

HOPATCONG BOROUGH SCHOOL
MIDDLE SCHOOL SCIENCE CURRICULUM
GRADE 6
AUGUST 2009

EARTH SCIENCE

2009

COURSE DESCRIPTION: The sixth grade science curriculum will focus on earth and space science. A specific emphasis will be placed on Earth's Structure and Natural Processes (Internal & External Forces that Change Earth's Surface, Hydrologic Cycle, Atmospheric Patterns) and the Solar System (Origin and Structure, Moon and Its Relationship to Earth). This course is designed to encourage students to develop and use problem-solving and decision-making skills along with collaborative research techniques through experimentation. Students will be formulating questions and hypotheses along with interpreting and analyzing data, drawing conclusions and communicating results.

All middle school science classes will cover Problem Solving and Mathematics (Problem Solving in Science, Scientific Procedures, Mathematics in Science), History of Science, Technology, and Society (Relationship of Science, Technology, and Society, Scientific Measurement Tools and Observational Strategies, Technological Advances and Space Exploration).

Technology literacy will be addressed in the science classroom as students utilize computer applications to gather and organize data and solve problems.

By the discovery process, the students will develop an understanding of fundamental scientific principles and science-related skills.

The sequence of the course will be determined by the classroom teacher pending material availability.

CORE CURRICULUM CONTENT STANDARDS:

STANDARD 5.1 (SCIENTIFIC PROCESSES) All students will develop problem-solving, decision-making and inquiry skills, reflected by formulating usable questions and hypotheses, planning experiments, conducting systematic observations, interpreting and analyzing data, drawing conclusions, and communicating results.

STANDARD 5.2 (SCIENCE AND SOCIETY) All students will develop an understanding of how people of various cultures have contributed to the advancement of science and technology, and how major discoveries and events have advanced science and technology.

STANDARD 5.3 (MATHEMATICAL APPLICATIONS) All students will integrate mathematics as a tool for problem-solving in science, and as a means of expressing and/or modeling scientific theories.

STANDARD 5.4 (NATURE AND PROCESS OF TECHNOLOGY) All students will understand the interrelationships between science and technology and develop a conceptual understanding of the nature and process of technology.

STANDARD 5.8 (EARTH SCIENCE) all students will gain an understanding of the structure, dynamics, and geophysical systems of the earth.

STANDARD 5.9 (ASTRONOMY AND SPACE SCIENCE) All students will gain an understanding of the origin, evolution, and structure of the universe.

STANDARD 5.10 (ENVIRONMENTAL STUDIES) All students will develop an understanding of the environment as a system of interdependent components affected by human activity and natural phenomena.

STANDARD 8.1 (COMPUTER AND INFORMATION LITERACY) All students will use computer applications to gather and organize information to solve problems.

STANDARD 8.2 (TECHNOLOGY EDUCATION) All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world as they relate to the individual society, and the environment.

**CUMULATIVE PROGRESS INDICATORS
SUGGESTED ACTIVITIES THAT ADDRESS THESE STANDARDS WHICH MAY
INCLUDE BUT ARE NOT LIMITED TO:**

5.1 Scientific Processes

A. Habits of Mind

1. What constitutes evidence?
2. When do you know you have enough and the right kind of evidence?
3. How can this result be best justified and explained to others?
 - Evaluate the strengths and weaknesses of data, claims, and arguments.
 - Communicate experimental findings to others.
 - Recognize that the results of scientific investigations are seldom exactly the same and that replication is often necessary.
 - Recognize that curiosity, skepticism, open-mindedness, and honesty are attributes of scientists.

B. Inquiry and Problem Solving

1. What makes a question scientific?
 - Identify questions and make predictions that can be addressed by conducting investigations.
 - Design and conduct investigations incorporating the use of a control.
 - Collect, organize, and interpret the data that result from experiments.

