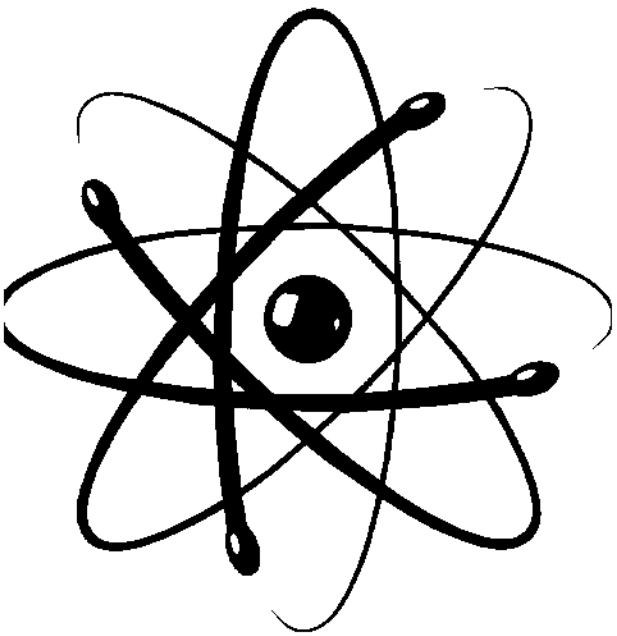
THE ATOM



CFE 3214V

OPEN CAPTIONED
ANNENBERG/CPB PROJECT
1990
Grade Levels: 12-13+
29 minutes

DESCRIPTION

This detailed explanation of atoms emphasizes their physical makeup, charge, characteristics, and energy. Discusses the scanning tunneling microscope which allows atoms to be seen. Experiments help clarify the information; notes emission spectroscopy's use in environmental issues. Conclusion reviews the powerful atom, the smallest building block of the universe.

INSTRUCTIONAL GOALS

- To examine some of the applications gained from knowledge of the structure of the atom.
- To review the history of learning about the atom.
- To illustrate the structure of an atom.
- To demonstrate how charged particles affect each other.
- To show how the scanning tunneling microscope (STM) is used to study atomic structure.
- To explain how emission spectroscopy is used in environmental analysis.

BEFORE SHOWING

1. Preview the video to determine unfamiliar vocabulary and language concepts.
2. Make a time line of the development of scientific theories relating to the atom.

DURING SHOWING

1. View the video more than once, with one showing uninterrupted.
2. Pause at the scene showing images seen on the STM and clarify.
3. Pause at the scene showing the Rutherford experiment.
    a. Discuss why most of the particles passed straight through the foil, but some did not.
    b. Discuss the implications of this relating to atomic structure.

AFTER SHOWING

1. Research and report on scientists involved in the discovery of the atom and in proposing theories about the atom.
2. Research the history of the development of the microscope. Draw a time line.
3. Obtain a diagram of Crookes's tube and discuss how it works.
4. Draw a diagram of Rutherford's experiment. Report on and justify the results of this experiment.
5. Using clay or styrofoam, create a 3-D model of an atom.
6. Conduct a flame test with the following metals: barium, strontium, sodium, copper, and lithium.
    a. Discuss why each metal gives off a characteristic color.
    b. Discuss some of the applications of this property, such as metal identification and use in logs for a fireplace.
7. Report on the scanning tunneling microscope. Discuss the likelihood of it being the future microscope of all chemistry laboratories.
8. Research lab manuals or science texts for experiments demonstrating the properties of positively and negatively charged atoms.
9. Report on emissions spectography and its use in various fields.
10. The electron cloud is 10,000 times larger than the nucleus. Devise an activity to illustrate the comparison of size.
    a. Count the number of candy-coated chocolates in one large bag.
    b. Calculate the number of bags needed for 10,000 candy-coated chocolates.
    c. Draw a poster to illustrate the comparison.
11. Research the importance of selenium in the diet.
12. Report on lead poisoning and scientific methods used to detect it.

WEBSITE

Explore the Internet to discover sites related to this topic. Check the CFV website for related information (http://www.cfv.org).

SUMMARY

Atoms are the smallest chemical building blocks that make up our world. Over the past 2,000 years, scientists have used simple and massive devices to study the structure of the atom. This knowledge has been applied in many ways. The atom's signals are analyzed to produce images of the body or examine mental activity in the brain. Nuclear reactors generate electricity for homes and industries. Understanding of the atom has enabled scientists to develop new drugs, paints, fertilizers, cosmetics, and fabrics.

The idea of the atom began with a Greek philosopher, Democritus, who proposed that matter was made up of tiny particles called atoms. Much later, in the 1800s, scientists established that specific chemical reactions involved the combination of definite amounts of reactants and resulted in definite amounts of end products. John Dalton proposed that during reactions, atoms combined in predictable ways.

The atom has three components: positively charged protons, neutrons with no charge, and negatively charged electrons. The electrons occupy a space called the electron cloud. Different electron clouds have different shapes, depending upon energy level. Two of the most common levels are the s-cloud and the p-cloud. When an s-cloud changes to a p-cloud, energy is absorbed. When the p-cloud changes to an s-cloud, energy is given off.

Scientists use a technique called *emission spectroscopy* to analyze energy signals and identify what types of atoms are present. This idea is useful in environmental analysis where excessive levels of

harmful elements or deficient amounts of vital elements can be traced in the soil or air.

Another instrument used to study the structure of atoms is the scanning tunneling microscope. The STM uses a small needle to trace the shape of each atom's electron cloud to produce two- and three-dimensional images of the atoms. Besides being one of the few instruments used to observe individual atoms, the STM is inexpensive and provides much information.

Chemistry operates on many levels. With partial, incomplete understanding, it is sometimes wrong. Incredibly, it is most of the time right.