

MORENO VALLEY HIGH SCHOOL SCIENCE SURVEY CURRICULUM

Course Title: Science Survey Course Number: SCN12

Department: Science ADS Number: SCN12

Prerequisites: Algebra Concurrent

Length of Course: 2 Semesters Credit/PRI Area: 0.5 credits per semester. Grade Level(s): 9-10

Important Notes: There is no lab with this course.

COURSE DESCRIPTION

This is an introductory high school science course, designed to develop scientific thinking, understand the basic structure of the universe, scientific discoveries, inventions, and how society is influenced by these ideas. The course uses extensive electronic media (DVDs, internet) and discussion. Grading is based on classroom participation, and four significant projects per semester.

SYLLABUS

1. Units of Study:

- a) The History of Science.
- b) Science and Society.
- c) New Ideas and their effects.

2. Skills:

- a) Scientific thinking and practice: Prepares students to ask scientific questions and conduct research to find solutions. Critical thinking is required.
- b) Content of Science: Knowledge and skills provide the foundation that students need for critical thinking and problem solving.
- c) Science and society: Prepares students to understand the ways in which science influences the individual and society.

STRATEGIES: Paideia Methodology

Didactic: Lecture, guided discussion, research, and weekly science topics.

Intellectual Coaching: Group discussion is strongly encouraged with evaluation of science impact on individuals.

Seminar: Historical ideas and developments are examined for changes in ways of scientific thinking.

ASSESSMENTS

- **Forced Choice Items** – multiple choice tests, true/false, fill-in-the-blank, matching.
- **Essay Questions**
- **Performance Tasks** – I.e. Labs, research, presentations etc.
- **Socratic Seminar Rubric** – The framework of the rubric is listed below:
 1. **ACADEMIC SKILLS** – Textual understanding; speaking; listening; knowing how to learn; critical thinking
 2. **SOCIAL SKILLS** – Teamwork; Sensitivity/Good manners

3. PERSONAL SKILLS – Honesty and integrity; Willingness to accept criticism; Responsibility and initiative

- **Teacher Observation** – Group participation and individual contributions and effort.
- **Student Self-Assessment** – Students reflect on what they learned, strengths and weaknesses, and goal setting.

SUGGESTED TEXTBOOKS AND INSTRUCTIONAL MATERIALS

Global Science by John Christensen

BBC News and Science section

SUGGESTED TITLES/AUTHORS WEB SITES

www.lightandmatter.com

www.wikipedia.org

<http://www.shatters.net/celestia/>

SEMINAR PIECES OR USE

Burning Chrome by William Gibson

Neuromancer by William Gibson

Newtonian Physics by Benjamin Crowell

Seminar pieces cover all branches of science, history of science, and contemporary science.

STRAND I: SCIENTIFIC THINKING AND PRACTICE
CONTENT STANDARD 1: UNDERSTAND THE PROCESSES OF SCIENTIFIC INVESTIGATIONS AND USE INQUIRY AND SCIENTIFIC WAYS OF OBSERVING, EXPERIMENTING, PREDICTING, AND VALIDATING TO THINK CRITICALLY.

BENCHMARK: *Understand that scientific processes produce scientific knowledge that is continually evaluated, validated, revised, or rejected.*

GRADE	PERFORMANCE STANDARDS	ILLUSTRATIONS
9-10	<ol style="list-style-type: none"> 1. Understand how scientific processes produce valid, reliable results, including: <ul style="list-style-type: none"> • consistency of explanations with data and observations • openness to peer review • full disclosure and examination of assumptions • testability of hypotheses • repeatability of experiments and reproducibility of results. 2. Use scientific reasoning and valid logic to recognize: <ul style="list-style-type: none"> • faulty logic • cause and effect • the difference between observation and unsubstantiated inferences and conclusions • potential bias 3. Understand how new data and observations can result in new scientific knowledge. 4. Critically analyze an accepted explanation by reviewing current scientific knowledge. 5. Examine investigations of current interest in science (e.g., superconductivity, molecular machines, age of the universe). 6. Examine the scientific processes and logic used in investigations of past events (e.g., using data from crime scenes, fossils), investigations that can be planned in advance but are only done once (e.g., expensive or time-consuming experiments such as medical clinical trials), and investigations of phenomena that can be repeated easily and frequently. 	<p>Students are introduced to the history of science from the perspective of the individuals who performed that science. The students share their understanding of the pervading ideas that these scientists had to overcome.</p> <p>Project: Using da Vinci's proportions of man, students take six of the proportions and conduct an experiment to see if daVinci was correct. http://en.wikipedia.org/wiki/Proportions_of_Man</p>