C. Safety

1. What does Safety First demand of us in each setting?
2. What rules are general and what are situation-specific?
 - Know when and how to use appropriate safety equipment with all classroom materials.
 - Understand and practice safety procedures for conducting science investigations

SUGGESTED ACTIVITIES:

- The students will develop the skills necessary for being a middle school student by finding the main idea of a paragraph, taking notes from an oral presentation or demonstration and learning and developing new test taking skills.
- The teacher will present to the students a number of problems faced by scientists. The students will use the scientific method and previously learned problem-solving skills to bring the problem to conclusion. (Written activity)
- Introductory activity for scientific method- What's Inside? (Mystery Box Activity)
- Writing a lab report based on lab activity- Which paper towel is the most absorbent?
- Using cooperative learning groups, students can present and communicate their experimental findings from lab work.
- Identify, interpret, and construct a graph from data obtained through experimentation. (Assign preset lab data)

- Teacher will model safety procedures in the classroom.
- Recognize safety symbols via mini posters- teacher/student created.
- Safety story corrections (Sponge Bob & Friends story)
- The students will demonstrate proper and safe use of laboratory equipment.

5.2 Science and Society

A. Cultural Contributions

1. What do we mean in science when we say that we stand on the shoulders of giants?
 - Recognize that scientific theories develop over time, depend on the contributions of many people, and reflect the social and political climate of their time.
 - Know that scientists are men and women of many cultures who often work together to solve scientific and technological problems.
 - Describe how different people in different cultures have made and continue to make contributions to science and technology.

B. Historical Perspectives

1. How do science and technology influence each other?
 - Describe the impact of major events and people in the history of science and technology, in conjunction with other world events.
 - Describe the development and exponential growth of scientific knowledge and technological innovations.

SUGGESTED ACTIVITIES:

- Brief explanation of several theories of how the Earth began. Use this explanation to lead into assigned cooperative learning groups that will research these theories. Groups will complete research and present the information to the class via a poster or display.
- The teacher will identify scientists of different cultures, both male and female that have contributed to current scientific thinking.
- Show United Streaming clips of scientists of the world sharing scientific knowledge and technological innovations – historical and current. Follow-up with class discussions and teacher generated questions.
- The teacher will explain the impact that scientific discoveries have had on society and the world and how these discoveries have paved the way for more research and advances.

5.3 Mathematical Applications

A-D. Numerical Operations, Geometry and Measurement, Patterns and Algebra, Data Analysis and Probability

1. How do we use mathematics to model objects, events and relationships in science?
 - Express quantities using appropriate number formats, such as decimals, percents, and scientific notation.
 - Perform mathematical computations using labeled quantities and express answers in correctly derived units.
 - Express physical relationships in terms of mathematical equations derived from collected data.

- Represent and describe mathematical relationships among variables using graphs and tables.
- Analyze experimental data sets using measures of central tendency such as mean, mode, and median.
- Construct and use a graph of experimental data to draw a line of best fit and identify a linear relationship between variables.
- Use computer spreadsheets, graphing and database applications to assist in quantitative analysis of data.

SUGGESTED ACTIVITIES:

- Metric System worksheets (Examples: symbol identification of metric units, converting metric units from one form to another, interpreting graphs and charts from other sources.)
- Identify large and small numbers using decimals. Divide by moving the decimal to the left or to the right. Use scientific notation to express these numbers.
- Use of metric tools (meter sticks, metric rulers, balances, graduated, and thermometers).
 - Individual metric tools hands on activities:
 - ♣ Activity: Paper Airplane Trials using measurement of length/distance. Collecting, reading, and interpreting data from trials. Graph individual/class data and analyze mean, mode, and median.
 - ♣ Create a Time Line of History of Flight- Wright Brothers to Space Travel. (Ties with Strand 5.4B)
 - Cumulative metric stations

5.4 Nature and Process of Technology

A. Science and Technology

1. How do science and technology influence each other?

- Compare and contrast science with technology, illustrating similarities and differences between these two human endeavors.

B. Nature of Technology

1. Are there ways to circumvent physical and social constraints when using technology?

- Analyze a product or system to determine the problem it was designed to solve, the design constraints, trade-offs and risks involved in using the product or system, how the product or system might fail, and how the product or system might be improved.

1. How is the overarching concept of systems related to design and technology?

- Recognize how feedback loops are used to control systems.

