

## HCPS III 8<sup>th</sup> Grade Science Benchmarks Addressed

Ola Ka Honua is aligned to HCPS III 8<sup>th</sup> Grade Science Benchmarks. It addresses all Science content and performance indicators in this area. When the current (2005) benchmarks were published, each lesson (and their objectives) was revised and rewritten to align with the new HCPS III benchmarks. The following list identifies how Ola Ka Honua addresses each benchmark:

### **Benchmark SC.8.1.1**

*Determine the link(s) between evidence and the conclusion(s) of an investigation*

Ola Ka Honua meets this benchmark by guiding students through many hands-on scientific investigations. In each such lesson students are asked to collect and/or analyze evidence (data) to reach a conclusion. Lessons meeting this benchmark include:

Unit 1: "Introduction to the Scientific Method"

Unit 2: "Liquid Layers"

    "Convection Current"

    "Putting Earth in its Place"

Unit 3: "Pangaea Puzzle"

    "Pangaea Science Theories"

Unit 4: "Hess's Method"

Unit 5: "Lava Flows"

    "Tephra Catapults"

Unit 6: "Rate of Plate Movement"

Unit 7: "Measuring Magma Chamber Changes"

    "Determining Lava Temperatures"

Unit 8: "Locating the Epicenter"

### **Benchmark SC.8.1.2**

*Communicate the significant components of the experimental design and results of a scientific investigation*

Ola Ka Honua meets this benchmark by guiding students through many hands-on scientific investigations. Students are asked to complete a prompted lab report as they work with each scientific investigation lesson. These reports require students to demonstrate understanding of the significant components of experimental design and investigation results by developing a hypothesis in response to a testable question, following a detailed experimental procedure, collecting, recording and analyzing data, writing conclusions, explaining how conclusions were reached, and applying knowledge gained through the investigation to other related concepts and situations. Lessons meeting this benchmark include:

Unit 1: "Introduction to the Scientific Method"

Unit 2: "Liquid Layers"

    "Convection Current"

    "Putting Earth in its Place"

Unit 3: "Pangaea Puzzle"

- Unit 4: “Hess’s Method”
- Unit 5: “Lava Flows”
  - “Tephra Catapults”
- Unit 6: “Rate of Plate Movement”
- Unit 7: “Measuring Magma Chamber Changes”
  - “Determining Lava Temperatures”
- Unit 8: “Locating the Epicenter”

**Benchmark SC.8.2.1**

*Describe significant relationships among society, science, and technology and how one impacts the other*

Ola Ka Honua meets this benchmark by introducing students to a variety of technological instruments used by scientists to better understand volcanic eruptions, emissions, flow boundaries and magma chamber inflation/deflation. The curriculum uses hands-on lessons and an interactive DVD to demonstrate how these instruments are used by scientists and how understanding of these processes benefits society (i.e. Understanding where volcanic vents are located combined with knowledge of scientifically gauged prevailing wind patterns guides urban development.) Lessons meeting this benchmark include:

- Unit 4: “Earth’s Crust Scavenger Hunt”
  - “Hess’s Method”
- Unit 7: “Monitoring Volcanoes Scavenger Hunt”
  - “Measuring Magma Chamber Changes”
  - “Water Tube Tiltmeters”
  - “GPS Mapping”
  - “Using Satellite Images”
  - “Pace and Compass”
  - “Determining Lava Temperatures”
  - “P-Waves and S-Waves”
  - “Monitoring Volcanoes Vocabulary”
- Unit 8: “Tracking Ash Plumes”
  - “Locating the Epicenter”
  - “Carbon Dioxide”
  - “Volcanic Hazards and Risks”
  - “Volcano Hazards Vocabulary”
  - “Volcano Hazards Scavenger Hunt”

**Benchmark SC.8.2.2**

*Describe how scale and mathematical models can be used to support and explain scientific data*

Ola Ka Honua addresses this benchmark by requiring students to create and/or use several scale models and representations, including a scale model of the solar system, a scale map of the school grounds, and scaled images of ash plumes and lava flows. Lessons addressing this benchmark include:

Unit 2:	“Putting Earth in its Place”
Unit 7:	“GPS Mapping”
	“Using Satellite Images”
	“Pace and Compass”
Unit 8:	“Tracking Ash Plumes”
Cross Curricular Lessons:	“Scale Drawing of Earth”
	“Size of Earth”

### **Benchmark SC.8.5.1**

*Describe how changes in the physical environment affect the survival of organisms*

Several cross curricular Ola Ka Honua lessons address this benchmark by teaching students about the unique adaptations of Hawaii’s animals to their environment. Through research, role-playing games and hands-on activities, students learn how changes in Hawaii’s environment impact native birds and animals. Lessons addressing this benchmark include:

Cross Curricular Lesson:	“Bird Beak Game”
	“Hydrothermal Vents”
	“Owl Pellet Book”
	“Cricket Lab”
	“Native Plants and Animals”
	“Future Creature Book”
	“Environmental Vocabulary Book”
	“Environmental Story”

### **Benchmark SC.8.6.1**

*Explain the relationship between the color of light and wavelength within the electromagnetic spectrum*

Ola Ka Honua lays the foundation for addressing this benchmark within the Monitoring Volcanoes unit of the CD-ROM. Using interactive graphics and voice-over text, the CD-ROM demonstrates and describes how ultraviolet spectrometers are used to measure the SO<sub>2</sub> released by a volcano. Two classroom lessons are under development to broaden student understanding of this concept.

