

BERKELEY HEIGHTS PUBLIC SCHOOLS
BERKELEY HEIGHTS, NEW JERSEY

**COLUMBIA MIDDLE SCHOOL
SCIENCE DEPARTMENT**

CONCEPTS OF EARTH SCIENCE

Curriculum Guide

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Mrs. Judith Rattner, Superintendent
Mr. Matthew Jennings, Assistant Superintendent
Mr. Vincent Parisi, District Supervisor

Developed by: Carol Faillace
Joseph Mark

This curriculum may be modified through varying techniques,
Strategies, and materials, as per an individual student's
Individualized Educational Plan (IEP).

Approved by the Berkeley Heights Board of Education
at the regular meeting held on 10/20/2005.

TABLE OF CONTENTS

	Page
Philosophy and Rationale.....	1
Course Proficiencies.....	2
Course Objectives	2
Student Proficiencies	4
Methods of Evaluation.....	6
Course Outline/Student Objectives	7
Suggested Audio Visual/Computer Aids.....	15
Suggested Materials	16

PHILOSOPHY/RATIONALE

The goal of this program is to develop scientifically literate students who are capable of making informed decisions about current scientific and environmental issues that impact their lives. Students should recognize that Earth, as a system, is the result of the interaction between the two most basic components: matter and energy. The cycles in this system and their interactive effects will be examined.

Understanding the interactions in Earth Science is accomplished through the knowledge of these major topics:

- Earth as a system: the interrelation of the atmosphere, the hydrosphere, the geosphere and the biosphere
- Earth's geologic history
- Earth's natural resources, including minerals, Earth's oceans and energy sources
- Earth's place in the solar system and the universe

In addition, students should be able to think critically, apply concepts to new situations, analyze and evaluate issues, communicate their ideas to others, interpret and construct tables and graphs, use technology when appropriate, and develop competency in using scientific tools.

Students enrolled in the *Concepts of Earth Science* course will be expected to complete laboratory investigations that stress higher-order thinking skills and cooperative group interaction. Examples of such investigations include the interpretation of topographic and weather maps, construction of conceptual models, and various applications of the scientific method. Students will be expected to interpret and analyze data, draw conclusions, and communicate their ideas in laboratory reports.

Concepts of Earth Science is intended for students in Grade 8 who have met District-developed criteria. It is a comprehensive course that covers astronomy, geology, meteorology, and oceanography.

COURSE PROFICIENCIES

COURSE OBJECTIVES

1. To identify and solve problems related to Earth Science.
5.1/8B1
2. To correctly use scientific instruments and apparatus and demonstrate the skills necessary to conduct science investigations.
5.1/8B1-3
C1,2
3. To recognize the development of scientific theories over time and the contributions of men and women from different cultures.
5.2/8A1-3
B1,2
4. To appreciate the role of mathematics in the study of Earth Science.
5.3/8A1
B1
C1
D1
5. To develop an understanding of the composition, properties, and interactions of matter.
5.6/8A1-4
B1-4
6. To comprehend Earth's properties and composition, including minerals, rocks and soil. Also to recognize how scientists have developed an understanding of Earth's geologic history by studying these materials along with fossil remains.
5.8/8C1,2
7. To describe the composition, circulation, and distribution of the Earth's oceans and marine environments.
5.8/6B1
8. To understand how weather is caused by atmospheric changes and to study the effects of weather upon the Earth.
5.8/8B1
9. To acquire a knowledge of Earth's physical features and how they are represented on maps and models.
5.8/8D2

STUDENT PROFICIENCIES

The student will be able to:

