FAMILY FUN GUIDE

to the National Museum of Nuclear Science & History Exhibits

The NATIONAL MUSEUM OF NUCLEAR SCIENCE & HISTORY

Smithsonian Institution
Affiliations Program

YOU WON'T LEAVE THE WAY YOU CAME!

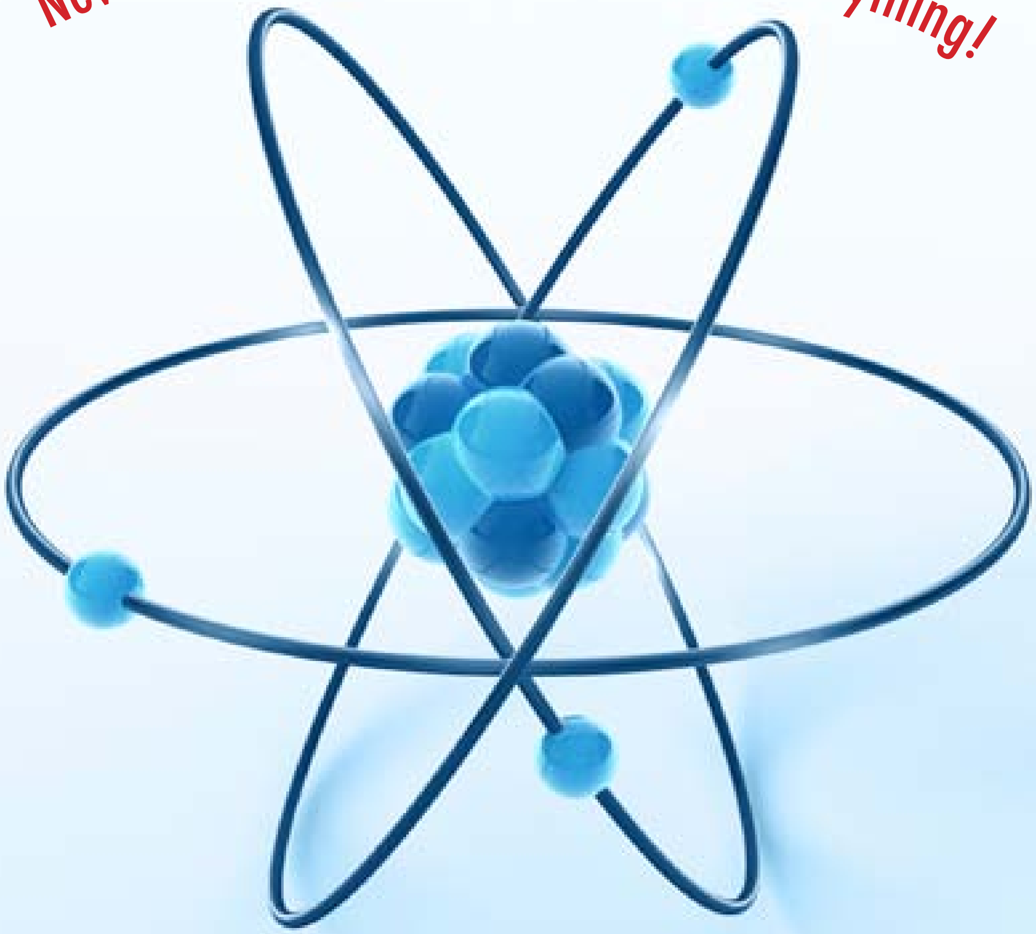
Welcome to the National Museum of Nuclear Science & History!

Use this guide in any order to have fun, search for symbols and details in the exhibits, and talk about what you see. Some pages have extra activity ideas to continue at home or at your school. Learn and explore something new about air, chemistry, magnet, radiation, and more!

There are amazing things to discover here. Like other science museums, you will learn how things work and try a few experiments. Like other history museums, you will learn about people, places, and things that have shaped some of the events of our world. You can learn about how technology has changed the way we live.

You already know more than you think, so let's get started on our museum exploration!

Never trust an atom. They make up everything!



