

Teacher's Guide For

Core Astronomy

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.

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 Astronomy is a unique approach to presenting in a logical way the discoveries relating to celestial objects, space, and the physical universe, as a whole as well as the laws governing their behavior. 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 Astronomy* examines the key points in the development of astronomy beginning with Greek astronomer Ptolemy's earth centered paradigm to Nicholas Copernicus's introduction of a sun centered solar system, and Isaac Newton's three laws of motion. It then examines the discovery of Neptune, Einstein's theories of Special and General Relativity, Hubble's expanding Universe, and the discoveries of quasars, White Dwarfs, Neutron Stars, Pulsars and Black Holes, and finally ends with astronomy's modern frontiers - the great attractor, dark matter, and life existing on an extra-solar planet.

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 Astronomy

- 130 -1640 - Ptolemy to Galileo
- 1688 -1796 Newton to Nebular Theory of the Solar System
- 1846 - The Planet Neptune is Discovered
- 1905 - Einstein's Theories of Special and General Relativity
- 1929 - The Expanding Universe

1963 - Quasars
1967 - White Dwarfs, Neutron Stars, Pulsars and Black Holes
1990 - The Great Attractor and Dark Matter
2004 - Organic Material Found on Extrasolar Planet

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 Astronomy

This program on Core Astronomy presents the key concepts in the development of astronomy.

Chapter one follows the development of astronomy that evolved from the geocentric Ptolemaic view of the universe to the heliocentric view proposed by Nicholas Copernicus and then goes on to present Galileo’s law of gravitational attraction,

Chapter two discusses Newton’s three laws of motion and the nebular theory of the solar system’s formation from a gas cloud.

Chapter three follows the use of theory and mathematics by mid 19th century astronomers to predict the location of new planets such as Neptune and Pluto.

Einstein’s Theory of Special Relativity, showing that time and space were relative to the observer not absolute, and his Theory of General relativity, showing how gravity could be explained as the bending of space, are outlined in chapter four.

Chapter five examines the expansion of the universe as early 20th-century astronomers found that our sun was only one of a billion suns in a galaxy of a billion galaxies. It also discusses the Big Bang Theory when everything, including space and time, came into existence in a single moment.

The discovery by astronomers using radio telescopes of Quasars, which turn out to be the

core of a developing galaxy is explored in chapter six.

White Dwarfs, Neutron Stars, Pulsars and Black Holes are examined in chapter seven.

Chapter eight follows the work by astronomers as they unravel the meaning behind a center of intense gravitational pull drawing our galaxy towards it. This phenomena was given the name the Great Attractor. It also discusses the discovery of dark matter.

Astronomy's discovery of planets with biomarkers, showing humans are not alone in the universe is discussed in chapter nine.

130 -1640 - Ptolemy to Galileo

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

- That ancient Greeks began the western scientific tradition
- That the first the idea of the universe had the earth at its center
- That during the Renaissance Nicholas Copernicus correctly proposed that the planets orbited the sun
- Galileo's law of gravitational attraction

1688 -1796 Newton to Nebular Theory of the Solar System

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

- Newton's three laws of motion
 - Newton's first law of motion states: every object in uniform motion tends to remain in that state of motion unless an external force is applied to it
 - Newton's second law states: that heavier objects require more force to move them the same distance than do lighter objects
 - Newton's third law states: for every action there is an equal and opposite reaction
- That calculus from mathematics could be used to calculate the movement of the heavenly bodies
- That our solar system came from a gas cloud

1846 - The Planet Neptune is Discovered

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

- All the planets and celestial bodies that makeup our solar system
- Using mathematics and calculus astronomers are able to predict where to look for new planets.

1905 - Einstein's Theories of Special and General Relativity

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

- The two experiences that lead Einstein to Special relativity
- That the speed of light is constant while space and time are relative
- That there is no one set of events that occur at the same time for everyone

- That Special relativity gave us $E = MC^2$ and the atomic bomb
- What General relativity is

1929 - The Expanding Universe

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

- What the three kinds of nebula are
- How the universe is laid out
- What a galaxy is
- What the Big Bang is

1963 - Quasars

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

- How radio telescopes are used to discover new astronomical objects
- What is a quasar is

1967 - White Dwarfs, Neutron Stars, Pulsars and Black Holes Student

Goals - In this Core Astronomy chapter the students will learn:

- How the Big bang created the universe
- How stellar deaths can be peaceful or violent
- The different kinds of stellar cinders
- How black holes create new galaxies

1990 - The Great Attractor and Dark Matter

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

- What the great attractor is
- What dark matter is

2004 - Organic Material Found on Extrasolar Planet

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

- That the universe contains other solar systems some with bio markers indicating the
- Probability of extraterrestrial life
- That many of the fundamental questions of science are still unanswered

Answers to Blackline Master 1A Quiz

1-a; 2-b; 3-c; 4-b; 5-b; 6-a; 7-b; 8-b; 9-b & c; 10-b; 11-a; 12-a & c; 13-b; 14-b; 15-c; 16-c; 17-b; 18-a; 19-a; 20-b; 21-b, c, e & f; 22-b; 23-a; 24-b; 25-b; 26-b