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C. BENCHMARK: *Use mathematical concepts, principles, and expressions to analyze data, develop models, understand patterns and relationships, evaluate findings, and draw conclusions.*

GRADE	PERFORMANCE STANDARDS	ILLUSTRATIONS
9-10	<ol style="list-style-type: none"> 1. Create multiple displays of data to analyze and explain the relationships in scientific investigations. 2. Use mathematical models to describe, explain, and predict natural phenomena. 3. Use technologies to quantify relationships in scientific hypotheses (e.g., calculators, computer spreadsheets and databases, graphing software, simulations, modeling). 4. Identify and apply measurement techniques and consider possible effects of measurement errors. 5. Use mathematics to express and establish scientific relationships (e.g., scientific notation, vectors, dimensional analysis). 	<p>See Project above. – students will draw scale models of their proportions and create a spreadsheet of class data to:</p> <ul style="list-style-type: none"> • analyze the accuracy of their hypothesis • calculate the ratios of the proportions • compare their results to the ideal ratio of 1 to 1.

STRAND III: CONTENT OF SCIENCE: EARTH AND SPACE SCIENCE
CONTENT STANDARD I: UNDERSTAND THE STRUCTURE OF EARTH, THE SOLAR SYSTEM, AND THE UNIVERSE, THE INTERCONNECTIONS AMONG THEM, AND THE PROCESSES AND INTERACTIONS OF EARTH'S SYSTEMS.

A. BENCHMARK: *Examine the scientific theories of the origin, structure, contents, and evolution of the solar system and the universe, and their interconnections.*

GRADE	PERFORMANCE STANDARDS	ILLUSTRATIONS
9-10	<ol style="list-style-type: none"> 1. Understand the scale and contents of the universe, including: <ul style="list-style-type: none"> • range of structures from atoms through astronomical objects to the universe • objects in the universe such as planets, stars, galaxies, and nebulae. 2. Predict changes in the positions and appearances of objects in the sky (e.g., moon, sun) based on knowledge of current positions and patterns of movements (e.g., lunar cycles, seasons). 3. Understand how knowledge about the universe comes from evidence collected from advanced technology (e.g., telescopes, satellites, images, computer models). 4. Describe the key observations that led to the acceptance of the Big Bang theory and that the age of the universe is over 10 billion years. 5. Explain how objects in the universe emit different electromagnetic radiation and how this information is used. 6. Describe how stars are powered by nuclear fusion, how luminosity and temperature indicate their age, and how stellar processes create heavier and stable elements that are found throughout the universe. 7. Examine the role that New Mexico research facilities play in current space exploration (e.g., Very Large Array, Goddard Space Center) 	<p>The students will exhibit their knowledge of space and the that lie between planets, stars, stellar systems, and galaxies through verbal, visual, or kinesthetic demonstrations.</p> <p>For example, a group of students will build a scale model of the solar system, show all calculations to scale, and explain what would happen if another planet was added. Celestia software is a resource for students.</p>

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B. BENCHMARK: *Examine the scientific theories of the origin, structure, energy, and evolution of Earth and its atmosphere, and their interconnections.*