Unit 7: “SO <sub>2</sub> --Clouds of Blue”
“Ultraviolet Spectrometers—Tools of Daylight”

### **Benchmark SC.8.6.2**

*Explain how seismic waves provide scientists with information about the structure of Earth's interior*

Ola Ka Honua addresses this benchmark with hands-on lessons to help students understand the differences between P-waves and S-waves and how seismic waves measured by seismometers help scientists determine the epicenter of earthquakes. Lessons addressing this benchmark include:

Unit 7: “P-Waves and S-waves”
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## Unit 8: “Locating the Epicenter”

### **Benchmark SC.8.6.3**

*Identify the characteristics and properties of mechanical and electromagnetic waves*

Ola Ka Honua lays the foundation for understanding mechanical and electromagnetic waves with the CD-ROM discussions of: P-waves and S-waves and the seismometers used to record them; and volcanic emissions and the ultraviolet spectrometers used to measure them. These concepts are expanded to include properties of mechanical and electromagnetic waves in general in the following draft lessons under development:

Unit 7: “SO<sub>2</sub>--Clouds of Blue”

“UV Spectrometers—Tools of Daylight”

“Waves We Measure—Mechanical or Electromagnetic?”

### **Benchmark SC.8.7.1**

*Explain that every object has mass and therefore exerts a gravitational force on other objects*

The foundation for understanding mass and gravitational force is laid when students measure rock density within Unit 2 of the Ola Ka Honua curriculum, and strengthened when they calculate the differences between the distance a large mass and a small mass travel from a volcanic vent in Unit 5. This foundation is expanded upon in Unit 10, which is under development. Lessons within unit 10 describe the gravitational force exerted by other volcanic bodies in the solar system, and how planet mass determines this gravitational force.

### **Benchmark SC.8.8.1**

*Compare the characteristics of the three main types of rocks*

Ola Ka Honua addresses this benchmark using new lessons developed with Hawaii teacher Jim Cox. These lessons guide students in creating a foldable diagram illustrating the characteristics of igneous, sedimentary and metamorphic rocks, then use this diagram to help them identify rock samples based on visible characteristics.

Unit 7: “Rocks and Rock Cycle Pocket Guide”

“Identifying Rocks”

### **Benchmark SC.8.8.2**

*Illustrate the rock cycle and explain how igneous, metamorphic, and sedimentary rocks are formed*

This benchmark also is addressed within the rock lessons developed with the assistance of Jim Cox. The outside of the foldable diagram students create illustrates rock characteristics, while the inside includes a drawing of the rock cycle and illustrations of how igneous, metamorphic and sedimentary rocks are formed.

Unit 7: “Rocks and Rock Cycle Pocket Guide”

**Benchmark SC.8.8.3**

*Describe how the Earth's motions and tilt on its axis affect the seasons and weather patterns*

The Hazard Simulator on the Ola Ka Honua CD-ROM sets the stage for understanding how weather and seasons relate to study of volcanoes by explaining various volcanic hazards exacerbated by ice-caps and heavy rainfall. Unit 10: Volcanoes in Space, which is under development, expands upon this concept to help students describe how Earth's (and other planet's) motions and tilt on its axis affect seasons and weather patterns, enabling students to predict seasonal eruption hazards in different parts of the world.

Unit 10: "Hazards of the Tilt-A-World"  
"3-D Planets"

**Benchmark SC.8.8.4**

*Explain how the sun is the major source of energy influencing climate and weather on Earth*

In addition to the Hazard Simulator on the Ola Ka Honua CD-ROM, classroom lessons within Ola Ka Honua's Unit 8 introduce the importance of weather to understanding volcanic hazards and risks. Within these hands-on lessons, students are asked to track volcanic ash plumes carried by the wind, and to study wind patterns and volcanic vent locations to identify safe sites for Big Island construction projects. These lessons lay the groundwork for understanding connections between weather, climate and volcanic events. The Volcanoes in Space unit of the Ola Ka Honua CD-ROM (still under development) features an interactive "Fun Sun Facts" page explaining the sun's role as an energy source influencing climate and weather. The following accompanying classroom lessons further explain this role:

Unit 10: "Hazards of the Tilt-A-World"

**Benchmark SC.8.8.5**

*Explain the concepts of continental drift and plate tectonics*

Ola Ka Honua meets this benchmark with extensive hands-on lessons regarding plate tectonics and continental drift. Students working with Ola Ka Honua curriculum develop a clear understanding of the history of plate tectonics, the variety of plates and plate boundaries on Earth's surface, the forces that drive plate movement, volcano formation at plate boundaries etc. Many lessons within the program address this concept in some way, as it is an essential concept in understanding volcanic processes. Lessons meeting this benchmark include:

