Teacher's Guide For

Core Physics:
Classical Physics

For grade 7 - College

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Executive Producer
William V. Ambrose

Teacher's Guide by
Ron Meyer

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145 West 45th St., Suite 1115
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1-800-526-4663
24-Hour Fax 212-768-9282
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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.

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 Physics: Classical Physics is a unique approach to presenting in a logical way classical physics' core principles relating to the nature and property of matter. In the long history of physics, a series of discoveries and laws have laid the foundation for how the universe works. This program, *Classical Physics* covers the period, which led to the Industrial Revolution and modern technology. Presented in an effective format designed to promote successful student learning, the core principles, discoveries and laws of this period are laid out in chronological order, each naturally building on the former. This program examines the key points in the development of classical physics beginning with Isaac Newton's investigation of light and continuing with the discovery of light's spectral lines in 1814, the discovery of electromagnetism and the Doppler effect, the formulation of the laws of thermodynamics, Faraday's and Maxwell's investigations into electromagnetism, and ending with the discovery X-rays in 1896 by Wilhelm Röntgen.

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.

Core Physics: Classical Physics

1814 - Light Reveals Spectral Lines
1820 - Electromagnetism is Discovered
1824 - Laws of Thermodynamics
1831 - Faraday Produces Electricity from Magnetism
1842 - Doppler Effect

1864 - Maxwell's Equations Unify Electricity and Magnetism
1895-6 - X-Rays and Radioactivity are Discovered

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); California State Content Standards for Physics (Grades 9-12): Motion and Forces, Conservation of Energy and Momentum, Heat and Thermodynamics and Waves. 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 classical physics in an historical order.

SUMMARY OF PROGRAM

Core Physics: Classical Physics

This program on Core Physics presents the key concepts in the development of classical physics.

Chapter one presents early investigations into the nature of light: how light was found to be made up of component colors; that light traveled at incredible speed; and that light was a wave.

Chapter two examines the basic properties of magnetism and then shows how, with great surprise, a wire carrying an electric current moved a compass needle demonstrating that somehow magnetism electricity were connected.

Chapter three investigates the fundamental laws of energy and explains how energy is defined as the potential to do work or produce an effect, and that the laws of thermodynamics govern the behavior of energy.

Michael Faraday development of the motor, and the dynamo, which today generate all our electricity, and electromagnetic induction are explained in chapter four.

The importance of Doppler's discovery of how sound was found to be made up of waves that follow laws, which apply to all waves, is discussed in chapter five.

Chapter six shows how the brilliant Scottish physicist, James Maxwell, unified electricity and magnetism, and determined that light, and all electromagnetic radiation, is actually made up of a field of electricity and a field of magnetism.

Chapter seven outlines the discovery of X-rays and later radioactivity and gamma rays.

1814 - Light Reveals Spectral Lines

Student Goals - In this Classical Physics chapter the students will learn:

- That light is made up of component colors
- How fast light travels
- That light behaves like a wave
- What Fraunhofer lines are
- That each atomic element has its own unique pattern of Fraunhofer lines

1820 - Electromagnetism is Discovered

Student Goals - In this Classical Physics chapter the students will learn:

- Energy is related to doing work
- Energy is not directly measurable, instead it's effect is what's observed or measured
- The first law of thermodynamics
- The second law of thermodynamics
- Why perpetual motion machines are not possible

1824 - Laws of Thermodynamics

Student Goals - In this Classical Physics chapter the students will learn:

- Nicolas Carnot formulates the laws of thermodynamics
- Energy is related to doing work
- Energy is not directly measurable, instead it's effect is what's observed or measured
- The first law of thermodynamics: Energy can neither be created nor destroyed
- The second law of thermodynamics: The ability to do work is always decreasing--that the universe is running down
- Why perpetual motion machines are not possible

1831 - Faraday Produces Electricity from Magnetism

Student Goals - In this Classical Physics chapter the students will learn:

- How an electromagnet is made
- How a motor works
- How electricity is produced by magnetism
- That expansion and contraction of a magnetic field produces electricity.
- That Michael Faraday invented the dynamo that is used today in generating electricity for home, school and work

1842 - Doppler Effect

Student Goals - In this Classical Physics chapter the students will learn:

- What the Doppler Effect is
- That sound occurs in the form of a wave
- The main properties of sound
- What red and blue shifts are

1864 - Maxwell's Equations Unify Electricity and Magnetism

Student Goals - In this Classical Physics chapter the students will learn:

- What electromagnetic radiation is
- How scientists learned to transmit radio waves
- New forms of electromagnetic radiation, microwaves and radio waves would soon be discovered joining light, infrared and ultraviolet light

1895-6 - X-Rays and Radioactivity are Discovered

Student Goals - In this Classical Physics chapter the students will learn:

- How X-rays were discovered
- How radioactivity was discovered
- The complete electromagnetic spectrum

Answers to Blackline Master 1A Quiz

1-b; 2-b; 3-b; 4-a; 5-b; 6-b; 7-a; 8-b; 9-b; 10-a; 11-a; 12-b; 13-b; 14-c; 15-a; 16-a; 17-b; 18-a; 19–a, b & c; 20-a; 21-b; 22-a & d