1. Solve problems cooperatively and creatively using the scientific method. (5.1/8B1-3)
2. Gather, organize and summarize data in tables and graphs. Analyze, interpret, conclude, and communicate results in a lab report. (5.1/8B3)
3. Represent data numerically and graphically using appropriate S. I. units and with the appropriate degree of precision. (5.3/8D1-4)
4. Design and conduct a controlled scientific experiment, practicing proper safety procedures. (5.1/8C1,2)
5. Recognize the contributions of scientists from different cultures. (5.2/8A1-3)
6. Understand that all matter is composed of atoms and combinations of atoms and that the atom is composed of elementary particles called protons, neutrons, and electrons. (5.6/8A1)
7. Develop knowledge of the physical and chemical properties of the elements and understand that the Periodic Table is arranged in a manner to reflect the common properties of some elements in terms of their structure and reactivity. (5.6/8A3)
8. Apply one's knowledge of the Periodic Table and an understanding of how elements combine to form compounds and mixtures through chemical and physical changes. (5.6/8A4, B1,2)
9. Describe the composition and formation of minerals, rocks, and soil as related to their chemical nature. (5.8/8C1,2)
10. Integrate their knowledge of mineral, rock, and soil formation in a manner that will give them an understanding of the Earth's geologic record. (5.8/8C1,2)
11. Describe the development of weather systems and how these systems are represented on weather maps. (5.8/8B1)
12. Interpret information about physical features on the Earth's surface using different types of maps. (5.8/8B1)
13. Explain the relationship of the Earth's tilt, rotation, and orbital pattern to the seasons, tides and weather patterns. (5.9/8A1-3)
14. Compare and contrast refracting and reflecting telescopes. (5.9/8A1-3, B1, C1, D1)

STUDENT PROFICIENCIES (continued)

15. Compare and contrast the planets and minor bodies of the solar system. (5.9/8B1)
16. Explain the impact of environment on ecosystems. (5.10/8A1)
17. Summarize and evaluate scientific theories concerning atomic theory, origins of the solar system, extinction of the dinosaurs, plate tectonics, etc. (5.5/8B2; 5.6/8A1; 5.9/8B1,2)
18. Incorporate technology in identifying a problem, researching and developing ideas, and sharing solutions with others. (5.4/8A1)
19. Recognize and apply the action of forces on objects on Earth and in space. (5.7/8A1,2)
20. Describe the transfer of energy from the sun via radiation, conduction, and convection. (5.7/8B1,2)
21. To identify career opportunities in science. (9.1/8A1-7)

METHODS OF EVALUATION

Methods of evaluation that may be used include but are not limited to:

1. Homework
2. Oral presentations
3. Class participation/work
4. Tests and quizzes
5. Demonstrations
6. Lab reports
7. Research reports
8. Projects
9. Final exam

SCOPE AND SEQUENCE
COURSE OUTLINE/STUDENT OBJECTIVES

The student will be able to:

N. J. Core Curriculum Standards/ Grade	Strands & Indicators	Course Outline/Student Objectives
5.1/8 5.2/8 5.4/8 5.10/8 9.1/8 9.2/8	B1,2,3 A1,3 B1 A10 A1-5 F1-3	I. Introduction To Earth Science A. What is Earth Science 1. Describe two cultures that contributed to modern scientific study 2. Name the four branches of Earth Science 3. List and describe careers associated with each of the branches of Earth Science 4. Discuss how Earth scientists help us understand the world around us B. Science as a Process 1. Identify the steps that make up the scientific method 2. Differentiate among the following measurements and list the appropriate S. I. units: length, mass, weight, area, volume, density, and temperature 3. Accurately measure mass, volume, and density 4. Analyze how scientific thought changes as new information is collected 5. Explain how science affects society 6. Explain the necessity of safety in the lab
5.7/8 5.8/8 5.10/8	A2 B1 A A1	II. Earth As A System A. Earth: A Unique Planet 1. Describe the physical characteristics of Earth 2. Summarize Newton’s laws of motion and gravitation B. Energy in Earth Science 1. List the characteristics of Earth’s four major spheres 2. Identify the two main sources of energy in the Earth system and how matter and energy cycle on Earth C. Ecology 1. Define ecosystem and identify some factors that control the balance of an ecosystem 2. Summarize how energy is transferred through an ecosystem