All atoms are made up of tiny parts - the electrons orbit around the nucleus, or middle of the atom. The nucleus is made of protons and neutrons.

What is an Atom?

Atoms are the smallest units of matter. Everything is made up of atoms!

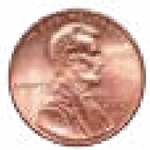
Did you notice that you just walked under a giant model of an atom?

WHAT IS AN ATOM?

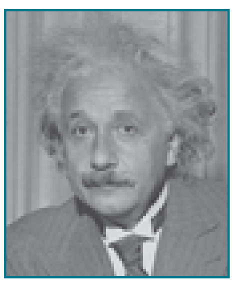
Did you see the four electrons circling around the atom when you walked in? That atom has the same number of protons. The proton count is the Atomic Number. The Atomic Number is engraved on the Museum floor in each box on the upper left hand corner of the Periodic Table.

Find this atom and write the letters of the symbol here:

You already know the names of some elements and what they are used for. What are the symbols or letters for the elements in these objects?



PIONEERS OF THE ATOM

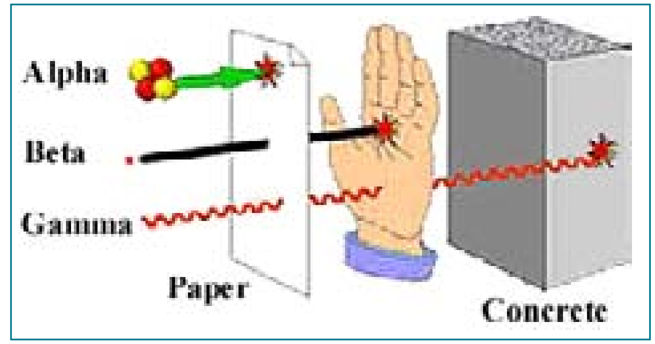


Albert Einstein discovered there is a huge amount of energy that comes from an atom. Find his formula in the exhibit and write it here:

Marie Curie coined the word *radioactivity* and discovered the elements Polonium and:

RADIATION 101

Radiation is a kind of energy. This energy travels in space as either waves or particles which are called α alpha, β beta, and γ gamma.



Elements with a large difference in the number of neutrons and protons are unstable. These elements give off radiation in order to become more stable. They are **radioactive**. The process is radioactive decay.

Do you hear that clicking sound?!?