GRADE	PERFORMANCE STANDARDS	ILLUSTRATIONS
9-10	<p>Characteristics and Evolution of Earth</p> <ol style="list-style-type: none"> 1. Describe the characteristics and the evolution of Earth in terms of the geosphere, the hydrosphere, the atmosphere, and the biosphere. 2. Recognize that radiometric data indicate that Earth is at least 4 billion years old and that Earth has changed during that period. 3. Describe the internal structure of Earth (e.g., core, mantle, crust) and the structure of Earth's plates. 4. Understand the changes in Earth's past and the investigative methods used to determine geologic time, including: <ul style="list-style-type: none"> • rock sequences, relative dating, fossil correlation, and radiometric dating • geologic time scales, historic changes in life forms, and the evidence for absolute ages (e.g., radiometric methods, tree rings, paleomagnetism). 5. Explain plate tectonic theory and understand the evidence that supports it. 	<p>The students will have class field trips where they can see the various geologies of Moreno Valley, and can question the geologic history.</p> <p>Students will collect fossils, record the layer where they were found, and attempt to reconstruct past environment based on fossil and rock data. Then students will present and defend data to the class.</p>

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9-10	<p>Energy in Earth's System</p> <p>6. Know that Earth's systems are driven by internal (i.e., radioactive decay and gravitational energy) and external (i.e., the sun) sources of energy.</p> <p>7. Describe convection as the mechanism for moving heat energy from deep within Earth to the surface and discuss how this process results in plate tectonics, including:</p> <ul style="list-style-type: none"> • geological manifestations (e.g., earthquakes, volcanoes, mountain building) that occur at plate boundaries • impact of plate motions on societies and the environment (e.g., earthquakes, volcanoes). <p>8. Describe the patterns and relationships in the circulation of air and water driven by the sun's radiant energy, including:</p> <ul style="list-style-type: none"> • patterns in weather systems related to the transfer of energy • differences between climate and weather • global climate, global warming, and the greenhouse effect • El Niño, La Niña, and other climatic trends. 	<p>Class discussions of contemporary events include,</p> <p>Use current news articles to discuss and present information related to earthquakes, tsunamis, weather patterns, and global warming. Examine interconnections between events and impact on local environments. For example, calculate the energy of a tidal wave (use Fermi problems).</p>

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9-10	<p>Geochemical Cycles</p> <p>9. Know that Earth's system contains a fixed amount of natural resources that cycle among land, water, the atmosphere, and living things (e.g., carbon and nitrogen cycles, rock cycle, water cycle, ground water, aquifers).</p> <p>10. Describe the composition and structure of Earth's materials, including:</p> <ul style="list-style-type: none"> • the major rock types (i.e., sedimentary, igneous, metamorphic) and their formation • natural resources (e.g., minerals, petroleum) and their formation. <p>11. Explain how layers of the atmosphere (e.g., ozone, ionosphere) change naturally and artificially.</p> <p>12. Explain how the availability of ground water through aquifers can fluctuate based on multiple factors (i.e., rate of use, rate of replenishment, surface changes, and changes in temperature).</p>	<p>Using field trips and research, students trace the element of the various cycles and present to the class.</p> <p>Resources: Hach Kits (water quality kits) Geological Society of NM</p>

STRAND III: SCIENCE AND SOCIETY

CONTENT STANDARD: UNDERSTAND HOW SCIENTIFIC DISCOVERIES, INVENTIONS, PRACTICES, AND KNOWLEDGE INFLUENCE, AND ARE INFLUENCED BY, INDIVIDUALS AND SOCIETIES.

A. BENCHMARK: *Examine and analyze how scientific discoveries and their applications affect the world, and explain how societies influence scientific investigations and applications.*

