



High Touch High Tech[®]

Science Experiences That Come To You

Einstein's Theory!

Ingredients & Supplies:

- 2 balloons
- Wooden skewer
- Jar of Vaseline
- Paper towel
- Garbage bag

Instructions:

In this experiment, you can demonstrate making electricity with nuclear energy. First, you need a balloon, a wooden skewer, a jar of Vaseline, and an adult to help you.

Blow up the balloon. (Don't tie it.) Slowly let the air out. Let the escaping air make a funny noise. This process is like how we make electricity with nuclear energy. The energy is released slowly like the air coming out of the balloon.

Famous Scientist, Albert Einstein, said if the energy comes out all at once it is the power of an atomic bomb. To demonstrate this, blow up the balloon and tie a knot. Carefully use a skewer and stick it into the balloon. It pops! The popping noise comes from the skewer making a hole in the balloon and all the air bursting out of the balloon at the same time. (*Ask an adult for help with the skewer.*)

Now, blow up the second balloon and tie a knot. Take your wooden skewer and dip it into the Vaseline. Slowly and carefully stick the skewer into the bottom of the balloon.

The skewer should pierce the skin of the balloon, and the Vaseline should clog up the hole so only a very small amount of air will come out. The air coming out is like the energy being released, slowly. If your balloon popped, the sudden rushing out of air, created a much louder more dramatic, and less controlled release of energy.

You just proved Einstein's theory! People refer to this as sustainable energy. We always have more of it. Unlike fossil fuels where there is a very limited amount.



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The Science Behind It:

Albert Einstein...have you heard of him? Well, he is probably the most famous scientist in history! Einstein was a great physicist and worked on many theories and projects relating to the Earth, Universe and most of all, Energy. He produced the well known equation $E = mc^2$.

In this experiment, you learned what this equation means and have proven Einstein's theory! Let's get some background on energy and how it is produced.

One of our largest resources for energy is *fossil fuels*. Fossil fuels are the remains of prehistoric life, such as dinosaurs! Coal, petroleum (oil), and natural gas are all examples of natural energy resources. Humans use fossil fuels everyday, and we use a lot of it. Unfortunately, the overuse of these natural resources causes harmful effects on the environment. Pollution from using fossil fuel causes a decaying of the protective layer of our atmosphere (ozone) and, ultimately, global warming.

Burning coal, natural gas, and petroleum releases energy stored in the fossil fuel. This release is in the form of heat. Humans use this heat to power electricity. Large industries burn a huge amount of coal because they require extremely high temperatures. Others choose to burn clean natural gas to heat their homes. No matter the type of fossil fuel, it is evident that we need to find other methods to generate electricity.

A major form of energy is *nuclear energy*. It is the energy trapped inside each atom. Einstein studied and made many theories on the concepts of nuclear energy. One of the laws of the universe is that matter and energy cannot be created nor destroyed. But they can be changed in form. Matter can be changed into energy.

To explain this theory, Albert Einstein created the mathematical formula $E=mc^2$.

What does this mean?

E is energy, **m** is mass, and **c** is the speed of light.

C^2 means the speed of light squared. (Squared means a number times itself.
In this, $C \times C = C^2$)

Energy equals **mass** multiplied by **the speed of light** times itself. This equation demonstrates the amount of energy stored in matter (mass). This also means that no object with mass can ever move faster than the speed of light!



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This equation explains the theory of *nuclear energy*. An atom's nucleus can be split apart. When this is done, a tremendous amount of energy is released. It's all about splitting atoms! The energy is both heat and light energy. Einstein said that a very small amount of matter contains a very LARGE amount of energy. This energy, when let out slowly, can be harnessed to generate electricity. When it is let out all at once, it can make a tremendous explosion, like in an atomic bomb. Therefore, splitting atoms creates nuclear energy!

Nuclear Power Plants

Fission means to split apart. Inside the reactor of an atomic power plant, uranium atoms are split apart in a controlled chain reaction. A *chain reaction* is when one thing affects something else which affects something else.

In a chain reaction, particles released by the splitting of the atom go off and strike other uranium atoms splitting those. Those particles given off split other atoms. This is a chain reaction. In nuclear power plants, control rods are used to keep the splitting regulated so it does not occur too fast or without warning. If the reaction is not controlled, you could have a crazy amount of energy produced, like an atomic bomb.

The reaction also creates radioactive material. This material could hurt people if released, so it is kept in a solid form. The very strong concrete dome that surrounds a reactor is designed to keep this material inside if an accident happens.

This chain reaction gives off heat energy. This heat energy is used to boil water in the core of the reactor. So, instead of burning a fuel, nuclear power plants use the chain reaction of atoms splitting to change the energy of atoms into heat energy.

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