2 neutrons = 4 amu) Four is what the periodic table says we should have (go back a slide, if needed, to show that). But look at the second one. It has an extra neutron making it weight 5 instead of 4. To be able to give this a label as an isotope of helium we would write it as ^{5}He or as He-5. In the last one, it has 6 neutrons, so it would be He-6 or ^{6}He. You can always verify these by looking at a periodic table. If the number is not the same as the number at the bottom of the periodic table, you have an isotope.

Matching:

:

144 - Nd	isotope
144 - Ce	not an isotope
145 - Nd	isotope
144 - Sm	not an isotope

Two or more atoms that all have the same number of protons but a different number of neutrons.	isotope



n06 Radioactive Isotopes

The definition of a radioactive isotope is an atom whose nucleus is not stable.

When an atom is unstable, the nucleus must decay in order to become stable. This process is called radioactive decay and it can be in several different forms:

Alpha, beta and gamma

An atom whose nucleus is not stable.	radioactive isotope

If a piece of paper is placed between a radioactive isotope and a person, which kind of radioactive particle will the person be protected from?

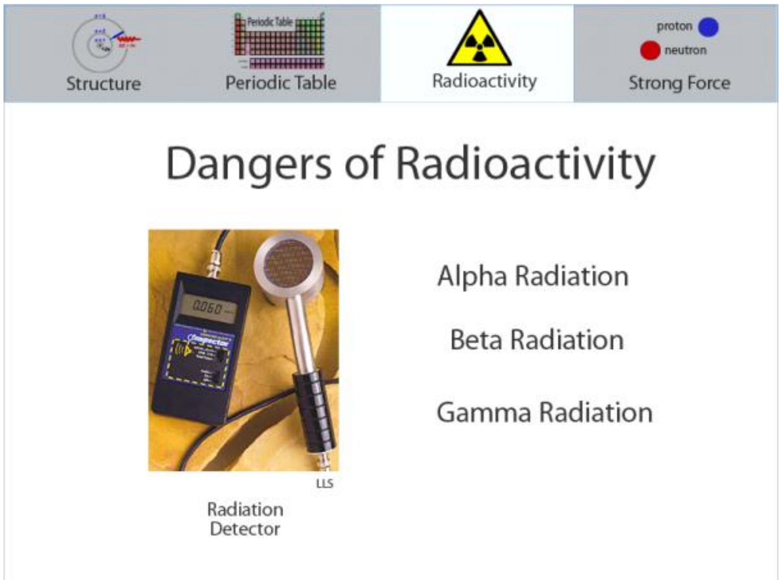
Choose one answer.
- a. gamma
- b. alpha (selected)
- c. beta

Matching:

Daughter product of alpha decay of 220 - Rn.	216 - Po
Daughter product of gamma decay of 239 - U.	239 - U
Daughter product of beta decay of 144-Ce.	144 - Pr

A radioactive isotope has a half-life of 3.0 hours. If a scientist has 30 grams of the isotope, how much is left after 15 hours?

0.9373 g



n07 Dangers of Radioactivity

Radioactivity can be dangerous, but it isn't always dangerous. Radiation is all around us everyday. Even a person next to you gives off a small amount of radiation.

Radiation isn't like a poison. It isn't a chemical reaction kind of thing. The danger comes in from the particles that are emitted. They are sort of like tiny machine guns and the particles are like bullets that can damage living cells. Most of the time if the bullet collides with a cell, the cell will be destroyed or on occasion it will hit the DNA and cause damage to the information coding for the cell.

Now, your body expects some cell death from all sorts of reasons, so a small number of cell deaths due to radiation isn't a problem. If the cells are getting killed off too fast from higher levels of radiation then you have a problem because the body cannot replace them fast enough. Or, if the genetic coding gets scrambled, you could get longer term problems because the cell will not be following the correct instructions and you could end up with messed up protein structures, missing proteins, or tumors.

Alpha particles are pretty weak. You can actually stop them with a piece of paper. Beta will take a thin sheet of metal. Gamma will take several inches of lead. These methods are called shielding.

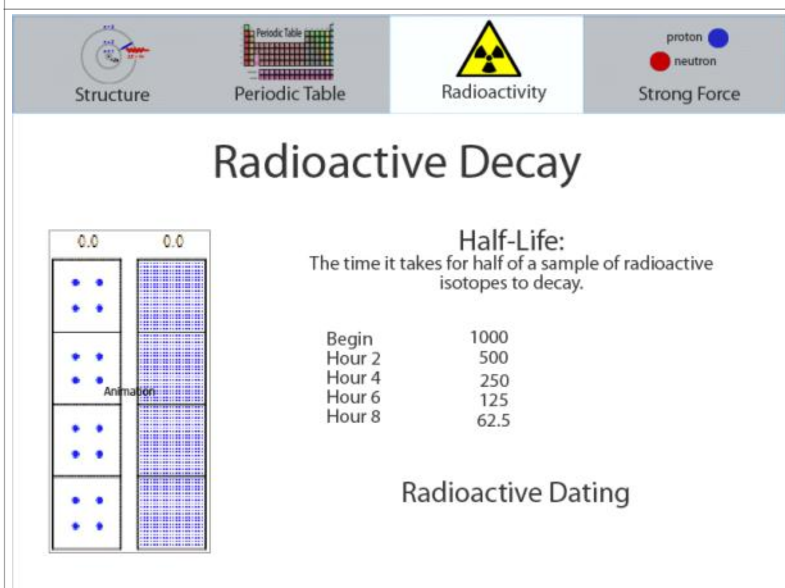
What causes the strong nuclear force, and why can this force act only over a short distance?

