

SYNOPSIS:

Chemistry has contributed to our lives in many ways. Most of the comforts and high-tech tools of our modern world would not exist without the discoveries made in science labs. Chemists study matter at its most basic level, investigating the atomic structure of the elements from which all matter is made. When these scientists apply their understanding, they can create miraculous substances and products that enrich our lives.

CURRICULUM UNITS:

Applied Science	Industrial Education
Chemistry	Physical Science
Engineering	Science, Technology & Society
General Science	

CAREER OPPORTUNITIES:

Chemical Engineer	Lab Technician
Chemist	Pharmacist
Farmer	Physicist
Inventor	Teacher

PROGRAM OVERVIEW:

This program offers an introduction to chemistry and can serve as a first lesson on the topic. It begins by stating that all matter in the universe, whatever its form (solid, liquid, or gas), is made up of basic substances called elements. Tell your students they may be very familiar with some of the elements that scientists have discovered. They may have celebrated a birthday with helium, the gas used to inflate balloons. Some may even be wearing a basic element or two—silver or gold in their jewelry.

This program then explains that the elements are formed from tiny atoms, and that each element is made of its own special kind of atom. Students get to see atoms of silicon, one of the most plentiful elements, through a scanning tunneling microscope (STM). They are also shown a piece of

diamond jewelry and learn that diamonds are made of the element carbon. Animation of a carbon atom illustrates that that atoms are made of protons, neutrons, and electrons—tiny particles we cannot see, even with the aid of the STM. To reinforce this, tell your students that an atom looks like a mini-solar system, with a center, where our sun would be. The nucleus is composed of the protons and neutrons. The electrons orbit around the nucleus, just as the earth and the other planets orbit around the sun.

Students also learn that two or more atoms may join together and form a molecule. All molecules contain atoms of at least one element. But many molecules, natural or manmade, are made up of combinations of elements called chemical compounds. Depending on your students' level of understanding, you could give them some examples of common chemical compounds such as water (a compound of the elements hydrogen and oxygen), table salt (the gaseous element chlorine, and metallic element, sodium), and rust (atoms of the element oxygen interacting with the molecules of the element iron).

The remainder of the program shows some of the many contributions scientist have made to modern living. Working with the same elements as nature, these scientists create new molecules and compounds for new products. These include agricultural products to improve quality and crop yield; modern packaging to preserve our food; synthetic fibers, pigments, and materials for our clothing, homes, and transportation.

ISSUES AND CRITICAL THINKING:

After viewing this program, ask your students the following:

- From what basic substances is all matter in our universe made?
- Of what are elements and molecules composed of?
- What three subatomic particles make up atoms?
- What is the work of a chemist?
- How has chemistry changed our lives?

Make models of molecules with toothpicks and clay, Styrofoam, gumdrops, or frozen peas.

Have each student research a different element and report about it to the class. Give specific guidelines: atomic symbol, discoverer, deposit, location, and uses.

Have students check the packages of their favorite foods and copy the list of ingredients. Which ingredients are natural and which are not? Why are certain chemicals added to foods? This project can be adapted to be used with toiletries or any other products students may use daily.

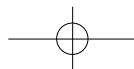
Collect samples of natural and synthetic materials and conduct tests for such characteristics as strength and durability, wrinkling, stain resistance, etc. Discuss the differences between natural and synthetic materials.

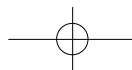
As a homework assignment, have the children check the labels of their clothing and prepare a list of the materials. Which are synthetic? Which are natural? Discuss the properties of the various materials.

Invite a chemist from a local company to talk to the class about careers in a chemical industry.

Arrange a field trip to a local chemical company or laboratory.

Demonstrate a few, safe chemical reactions such as baking soda and vinegar (or dry yeast and hydrogen peroxide solution). Before the experiment ask students to predict what will happen. After, ask the students to describe the states of matter they observed.





GLOSSARY:

AEROSPACE- Refers to the air (the atmosphere of the earth) and the space beyond in which vehicles such as airplanes and missiles fly.

AMOEBIA- A microscopic organism that is the simplest form of animal life.

ATOM- The smallest part of an element that has all the properties of that element.

CHEMISTS- Scientists that work with atoms, elements, and molecules to analyze and/or create chemical compounds.

ELECTRON- One of the three kinds of molecules that make up atoms. It is negatively charged and travels around the atom's nucleus. Electrons contribute very little to the mass of an atom but very much to an atom's reactivity.

ELEMENTS- Substances that cannot be chemically broken down into more simple substances.

FERTILIZERS- Natural or manmade substances added to soil to increase crop yields.

GASES- One of the three states of matter, neither solid nor liquid.

KEVLAR- A strong, space-aged material used in many products such as aircraft, space shuttles, bulletproof vests, and sails.

LAVA- Molten rock that reaches the earth's surface from the superheated magma layer located below the crust.

LIQUIDS- One of the three states of matter, neither solid nor gas.

MATTER- A physical substance that can be detected by one or more senses.

MOLECULE- The smallest bit of an element or chemical compound formed when two or more atoms join together.

NEUTRON- One of the three kinds of molecules that make up atoms. It is neutral, having a neither positive nor negative charge. Neutrons may make up half the mass of an atom.

NYLON- A strong synthetic material often used in clothing, forms a polymer chain. Nylon replaced silk as the material of choice for stockings.

PROTON- One of the three kinds of particles that make up atoms. Protons are positively charged and may make up half the mass of an atom.

SCANNING TUNNELING MICROSCOPE- A new and very powerful microscope. It allows scientists to view molecules on an atomic level.

SEMICONDUCTOR- A material that is neither a conductor nor an insulator. It is neither a metal, nor a nonmetal. An example would be silicon.

SILICON- An element found in the Earth's crust and used in glass, semiconductors, concrete, and many other products. It is the second most abundant element.

SOLIDS- One of the three states of matter, neither a liquid nor a gas; has a definite shape.

SYNTHETIC- A manmade substance.

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