SUGGESTED ACTIVITIES:

- Discuss what is meant by science (facts about the natural world, how we obtain these facts using the scientific method) and technology (the application of the results of science to meet specific objectives and goals).
- Students will observe and discuss various technological feats including bridges. Students will identify the problem the technology is hoping to solve, form hypotheses, and draw conclusions on possible improvements and trade offs. This can be applied to any form of technology including pencils, staplers, cars, and buildings.
 - Students will design an Earthquake proof house. (See activity under Strand 5.8C.)

- Creation of moon house – solving problems of finding energy sources, oxygen, CO₂, H₂O, viable housing materials, and overcoming of lack of gravity. (See activity under Strand 5.9A)
- Video: Development of robotics in space for planet exploration. (See information under Strand 5.9B.)
- A very basic feed back system used everyday is a thermostat to control temperature in houses and buildings and a compass. The teacher will discuss and demonstrate the technology. Other examples of feed back systems may include: computers, applications on computer systems, transitional sunglasses, and burglar alarms.
- Lecture/Video: Exploration of the ocean depths using sonar technology. (See information under Strand 5.8D)
- Create a Time Line of History of Flight- Wright Brothers to Space Travel. (See information under Strand 5.3D)
- Using current weather forecasting and online data to track the path of a hurricane. (See information under Strand 5.8B)

5.8 Earth Science

A. Earth's Properties and Materials

1. How does understanding the properties of Earth materials and the physical laws that govern behavior lead to prediction of Earth events?

- Reinforce indicators from previous grade level.

B. Atmosphere and Weather

1. How do changes in one part of an Earth system affect other parts of the system?

- Describe conditions in the atmosphere that lead to weather systems and how these systems are represented on weather maps.

C. Processes that Shape the Earth

1. How do geologic events occurring today provide insight into Earth's past?

- Explain how Earth's landforms and materials are created through constructive and destructive processes.
- Show how successive layers of sedimentary rock and the fossils contained in them can be used to confirm the age, history, changing life forms, and geology of Earth.

D. How We Study the Earth

1. How does technology extend human senses and understanding of Earth?

- Utilize data gathered from emerging technologies (e.g., geographic information systems (GIS) and global positioning systems (GPS)) to create representations and describe processes of change on the Earth's surface.
- Explain how technology designed to investigate features of the Earth's surface

SUGGESTED ACTIVITIES:

- Layers of the Earth- Create a Model and a set of directions for constructing the model.
- Reinforcing the theory of plate tectonics/Pangaea and predicting future movements of the landforms and continents.
 - Pangaea worksheets and cut-outs

- Process of Ocean Floor Spreading Activity- 1. Create cards with various steps of process, 2. Randomly distribute cards, 3. Students will line up in order in front of class and act out steps of Ocean Floor Spreading, 4. Repeat steps for reinforcement.
- Introduction: Students will make outside weather observations during class period- wind (speed), wind direction (compass), clouds/sunny. Students will then return to class and compare their information to actual daily weather report.
- Brainstorming session on how weather affects us.
- Weather Factors (heat energy, wind, air pressure, moisture) and the tools that measure each. (Develop lesson to convey each factor.)
- Graphing activity to compare weather (high/low temperatures by month) the year students were born to today's weather.
- Air masses related to weather formations: poster activity, video clips from United Streaming.
- Using current weather forecasting and online data to track the path of a hurricane. (ties to Strand 5.4B)
- Natural Disasters Webquest – identifies causes, general locations, types of damage, impacts on people and the economy, relate disaster information specifically to how it impacts NJ, safety rules and a preparedness plan (ties to Strand 5.10B)
- Storm Stories – Teacher will identify specific types of storms, rating system, safety issues, how storm is formed, and also relate information specifically to how it impacts NJ. For story students will select a storm and create a story that depicts all aspects of that storm. Students can choose to tell the story from various positions- observers, weather reporter, and victims of the storm. Students must find pictures to compliment the story (ties to Strand 5.10B).
- Volcano Workstations
- Earthquake time lines and guided notes.
- Design an Earthquake proof house (ties to Standard 5.4B)
- Rock formations and sedimentation - Rock Identification Activity
- Identify 3 types of rocks and how they form – use rock samples, activity sheets, internet websites (suggested website: Discover How Rocks Are Formed ~ www.fi.edu/fellows/payton/rocks/create/index.html)
- Internet research on various rock formations (ex: Grand Canyon, Himalayas, Alps): Identify the various types of rocks the formation is made from and how they originated.
- Rock Cycle Activity using rock samples and flow charts.
- Fossil connections to past geological times and the shifting of Earth's structures (use of fossil collections and various activities).
- Lecture/Video: Exploration of the ocean depths using sonar technology. (ties to Strand 5.4B)

5.9 Astronomy and Space Science

A. Earth, Moon, Sun System

1. What predictable, observable patterns occur as a result of the interaction between Earth, Moon, and Sun?
2. What causes these patterns?

