GLOSSARY:

Actinide series: The series of 15 radioactive elements with increasing atomic numbers from actinium to lawrencium.

Alkali metals: Group of soft metallic elements that form alkali solutions when they combine with water. They include lithium, sodium, potassium, rubidium, cesium, and francium. They have one electron in their outer shell, and therefore react easily with other elements and are found in nature only in compounds.

Anode: The positively charged element of an electrical device, such as a vacuum tube or a diode, to which electrons are attracted.

Atomic number: The number of protons in the nucleus of an atom. In electrically neutral atoms, this number is also equal to the number of electrons orbiting about the atom's nucleus. The atomic number of an element determines its position in the Periodic Table and is usually denoted by the letter Z.

Atomic weight: The total weight of an atom, roughly equal to the number of protons and neutrons, with a little extra added by the electrons.

Cathode: The negative electrode in an electrolytic cell, toward which positively charged particles are attracted.

Electrolyte: A conducting medium in which the flow of current is accompanied by the movement of matter in the form of ions.

Halogens: Any of a group of five nonmetallic elements with similar properties. The halogens are fluorine, chlorine, bromine, iodine and astatine. Because they are missing an electron from their outermost shell, they react readily with most metals to form salts.

Isotopes: Any of two or more forms of a chemical element, having the same number of protons in the nucleus, or the same atomic number, but having different numbers of neutrons in the nucleus, or different atomic weights. There are 275 isotopes of the 81 stable elements, in addition to over 800 radioactive isotopes, and every element has known isotopic forms.

Lanthanide series: The class of 15 chemically related elements with atomic numbers from 57 (lanthanum) to 71 (lutetium).

Law of triads: When certain elements are placed in ascending order of atomic masses, groups of three elements having similar properties are obtained. The atomic mass of the middle element of the triad is equal to the mean of the atomic masses of the other two elements of the triad.

Noble gas: Any of the six gases - helium, neon, argon, krypton, xenon, and radon. The outermost electron shell of atoms of these gases is full, so they do not react chemically with other substances except under distinct special conditions.

Transition metals: Element in any of the series of elements with atomic numbers 21–29, 39–47, 57–79, and 89–107, that in a given inner orbital has less than a full quota of electrons.

Transuranic elements: Elements having an atomic number greater than 92, the atomic number of uranium. All such elements are radioactive and can be synthesized by bombarding a heavy element with a light particle or element.

Valence electrons: An electron in one of the outer shells of an atom that can participate in forming chemical bonds with other atoms.

TMW MEDIA GROUP
2321 Abbot Kinney Blvd., Venice, CA 90291
(310) 577-8581 Fax: (310) 574-0886
Email: sale@tmwmedia.com Web: www.tmwmedia.com
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Show Me Science Advanced

Chemistry - Periodic Table of Elements

K4580DVD

Advanced Teachers Guide

SYNOPSIS:

Chemists take into account physical and chemical properties to organize elements into groups. Hundreds of years ago, scientists utilized some of these properties to assign groupings and the periodic table started to take form. Dmitri Mendeleev, a Russian chemist, laid the groundwork for what is the modern periodic table of elements.

This program explores the discoveries that led up to the organization of the periodic table and how it is presently organized. Dissecting each row and column, several elements are highlighted and discussed in regard to their effects on our everyday lives and the environments in which they occur.

CURRICULUM UNITS:

- Chemistry
- Engineering
- Environmental science
- History and nature of science
- Physics

CAREER OPPORTUNITIES:

- Chemist
- Engineer
- Physicist
- Researcher

PROGRAM OVERVIEW:

Chemistry is important because it connects physics with other natural sciences such as astronomy, geology and biology. A better understanding of chemistry has been used to create stronger and lighter building materials, enrich soil for agriculture, improve health, and protect our environment.

Russian chemist Dmitri Mendeleev recognized patterns in the atomic weights and properties of halogens, alkali metals and alkaline metals. He observed similarities between different series of elements. To make sense of these patterns, he created a card for each of the 63 known elements of the time. Each card contained the element's symbol, atomic weight, and its chemical and physical properties.

He arranged the cards in order of ascending atomic weight (or mass), grouping elements of similar properties together in a manner that led to the early organization of the periodic table. This program explores the elements hydrogen and titanium, their placement on the periodic table, and some of their common everyday uses.

ISSUES & CRITICAL THINKING:

1. Discuss with students how the periodic table is organized and the distinctions between the rows and columns. On a periodic table, block off several elements. Tell students that in Mendeleev's time, he knew that not all elements had been discovered, but the periodicity of the table predicted the qualities of the undiscovered elements.

2. Break the class into groups and have them pick several different elements from the periodic table. Have them research the history and current uses of each element they chose.

3. Discuss with students why the lanthanide and actinide series are located below the table.

4. Discuss hydrogen's isotopes. It is the only element that has different names for its isotopes – protium, deuterium, and tritium.

5. Have students research how radioactive isotopes are used to calculate the age of fossils. Some typical isotopes are C-14, and the potassium argon series. When an organism eats, it takes in a certain ratio of 'normal' carbon-12 and its isotope, C14. When the organism dies, it no longer takes in carbon compounds. The isotope degrades. A simple calculation is used to determine how long ago the organism lived.