

Teacher's Guide For

Core Chemistry

For grade 7 - College

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MATERIALS IN THE PROGRAM

Teacher's Guide -This Teacher's Guide has been prepared to aid the teacher in utilizing materials contained within this program. In addition to this introductory material, the guide contains the following:

- Suggested Instructional Notes
- Student Learning Goals
- Test Questions on Blackline Masters A for duplication and handout to students
- Timeline of important events in the history of chemistry

INSTRUCTIONAL NOTES

It is suggested that you preview the program and read the related Student Goals and Teacher Points. By doing so, you will become familiar with the materials and be better prepared to adapt the program to the needs of your class. You will probably find it best to follow the programs in the order in which they are presented in this Teacher's Guide, but this is not necessary. It is also suggested that the program presentation take place before the entire class and under your direction. As you review the instructional program outlined in the Teacher's Guide, you may find it necessary to make some changes, deletions, or additions to fit the specific needs of your students. After viewing the programs you may wish to copy the Test Questions on Blackline Master 1A, and distribute to your class to measure their comprehension of the events.

INTRODUCTION AND SUMMARY OF PROGRAM

Core Chemistry is a unique approach to presenting in a logical way the discoveries and the science of the physical interactions of matter, including the atomic structure of the elements, how combinations of atoms form molecules, the study of chemical reactions and their resulting electrical and chemical properties. Presented in an effective format designed to promote successful student learning, these core principles are laid out in chronological order, each naturally building on the former. *Core Chemistry* examines the key points in the development of chemistry. It opens with early man's discovery of the most basic chemical reaction for the development of civilization – fire, and continues with the major chemical discoveries of making bronze, iron and gunpowder, and then moves to the beginnings of modern chemistry initiated by Robert Boyle in 1661. With the advent of modern chemistry, the program next presents the chemical process of electrolysis, the atomic theory of matter, the founding of organic chemistry, the creation of the first periodic table by Dmitri Mendeleev and ends with the 20th century's most important advances in chemistry –the creation of polymers, catalysts and millions of new chemicals all of which have created the world we inhabit in the 21st century.

Below is a list of the program and its segments. Using this program, teachers can create a lesson plan to cover the specific concepts, themes and the historical figures mentioned. In addition, *Core Chemistry* is used in the chemistry unit of Earth Sciences courses.

Core Chemistry

2 Million B.C. to 1661 - Ancient Chemistry

1800 - Electrolysis Reveals That Electricity Can Produce a Chemical Reaction

1808 - Atomic Theory of Matter is Announced

1828 - Organic Chemistry

1869 - The First Periodic Table

1945 to Present - Catalysts and New Chemicals

LINKS TO CURRICULUM STANDARDS

The design for this program includes the following curriculum correlations: National Science

Educations Standards, Content Standard B - Properties and changes of properties in matter, motions and forces, transfer of energy: Content Standard D – Structure of the Earth system, Earth’s history, Earth in the solar system and the McRel K-12 Science Standards and Benchmarks, Level III (Grades 6-8) and Level IV (Grades 9-12). There are also many correlations to the standards of Astronomy, Chemistry and Geology. The content of this program presents the foundational discoveries and principles of chemistry in an historical order.

SUMMARY OF PROGRAM

Core Chemistry

This program on Core Chemistry presents the key concepts in the development of chemistry.

Chapter one follows the development of chemistry from earliest man’s discovery of fire and charcoal, through the chemical changes that occur during the making of bronze and iron. It ends with perhaps the most important discovery of ancient world – gunpowder.

Next, in chapter two, we see how the 2000 year old phlogiston theory of matter ended with the study of electricity; how the first battery was built; and how electricity was used to separate water into hydrogen and oxygen by a process called hydrolysis, showing that water was not elemental.