		<p>II. Earth As A System (continued)</p> <p>3. Describe how ecosystems respond to environmental change</p>
5.6/8	A1,2,3,4 B1,2,3,4	<p>III. Composition Of The Earth</p> <p>A. Matter</p> <ol style="list-style-type: none"> 1. Compare the chemical and physical properties of matter 2. Define atom and element 3. Describe the basic structure of an atom 4. Explain the arrangement of elements in the Periodic Table <p>B. Combinations of Atoms</p> <ol style="list-style-type: none"> 1. Define compound and molecule 2. Interpret and balance chemical equations 3. Contrast compound and mixture 4. Describe two ways that electrons form chemical bonds between atoms
5.4/8	B1	<p>IV. Models Of The Earth</p> <p>A. Finding Locations on Earth</p> <ol style="list-style-type: none"> 1. Distinguish between latitude and longitude 2. Explain how latitude and longitude can be used to locate places on Earth's surface <p>B. Mapping Earth's Surface</p> <ol style="list-style-type: none"> 1. Explain two ways that scientists get data to make maps 2. Describe the characteristics and uses of three types of map projections 3. Summarize how to use keys, legends, and scales to read maps <p>C. Types of Maps</p> <ol style="list-style-type: none"> 1. Explain how elevation and topography are shown on a map 2. Describe the types of information shown in geologic maps and soil maps
5.7/8 5.9/8	B1,4 A1,3 D1	<p>V. Studying Space</p> <p>A. Viewing the Universe</p> <ol style="list-style-type: none"> 1. Describe characteristics of the universe in terms of time, distance, and organization 2. Identify the visible and non-visible parts of the electromagnetic spectrum 3. Compare refracting and reflecting telescopes 4. Explain how telescopes for non-visible electromagnetic radiation differ from light telescopes

		<p>V. Studying Space (continued)</p> <p>B. Movements of Earth</p> <ol style="list-style-type: none"> 1. Describe evidences for Earth's rotation and revolution 2. Summarize how Earth's rotation and revolution provide a basis for measuring time 3. Explain how the tilt of the Earth's axis and Earth's movement cause the seasons
5.9/8	A1,2 B1	<p>VI. Minor Bodies Of The Solar System</p> <p>A. Earth's Moon</p> <ol style="list-style-type: none"> 1. Describe the physical characteristics of the moon 2. Summarize three stages of the moon's formation <p>B. Movements of the Moon</p> <ol style="list-style-type: none"> 1. Describe the shape of the Moon's orbit around Earth 2. Explain why eclipses occur 3. Describe the appearance of the phases of the moon 4. Explain how the movements of the moon affect tides on Earth <p>C. Satellites of Other Planets</p> <ol style="list-style-type: none"> 1. Describe the satellites of the planets other than Earth 2. Compare the characteristics of the rings of Saturn with the rings of the other outer planets <p>D. Asteroids, Comets, and Meteoroids</p> <ol style="list-style-type: none"> 1. Describe the physical characteristics of asteroids and comets 2. Describe where the Kuiper Belt is located 3. Compare and contrast meteoroids, meteors, and meteorites 4. Explain the relationship between the Oort cloud and comets
5.7/8	B1	<p>VII. The Sun</p> <p>A. Structure of the Sun</p> <ol style="list-style-type: none"> 1. Explain how the sun converts matter into energy in its core 2. Describe the three layers of the sun's atmosphere <p>B. Solar Activity</p> <ol style="list-style-type: none"> 1. Explain how sunspots are related to powerful magnetic fields on the sun 2. Compare prominences, solar flares, and coronal ejections 3. Describe how the solar wind can cause auroras on Earth

5.9/8	C1 D1	<p>VIII. Stars, Galaxies And The Universe</p> <p>A. Characteristics of Stars</p> <ol style="list-style-type: none"> 1. Describe how astronomers determine the composition, temperature, and movement of stars 2. Explain the difference between absolute magnitude and apparent magnitude <p>B. Stellar Evolution</p> <ol style="list-style-type: none"> 1. Describe the evolution of a star 2. Interpret the Hertzsprung- Russell Diagram <p>C. Star Groups</p> <ol style="list-style-type: none"> 1. Describe the characteristics that identify a constellation 2. Describe the three main types of galaxies 3. Explain how a quasar differs from a typical galaxy
5.7/8 5.8/8	B1 B1	<p>IX. The Atmosphere</p> <p>A. Characteristics of the Atmosphere</p> <ol style="list-style-type: none"> 1. Describe the composition of Earth's atmosphere 2. Explain how two types of barometers work 3. Identify the layers of the atmosphere 4. Identify two effects of air pollution <p>B. Solar Energy and the Atmosphere</p> <ol style="list-style-type: none"> 1. Explain how radiant energy reaches Earth 2. Summarize the processes of radiation, conduction, and convection <p>C. Atmospheric Circulation</p> <ol style="list-style-type: none"> 1. Explain the Coriolis effect 2. Describe the global patterns of air circulation and name three global wind belts 3. Identify two factors that form local wind patterns
5.8/8	B1	<p>X. Water In The Atmosphere</p> <p>A. Atmospheric Moisture</p> <ol style="list-style-type: none"> 1. Explain how heat energy affects the changing phases of water 2. Explain what absolute humidity and relative humidity are, and describe how they are measured 3. Describe what happens when the temperature of air decreases to the dew point or below the dew point <p>B. Clouds and Fog</p> <ol style="list-style-type: none"> 1. Describe the conditions that are necessary for clouds to form 2. Explain the processes of cooling that can lead to the formation of clouds