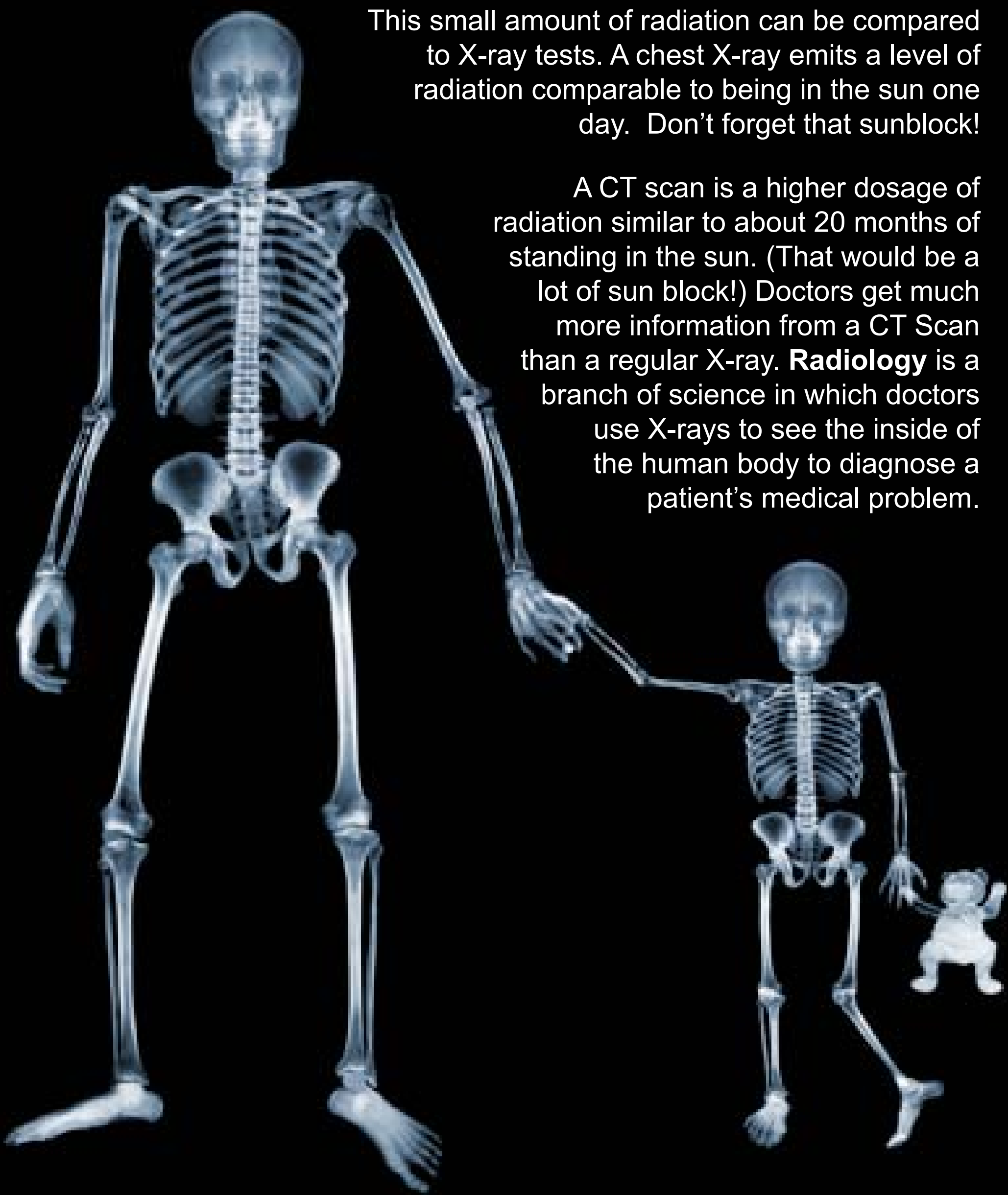
The **Geiger counter** in the display case is clicking every time the radioactive materials come near. Radioactivity is measured in **millirems**, and this amount is displayed on the gauge on top of the counter. Watch the needle change. Put an X in the box of the object which has more radioactivity.

What color of Fiestaware pottery was made with a radioactive glaze in the 1930s and 1940s?

NUCLEAR MEDICINE

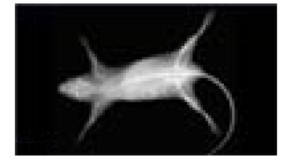
We are all exposed to a small amount of natural radiation every day of our lives from many sources like the sun, rocks, and soil. Yes, even the soil! This small amount of radiation can be compared to X-ray tests. A chest X-ray emits a level of radiation comparable to being in the sun one day. Don't forget that sunblock!

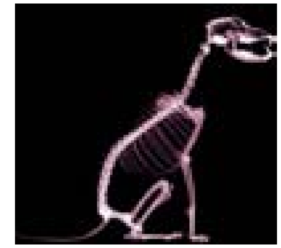
A CT scan is a higher dosage of radiation similar to about 20 months of standing in the sun. (That would be a lot of sun block!) Doctors get much more information from a CT Scan than a regular X-ray. **Radiology** is a branch of science in which doctors use X-rays to see the inside of the human body to diagnose a patient's medical problem.



WHOSE BONES?

Match the images on the left with these X-ray skeletons on the right.





Nuclear Medicine is a branch of medicine that uses radioactive isotopes in drugs which enter the body of the patient with a shot or by swallowing. The compound gives off gamma rays, and these are detected by a giant gamma camera or scanner you see in this exhibit. The scan will show the sick part of the body "in action" and help the doctor decide how to treat it.