- Investigate the Earth, moon, and sun as a system and explain how the motion of these bodies results in the phases of the moon and eclipses.
- Explain how the regular and predictable motions of the Earth and moon produce tides.
- Explain how the tilt, rotation, and orbital pattern of the Earth relative to the sun produce seasons and weather patterns.

B. Solar System

1. How are planets and other objects in the Solar System similar to and different from Earth?
2. What implication does this have for the existence and sustaining of life?
 - Describe the physical characteristics of the planets and other objects within the solar system and compare Earth to the rest of the planets.

C. Stars

1. What characteristic does our Sun share with other stars?
 - Understand that the sun is a star and that it shares characteristics with other stars.

D. Galaxies and Universe

1. Is there order to the Universe?
 - Know that the universe consists of many billions of galaxies, each including billions of stars.

SUGGESTED ACTIVITIES:

- Use demonstrations to explain Earth's rotation and revolution in terms of day and night/seasons/year. Example: globe and lamp model, activity sheets, power point presentation.
- Comparison of Moon and Sun revolution to the Earth's revolution (video clip, model).
- Introductory lesson on moon phases followed by list of activities including moon flip book, large cards with phases~ place cards in order, moon calendar)
- Lesson on moon characteristics
 - Creation of moon house – solving problems of finding energy sources, oxygen, CO₂, H₂O, viable housing materials, overcoming of lack of gravity. (ties to Strand 5.4B)
- Introductory lesson on tides followed by list of activities including obtaining tide schedule from NJ beaches and using data to calculate the 4 tides of the day.
- Online presentations of solar and lunar eclipses.
- Identify planets and basic positions with relationship to sun and Earth.
- Comets, asteroids, and meteors: Halley's Comet video, meteorite magazine, Internet scavenger hunt.
- Video: Development of robotics in space for planet exploration. (ties to Strand 5.4B.)
- Life Cycle of a Star: activity sheet and flow chart
- Identify various constellations: activity sheet, real life observations of constellations from home
- Hubble Telescope Video (Discovery Channel) and connection with this technology to exploration and discovery of other galaxies in the universe.
 - Focus on types of galaxies, shapes, distances from Earth
 - Activity- plotting points on a graph to show shape of Milky Way Galaxy
- Optional Activity: Lesson on theory of beginning of the universe

5.10 Environmental Studies

A. Natural systems and Interactions

1. How can change in one part of an ecosystem affect change in other parts of the ecosystem?
 - Investigate the impact of catastrophic events such as forest fires, floods, and hurricanes on the environment of New Jersey.

B. Human Interactions and Impact

1. How do humans impact the diversity and stability of ecosystems?
 - Compare and contrast practices that affect the use and management of natural resources.

SUGGESTED ACTIVITIES:

- The teacher will identify naturally occurring events that impact the environment of New Jersey and point out positive and negative effects of such events.
 - Natural Disasters Webquest and Weather Stories (ties to Strand 5.8B)
- The teacher will identify the four laws of conservation: every thing must go somewhere, there is no such thing as a free lunch, nature knows best, and everything is connected. The teacher will use examples such as following the path of garbage and pollution through an ecosystem.
- Water Unit:
 - Water cycle (diagrams, poems, stories, classroom models)
 - Water filter lab
 - Acid rain lab
 - Follow local and national distribution of water systems via flow charts, maps, power point presentations.