Answer:

The strong nuclear force is caused by the exchange of pions. These can only exist for a very short time.

If a piece of paper is placed between a radioactive isotope and a person, which kind of radioactive particle will the person be protected from?

Choose one answer.
- ○ a. gamma
- ◉ b. alpha
- ○ c. beta



n08 Radioactive Decay

Most radioactive isotopes only shoot one 'bullet' and then it is stable. However, in even a small sample of radioactive isotopes there may be trillions of atoms. Eventually that sample will become largely stable but different isotopes will take different amounts of time to stabalize. Some will stabablize in less than a second, others take billions of years.

Half-life:
The time it takes for half of a sample of radioactive isotopes to decay.

[let the students work on what the half life would be in the half life time list on the slide - there is a moveable white cover that you can move down as they work it out.]

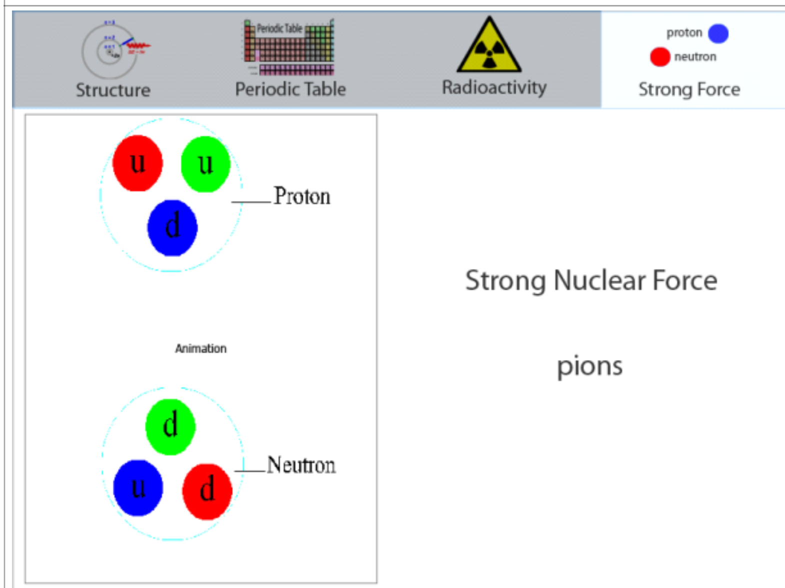
Radioactive Dating:
Dating objects based on how much of an isotope is left. Carbon-14 is the most well known one.

All living organisms contain some carbon-14. They constantly exchange this with their environment so that the levels are about the same as what the environment would contain during the organism's lifetime.

When the organism dies, the exchange stops and the levels begin to drop in the remains. With this method, scientists must make an assumption about how much carbon-14 there was in the organism's living environment. In C-14 dating, scientists assume that the amount of C-14 in our modern environment is the same as it has always been.

Scientists that study tree rings have measured the C-14 in the tree rings of trees about 3,000 years old and have found that the C-14 has varied by up to 70% of what we have now. Carbon dating beyond the known range of the tree rings is completely a shot in the dark then.

Daughter product of alpha decay of 220 - Rn.	216 - Po
Daughter product of gamma decay of 239 - U.	239 - U
Daughter product of beta decay of 144-Ce.	144 - Pr



n09 Strong Force

Has anything started to bother you about the idea that a lot of protons are all together in the nucleus? Shouldn't the positive charge make the proton spread apart?

This has puzzled physicists too. So they think that there must be some force inside the nucleus holding it together. It is short range and only work when protons and neutrons are very close to each other. This is the strong nuclear force.

In 1935 Hideki Yukawa proposed this force and said that the protons and the neutrons exchange tiny particles with each other called pions. He even estimated their mass. In 1947 the particles were found by experiment. He was awarded the Nobel Prize.

Pions are very short-lived and come from the mass of protons and neutrons.

{NOTE: I had designed the slide to include an animation here, but for some reason Elluminate said that the gif wasn't the right file type. Here is a link so that the students can still see it - http://upload.wikimedia.org/wikipedia/commons/3/35/Nuclear_Force_anim_smaller.gif