What is an isotope? It's not only the name of Albuquerque's baseball team! Isotopes are atoms that have the same number of protons but different numbers of neutrons. Most elements have isotopes and many are often un-stable and radioactive. A radioisotope is a radioactive isotope of an element, produced either naturally or artificially.

WORLD WAR II & THE MANHATTAN PROJECT

The evolution of nuclear weapons began with the 1938 discovery of nuclear fission. Scientists working in physics research recognized that it would be vital for the United States to develop an atomic bomb before the Germans. They urged President Roosevelt to support their research to design and produce a nuclear weapon. The project was called the **Manhattan Project**. The secret place picked for this project was Los Alamos, New Mexico. In 1945 the weapon was tested near White Sands, New Mexico.

TAKE A CLOSER LOOK! Match the letters to the numbers.

President in 1939	A	1	Trinity
Plane that dropped nuclear weapon on Hiroshima	B	2	J. Robert Oppenheimer
Secret code name for the first atomic bomb	C	3	Franklin Delano Roosevelt
Name of the test site for the atomic bomb	D	4	The Gadget
Scientific Director of the Manhattan Project	E	5	B-29 The Enola Gay

HAVE YOU NOTICED?

There was a flag flying near the Trinity test site in 1945. How many stars does it have?

Which states were missing from this flag? (clue - they became states in 1959)

***COOL FACT!** Sand has to be heated to nearly 1650° F to make glass. This process is called vitrification. This is what happened to form the sample of trinitite on display. This green glassy rock was formed from the heat on the sand at the site of the atomic weapon's test.*

THE BEGINNING OF THE NUCLEAR AGE

After World War II, many people felt that atomic weapons should never be used again. However, countries could not agree on how this power should be controlled. In 1949, the Soviet Union tested a nuclear device, and this spurred the Americans to develop more weapons. The Americans and Russians did not trust one another. The fear created during this time was called **The Cold War**.

Write some kinds of things people are afraid of today.

The United States Office of Civil Defense designed a sign for fallout shelters, which were planned spaces designed to protect occupants from radioactive debris, or **fallout**, in the event of a nuclear explosion. Have you ever seen one of these at your school or near your home?

Fill in the symbol for radioactivity here.

HERITAGE PARK

The B-29 was one of the largest aircraft in service during WWII.

Behind the Museum are the biggest things in our collection - airplanes and some of the missiles that were designed for them. Bomber planes were designed to drop any bombs, the fighter jets were designed to fly swiftly and to protect the bombers.

There are two smaller planes and two bigger planes. Which are the bombers and which are the fighters?

Find these planes and match them to their names.

B-52

F-105

ENERGY

Energy causes changes in matter. When heat energy warms water, it makes steam. Steam can turn a turbine with blades inside a generator to produce electricity. A coal burning power plant and a nuclear power plant both create steam to produce electricity. There are natural forces like wind and water which can also turn the turbine, producing electricity. **Electricity** is a form of energy used to power lights, appliances, and even vehicles.

What is the source of electric power for your town?

Most energy in the past has come from fossil fuels. Because these fuels take so long to form, supplies will run out and they are called **non-renewable** sources of energy. **Renewable** sources of energy such as wind power, water power, and solar power are in constant supply and create cleaner energy than fossil fuels. Nuclear power is also a clean fuel because it does not produce carbon dioxide, a climate changing gas.

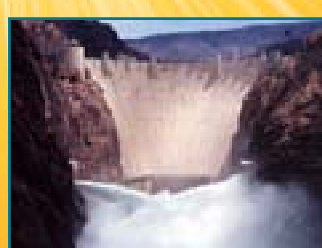
Circle the power sources below which are renewable.


Solar panels on the roof


Oil Rig


Nuclear power plant


Wind turbines


Hydropower

Energy that comes from the sun is called solar energy. It is around us every day. Energy from the sun travels as radiation. Light is radiation we see, and heat is radiation we feel. Again, don't forget that sunblock!