		<p>X. Water In The Atmosphere (continued)</p> <ol style="list-style-type: none"> 3. Describe the three types of clouds 4. Describe four ways in which fog can form <p>C. Precipitation</p> <ol style="list-style-type: none"> 1. Identify the four forms of precipitation 2. Compare the two processes that cause precipitation 3. Describe two ways that precipitation is measured 4. Explain how rain can be produced artificially
5.8/8	B1	<p>XI. Weather</p> <p>A. Air Masses</p> <ol style="list-style-type: none"> 1. Explain how an air mass forms 2. List the four main types of air masses 3. Describe how air masses affect the weather of North America <p>B. Fronts</p> <ol style="list-style-type: none"> 1. Compare the characteristic patterns of cold fronts with those of warm fronts 2. Describe how a mid-altitude cyclone forms 3. Describe the development of hurricanes, thunderstorms, and tornadoes <p>C. Weather Instruments</p> <ol style="list-style-type: none"> 1. Identify four instruments that measure lower-atmospheric weather conditions 2. Explain how computers help scientists understand weather <p>D. Forecasting the Weather</p> <ol style="list-style-type: none"> 1. Explain how weather stations communicate weather data 2. Explain how a weather map is created 3. Explain how computer models help meteorologists forecast the weather
5.8/8	B1	<p>XII. Climate</p> <p>A. Factors That Affect Climate</p> <ol style="list-style-type: none"> 1. Identify two major factors used to describe climate 2. Explain how latitude determines the amount of solar energy received on Earth 3. Describe how the different rates at which land and water are heated affect climate 4. Explain the effects of topography on climate
5.8/8	A1	<p>XIII. Minerals Of The Earth's Crust</p> <p>A. What Is a Mineral</p> <ol style="list-style-type: none"> 1. Define mineral 2. Compare the two main groups of minerals

		<p>XIII. Minerals Of The Earth's Crust (continued)</p> <ol style="list-style-type: none"> 3. Identify the six types of silicate crystalline structures 4. Describe three common non-silicate crystalline structures <p>B. Identifying Minerals</p> <ol style="list-style-type: none"> 1. Describe seven physical properties that help distinguish one mineral from another 2. List five special properties that may help identify certain minerals
5.8/8	C1,2	<p>XIV. Rocks</p> <p>A. Rocks and the Rock Cycle</p> <ol style="list-style-type: none"> 1. Identify the three major types of rock and explain how each type forms 2. Summarize the steps in the rock cycle 3. Explain Bowen's reaction series 4. Summarize the factors that affect the stability of rocks <p>B. Igneous Rock</p> <ol style="list-style-type: none"> 1. Summarize three factors that affect whether rock melts 2. Describe how the cooling rate of magma and lava affects the texture of igneous rock 3. Classify igneous rocks according to their composition and texture 4. Describe intrusive and extrusive igneous rock structures <p>C. Sedimentary Rock</p> <ol style="list-style-type: none"> 1. Explain the processes of compaction and cementation 2. Describe how chemical and organic sedimentary rocks form 3. Describe how clastic sedimentary rock forms 4. Identify examples of sedimentary rock <p>D. Metamorphic Rock</p> <ol style="list-style-type: none"> 1. Describe the process of metamorphism 2. Explain the difference between regional and contact metamorphism 3. Distinguish between foliated and nonfoliated metamorphic rocks and give examples of each
5.8/8	C1	<p>XV. Weathering And Soil</p> <p>A. Weathering Processes</p> <ol style="list-style-type: none"> 1. Identify three agents of mechanical and chemical weathering