8.1 Computer and Information Literacy

A. Basic Computer Skills and Tools

1. In a world of constant technological change, what skills should we learn?
2. How do I choose which technological tools to use and when it is appropriate to use them?
 - Input and access data and text efficiently and accurately through proficient use of other input devices, such as the mouse.
 - Create documents with advanced text-formatting and graphics using word processing.
 - Construct a simple spreadsheet, enter data, and interpret the information.
 - Design and produce a basic multimedia project.
 - Use network resources for storing and retrieving data.

B. Application of Productivity Tools

1. How can I transfer what I know to new technological situations/experiences?
2. What are my responsibilities for using technology? What constitutes misuse and how can it best be prevented?
 - Describe and practice safe Internet usage.
 - Describe and practice “etiquette” when using the Internet and electronic mail.

- Choose appropriate tools and information resources to support research and solve real world problems, including but not limited to online resources, databases, search engines and subject directories.
- Evaluate the accuracy, relevance, and appropriateness of print and non-print electronic information sources.

SUGGESTED ACTIVITIES:

- Utilize the above skills and tools while teaching science content as applicable.

8.2 Technology Education

A. Nature and Impact of Technology

1. Can we control the pace at which technology is created? Should we, even if we can?
 - Describe the nature of technology and the consequences of technological activity.
 - Describe how components of a technological product, system, or environment interact.
 - Describe how one technological innovation can be applied to solve another human problem that enhances human life or extends human capability.

B. Design Process and Impact Assessment

1. How does technology extend human capabilities? What are the positive and negative consequences of technology? Should technologies that produce negative impact continue to be used?
2. When are the most sophisticated tool required and when and the simplest tools best?
 - Use hands-on activities to analyze products and systems to determine how the design process was applied to create a solution.
 - Select and safely use appropriate tools and materials in analyzing, designing, modeling or making a technological product, system or environment.

C. Systems in the Designed World

1. Can a system continue to operate with a missing or malfunctioning component?
2. Is it always beneficial to use the most economical material/materials for production of a technological product?
 - Explain technological advances in medical, agricultural, energy and power, information and communication, transportation, manufacturing, and construction technologies.
 - Explain reasons why human-designed systems, products, and environments need to be monitored, maintained, and improved to ensure safety, quality, cost efficiency, and sustainability.
 - Explain the functions and interdependence of subsystems such as waste disposal, water purification, electrical, structural, safety, climatic control, and communication.

SUGGESTED ACTIVITIES:

- See Science Standard 5.4

Instructional Strategies (may include but are not limited to):

Lectures
Modeling Lab Procedure
Student Driven Labs and Experiments
Guest speakers/Video Conferencing
Overhead presentations, PowerPoint presentation, and/or Smart board lessons\
WebQuests
Podcasts
Wikis, Blogs, Nings, Voicethreads, Twitter, etc.
Brainstorming
Video presentations, United Streaming Clips
Use of NJASK materials
Quizzes/tests
Field trips
Individual class projects
Student oral presentations
Cooperative learning groups
Instructional and Review Games
Problem solving activities
Internet research
Text, magazine and internet readings
Activity sheets
Utilization of rubrics

Evaluation/Assessment of Students (may include but are not limited to):

Observation
Class participation
Notebooks and packets
Student projects
Lab reports
Homework
Writing Activities (stories, compare/contrast, poems, response to prompts)
Activity Sheets (Worksheets, graphs, tables, charts, etc.)
Research Projects
Quizzes/tests
Power Points
Communication platforms (Voicethreads, Wikis, Blogs, Nings, etc.)

Evaluation/Assessment of Curriculum:

This course of study will be evaluated/assessed by instructional staff during the first year of implementation for the purpose of necessary revision at the end of the first year. In addition, this course of study will be reviewed according to the Five-Year Curriculum Review schedule (see attached).

Resources/Bibliography:

Exploring Earth Science (Prentice -Hall, Inc. 2000)

Measuring Up on the New Jersey NJASK book (The Peoples Publishing Group, Inc.)

Measuring Up on the New Jersey ASK Diagnostic Practice Test 1 – 3 (The Peoples Publishing Group, Inc.)

Preparing for the New Jersey ASK (Amsco School Publishing, Inc.)

New Jersey ASK Student Preparation Booklet (New Jersey Department of Education)

Internet

Library and Technology Labs

Science-based journals and magazines

Non-fiction trade books

Lab Equipment

Teacher-created resources