Chapter three explores the atomic theory of matter, beginning with early theories of matter dating back to the Greeks, who claimed everything was made of earth, fire, air, and water. Beginning in the 17th century, through a series of experiments, the scientific method led to an early version of the modern-day atomic theory of matter.

Chapter four follows how Baron Jons Jacob Berzelius coined the term “organic chemistry” for the study of compounds derived from biological sources, and how this would lead to the discovery of new compounds, polymers and enzymes in the 20th century.

Then, chapter five shows how Mendeleev produced the first periodic chart of elements, and how this would form the basis of all chemistry.

The 20th century's discoveries of catalysts and polymers is examined in chapter six. These discoveries led to the modern world's plastics, pharmaceuticals and petrochemicals.

2 Million B.C. to 1661 - Ancient Chemistry

Student Goals - In this Core Chemistry chapter the students will learn:

- All matter – solids, liquids and gases – is made up of a finite number elements or combinations of these elements
- The first chemical reaction produced by humans started with wood
 - Fire a naturally occurring chemical event, is the oxidizing of combustible materials such as trees and grasses
 - The heat caused the chemical bonds that hold the carbon, hydrogen and oxygen together in wood to break apart, allowing the hydrogen and oxygen escape, and leaving behind pure carbon, known by the common name – charcoal
- Charcoal played the primary role in the creation of iron from iron ore and the alloying of bronze from copper and tin
- The other major chemical discovery of the ancient world was gunpowder, discovered by the Chinese around 200 A.D.
- Robert Boyle is one of the founders of modern chemistry

1800 - Electrolysis Reveals That Electricity Can Produce a Chemical Reaction

Student Goals - In this Core Chemistry chapter the students will learn:

- That static electricity and lightning are the same phenomena
- How a simple battery is made
- That water is not elemental
- How, using electricity, water can be turned into hydrogen and oxygen
- What a fuel is

1808 - Atomic Theory of Matter is Announced

Student Goals - In this Core Chemistry chapter the students will learn:

- That scientists first thought everything was made up of earth, fire, air, and water
- That early chemists who were actually alchemists tried to turn base metals into gold
- That the scientific method arose when chemists shared their results with other chemists
- That John Dalton proposed an atomic theory of matter to replace the old phlogiston theory of matter
- That the atomic theory of matter opened the door to modern chemistry

1828 - Organic Chemistry

Student Goals - In this Core Chemistry chapter the students will learn:

- In 1808, Baron Jons Jacob Berzelius coined the term “organic chemistry” for the study of compounds derived from biological sources
- 1828, German chemist Friedrich Wohler was the first to synthesize an organic compound
- That there is no separate life force in living matter
- The search for polymers began with the search for an alternative to rubber during WWI
- In 1935, DuPont Labs produced from coal a silk-like synthetic polymer called nylon
- Polymer science became a new branch of chemistry, leading to the modern wonders of plastics, based on petrochemicals

1869 - The First Periodic Table

Student Goals - In this Core Chemistry chapter the students will learn:

- How the periodic chart of elements was discovered
- How the periodic chart groups elements according to common properties
- That scientists are able to create man-made elements

1945 to Present - Catalysts and New Chemicals

Student Goals - In this Core Chemistry chapter the students will learn:

- With the detonation of the atomic bomb and the discovery of subatomic particles, the investigation into the fundamental nature of matter was now clearly in the realm of physics
- A couple of fundamental laws govern chemical reactions
 - The first – reactions always move from a higher energy state to lower energy state
 - Chemical reactions in nature proceed slowly
- Catalysts can speed up the rate of chemical reactions without being used up or changed themselves
- Finding new catalysts, including biocatalysts called enzymes, accelerated after WWII, resulting in an explosion in the invention of new chemicals

Answers to Blackline Master 1A Quiz

1-b; 2-a; 3-c; 4-d; 5-a; 6-b; 7-b; 8-b; 9-c; 10-d; 11-a; 12-d; 13-a&c; 14-b; 15-b; 16-a; 17-c