		<p>XV. Weathering And Soil (continued)</p> <ol style="list-style-type: none"> 2. Compare mechanical and chemical weathering processes 3. Describe four chemical reactions that decompose rock <p>B. Rates of weathering</p> <ol style="list-style-type: none"> 1. Explain how rock composition affects the rate of weathering 2. Discuss how surface area affects the rate at which rock weathers 3. Describe the effects of climate and topography on the rate of weathering <p>C. Soil</p> <ol style="list-style-type: none"> 1. Summarize how soils form 2. Explain how the composition of parent rock affects soil composition 3. Describe the characteristic layers of mature residual soils 4. Predict the type of soil that will form in arctic and tropical climates
5.8/8	C2	<p>XVI. The Rock Record</p> <p>A. Determining Relative Age</p> <ol style="list-style-type: none"> 1. State the principle of uniformitarianism 2. Explain how the law of superposition can be used to determine the relative age of rock 3. Compare three types of unconformities 4. Apply the law of crosscutting relationships to determine the relative age of rocks <p>B. Determining Absolute Age</p> <ol style="list-style-type: none"> 1. Summarize the limitations of using the rates of erosion and deposition to determine the absolute age of rock formation 2. Describe the formation of varves 3. Explain how the process of radioactive decay can be used to determine the absolute age of rocks <p>C. The Fossil Record</p> <ol style="list-style-type: none"> 1. Describe four ways in which entire organisms can be preserved as fossils 2. List five examples of fossilized traces of organisms 3. Describe how index fossils can be used to determine the age of rocks <p>D. A View of Earth's Past</p> <ol style="list-style-type: none"> 1. Summarize how scientists worked together to develop the geologic column

		<p>XVI. The Rock Record (continued)</p> <ol style="list-style-type: none"> 2. List the major divisions of geologic time 3. Summarize how evolution is related to geologic change <p>E. Summarize the principal life forms and geologic changes during the four eras</p>
<p>5.6/8 5.7/8 5.9/8</p>	<p>A2,4 A1 A2</p>	<p>XVII. Ocean Water</p> <p>A. Properties of Ocean Water</p> <ol style="list-style-type: none"> 1. Describe the chemical composition of ocean water 2. Describe the salinity, temperature, density, and color of ocean water <p>B. Ocean Currents</p> <ol style="list-style-type: none"> 1. Describe how wind patterns, the rotation of the Earth, and continental barriers affect surface currents in the ocean 2. Identify the major factor that determines the direction in which a surface current circulates 3. Explain how differences in the density of ocean water affect the flow of deep currents 4. Describe the formation of waves and the factors that affect wave size 5. Explain the different types of wave action
<p>5.10/8</p>	<p>B1</p>	<p>XVIII. Resources and Energy</p> <p>A. Mineral Resources</p> <ol style="list-style-type: none"> 1. Summarize Earth's mineral resources and describe how minerals are removed from compounds 2. Describe how humans use mineral resources <p>B. Nonrenewable Energy</p> <ol style="list-style-type: none"> 1. Describe how fossil fuels formed and how they are removed from Earth 2. Summarize the processes of nuclear fission and nuclear fusion and explain how nuclear fission generates electricity <p>C. Renewable Energy</p> <ol style="list-style-type: none"> 1. Describe sources of renewable energy 2. Describe how renewable sources can substitute for fossil fuels

SUGGESTED AUDIO VISUAL/COMPUTER AIDS

1. LCD Projector
2. VCR
3. Laser Disc player
4. Overhead projector
5. Microsoft Word Software
6. Microsoft PowerPoint Software
7. Microsoft Internet Explorer

SUGGESTED MATERIALS

Resources for Students

Text:

Allison, Mead A., Arthur T. DeGaetano, Jay M. Pasachoff
Earth Science
Holt, Rinehart and Winston
2006

Resources for Teacher

Text:

Allison, Mead A., Arthur T. DeGaetano, Jay M. Pasachoff
Earth Science Teacher's Edition
Holt, Rinehart and Winston
2006

Supplemental Materials:

Teacher's Resource Books for *Earth Science*