THE URANIUM CYCLE


ore truck

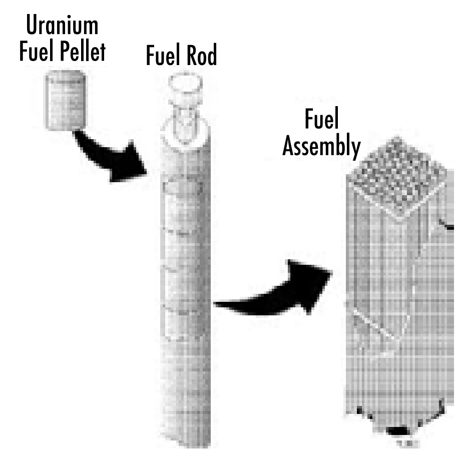

uranium


yellow cake

Uranium is one of the world's most important energy producing minerals. **Mining** is the process to remove uranium from the ground. New Mexico miners once used an ore truck like the one in this exhibit. In the second step, **milling**, the ground ore is washed with acid. The acid dissolves the uranium. Later, the uranium is removed from the solution, rinsed and dried. This product is sometimes called *yellow cake* because of its bright color.

After milling, the uranium is **refined** for the appropriate reactor in which it will be used. Finally, it will be enriched and fabricated into fuel pellets. One fuel pellet about the size of your fingernail contains the energy equivalent of a ton of coal.

These pellets will be stacked into rods, and the rods are put in bundles, ready to use for electricity generation at nuclear power plants.



Find the number of rods in the Nuclear Fuel Assembly in this exhibit.


fuel pellet

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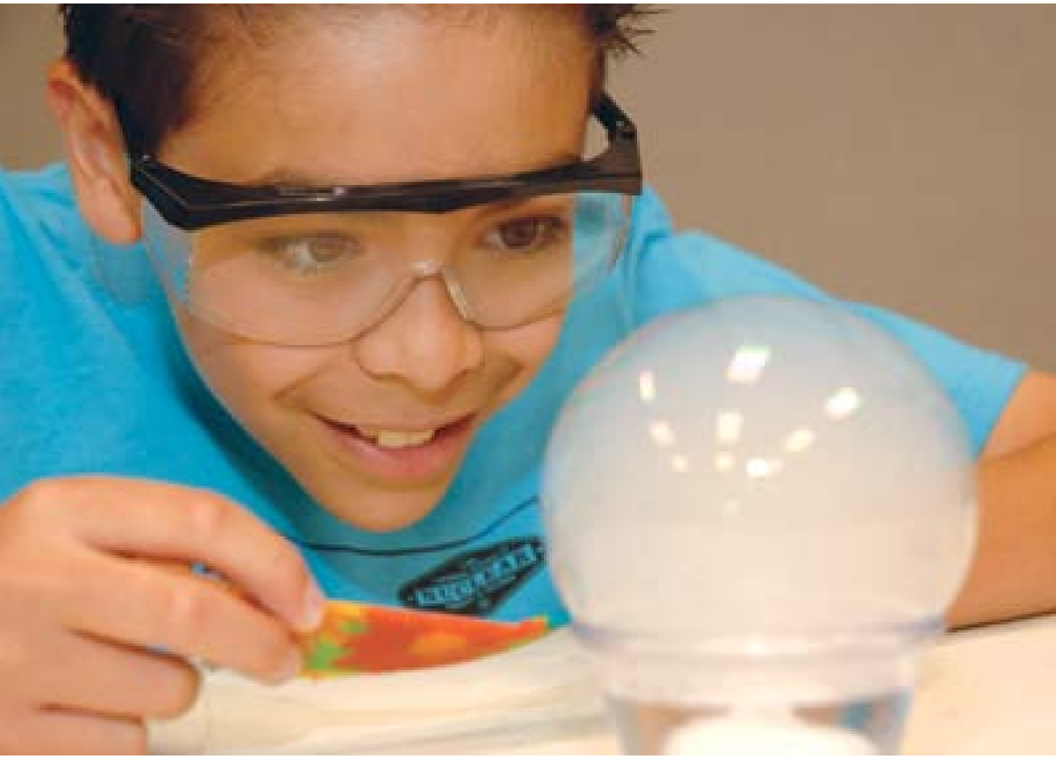

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