Unit 2: "Convection Current"

Unit 3: "Active Earth Scavenger Hunt"

"Pangaea Puzzle"

"Pangaea Science Theories"

"Plate Tectonics"

"Decoding Plate Names"

"Active Earth Vocabulary"

- Unit 4: “Earth’s Crust Scavenger Hunt”
  - “Hess’s Method”
  - “Mollie Magma”
  - “Table Tectonics”
  - “Earth’s Crust Vocabulary”
- Unit 5: “Volcanoes Scavenger Hunt”
  - “Drawing Magma”
  - “Volcanoes Vocabulary”
- Unit 6: “Hawaii Volcanoes Scavenger Hunt”
  - “Toothpaste Chain Volcanoes”
  - “Pacific Plate Movement”
  - “Rate of Plate Movement”
  - “Volcano: the Storyboard”
  - “Hawaii Volcanoes Vocabulary”

**Benchmark SC.8.8.6**

*Explain the relationship between density and convection currents in the ocean and atmosphere*

Ola Ka Honua addresses several concepts related to density and convection currents within hands-on classroom lessons. In these lessons students are required to measure density, create convection current by heating a beaker of water, and determine the relative densities of several liquids. Lessons are under development which will expand these understandings of density and convection within earth’s layers to density and convection within the ocean and atmosphere.

- Unit 2: “Liquid Layers”
  - “Determining Density”
  - “Convection Current”

**Benchmark SC.8.8.7**

*Describe the physical characteristics of oceans*

Ola Ka Honua addresses some physical characteristics of oceans (ocean depth and ocean floor spreading centers) through hands-on lessons. Lessons addressing this benchmark include:

- Unit 4: “Hess’s Method”
  - “Table Tectonics”

**Benchmark SC.8.8.8**

*Describe the composition of objects in the galaxy*

Ola Ka Honua currently addresses the formation of the sun, Earth and other planets in our solar system using the Ola Ka Honua CD-ROM (Unit 2). The curriculum also guides students through hands-on and written activities related to the composition of Earth. The final instructional unit of Ola Ka Honua: “Volcanoes in Space”, which will be completed in 2007, will meet this benchmark by expanding student understanding of the

composition of objects in the galaxy to include the sun, other planets, moons, comets, asteroids etc, as the composition of these items determines whether or not volcanoes occur there. Current lesson addressing this benchmark include:

- Unit 2: “Planet Earth Scavenger Hunt”
  - “Clay Model Earth”
  - “Earth’s Elements and Temperatures”
  - “Liquid Layers”
  - “Determining Density”
  - “Convection Current”
  - “Planet Earth Vocabulary”

### **Benchmarks SC.8.8.9 – SC.8.8.12**

*Explain the predictable motions of the Earth and moon*

*Compare the characteristics and movement patterns of the planets in our solar system*

*Describe the major components of the universe*

*Describe the role of gravitational force in the motions of planetary systems*

Unit 10: Volcanoes in Space, which is under development, addresses these benchmarks through hands-on solar system modeling activities, an interactive CD-ROM unit, and research activities to help students understand the structure and components of the universe, knowledge students need before they can understand how volcanoes can form and exist on other planets.

D2. Scientific investigation lessons are included in every unit of Ola Ka Honua instruction. These lessons require students to perform inquiry by making hypotheses, performing experiments, collecting and analyzing data, forming and defending conclusions, and applying new knowledge gained through investigation to related concepts. Each scientific investigation lesson follows a format developed for Ola Ka Honua by Hawaii teachers during a meeting with the curriculum development team. In this meeting teachers expressed a need for more classroom lessons enabling students to practice the abilities of inquiry. They insisted that the lessons follow a specific format to hone student inquiry skills. Though the teachers were from a variety of Hawaii schools, and used a variety of instructional methods, they were able to agree that Ola Ka Honua scientific investigation lessons should include: (1) a Testable Question; (2) Background Information about the concept; (3) a student formulated Hypothesis; (4) an Experiment including a materials list and detailed procedure; (5) Data Collection performed by the student where possible; (6) student Analysis of Data; (7) a student formed Conclusion; and (8) Further Questions posed by the teacher or the students themselves. The following scientific investigation lessons can be found in the Ola Ka Honua curriculum hardcopy that accompanies this self-assessment:

Unit 1: “Introduction to the Scientific Method”

Unit 2: “Liquid Layers,” “Convection Current,” and “Putting Earth in its Place”

Unit 3: “Pangaea Puzzle”

Unit 4: “Hess’ Method”

Unit 5: “Lava Flows,” and “Tephra Catapults”

Unit 6: “Rate of Plate Movement”

Unit 7: “Measuring Magma Chamber Changes,” and “Determining Lava Temperatures”

Unit 8: “Locating the Epicenter”