GRADE	PERFORMANCE STANDARDS	ILLUSTRATIONS
9-10	<p>Science and Technology</p> <ol style="list-style-type: none">1. Know how science enables technology but also constrains it, and recognize the difference between real technology and science fiction (e.g., rockets vs. antigravity machines; nuclear reactors vs. perpetual-motion machines; medical X-rays vs. Star-Trek tricorders).2. Understand how advances in technology enable further advances in science (e.g., microscopes and cellular structure; telescopes and understanding of the universe).3. Evaluate the influences of technology on society (e.g., communications, petroleum, transportation, nuclear energy, computers, medicine, genetic engineering) including both desired and undesired effects, and including some historical examples (e.g., the wheel, the plow, the printing press, the lightning rod).4. Understand the scientific foundations of common technologies (e.g., kitchen appliances, radio, television, aircraft, rockets, computers, medical X-rays, selective breeding, fertilizers and pesticides, agricultural equipment).5. Understand that applications of genetics can meet human needs and can create new problems (e.g., agriculture, medicine, cloning).6. Analyze the impact of digital technologies on the availability, creation, and dissemination of information.7. Describe how human activities have affected ozone in the upper atmosphere and how it affects health and the environment.	<p>Students will read selections from <i>Burning Chrome</i> and <i>Neuromancer</i>. Create character maps. Seminar on the impact of technology, communications, computers, medicine etc. on the characters, society, and our lives.</p>

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9-10	<p>Science and Society</p> <p>9. Describe how scientific knowledge helps decision makers with local, national, and global challenges (e.g., Waste Isolation Pilot Project [WIPP], mining, drought, population growth, alternative energy, climate change).</p> <p>10. Describe major historical changes in scientific perspectives (e.g., atomic theory, germs, cosmology, relativity, plate tectonics, evolution) and the experimental observations that triggered them.</p> <p>11. Know that societal factors can promote or constrain scientific discovery (e.g., government funding, laws and regulations about human cloning and genetically modified organisms, gender and ethnic bias, AIDS research, alternative-energy research).</p> <p>12. Explain how societies can change ecosystems and how these changes can be reversible or irreversible.</p> <p>13. Describe how environmental, economic, and political interests impact resource management and use in New Mexico .</p> <p>14. Describe New Mexico 's role in nuclear science (e.g., Manhattan Project, WIPP, national laboratories).</p>	<p>The textbook introduces these concepts to the student, and work in the classroom determines correct concept understanding.</p> <p>Seminars on how the items below affect humans an the Earth’s systems:</p> <ol style="list-style-type: none"> 1. Global warming 2. Las Alamos 3. Bird flu 4. Mad Cow Disease 5. Trout twirling disease <p>Use StarLogo to model one of the above projects. For example, students will create a model of the water cycle with variability in the amount of precipitation.</p> <p>Students will compare data from StarLogo models to real data and write a paper or present a poster comparing the similarities and differences and explaining why.</p> <p>Seminar: Was the Manhattan project justified?</p>

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9-10	<p>Science and Individuals</p> <p>15. Identify how science has produced knowledge that is relevant to individual health and material prosperity.</p> <p>16. Understand that reasonable people may disagree about some issues that are of interest to both science and religion (e.g., the origin of life on Earth, the cause of the Big Bang, the future of Earth).</p> <p>17. Identify important questions that science cannot answer (e.g., questions that are beyond today's science, decisions that science can only help to make,</p>	<p>Students will seminar in small groups on one of four questions (see example below) to answer the larger questions, “What is science and what is not science?”</p> <p>From: <i>Newtonian Physics</i> by Benjamin Crowell, pages 19-22.</p> <p>E.g. “Acupuncture is a traditional medical technique of Asian origin in which small needles are inserted in the patient’s body to relieve pain</p>

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	<p>questions that are inherently outside of the realm of science).</p> <p>18. Understand that scientists have characteristics in common with other individuals (e.g., employment and career needs, curiosity, desire to perform public service, greed, preconceptions and biases, temptation to be unethical, core values including honesty and openness).</p> <p>19. Know that science plays a role in many different kinds of careers and activities (e.g., public service, volunteers, public office holders, researchers, teachers, doctors, nurses, technicians, farmers, ranchers).</p>	<p>Many doctors trained in the west consider acupuncture unworthy of experimental study because if it had therapeutic effects, such effects could not be explained by their theories of the nervous system. Who is being more scientific, the western or eastern practitioners?"</p> <p>Students present their argument to the class.</p>