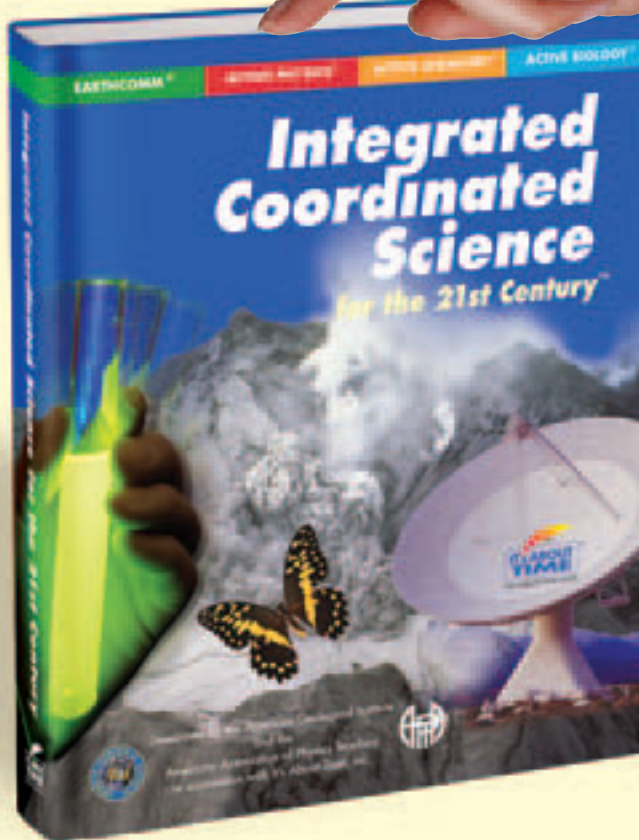


# Imagine having everything you need to meet the California State Frameworks at your fingertips.

Remember how you had to search all over the place to find the content you needed for an **Integrated Coordinated Science Year 1** course, and then, make sense of it when you tried to combine all the different materials into one cohesive curriculum? Search no more!

*It's About Time*, has taken four of its proven programs and created a coordinated curriculum that takes the work out of your hands, so you can concentrate on what you do best... educate your students.



# Your students can do any science. Here are the reasons why...

**Integrated Coordinated Science for the 21st Century™** has the following features that make it much easier for your students to understand the science principles they will be studying. You will find that regardless of which science discipline they approach, whether it be Earth science, physics, chemistry, or biology, the way they go about learning each of them is the same. Every step along the way will prepare them for the following step. Using all these features together will help your students actually learn about science and see how it works for them every day, everywhere.

**1**

**Volcanoes ...and Your Community**

**Getting Started**

In 1883, on the island of Krakatoa in the East Indies, one of the most violent eruptions of recorded time took place. Half of the island was blown away by a volcanic eruption. Over a cubic mile of rock was hurled into the air. The sound of the explosion was heard in Australia, over 3000 miles away.

Can a volcano that erupts on the other side of the world affect your community?

What do you think? Look at the Earth systems page. In your notebook, draw a picture to show one way that a volcanic eruption changes an Earth system. Then, think about how that change might cause a change in another Earth system. Add this to your drawing. Continue until you have connected the volcanic eruption to your community. Be prepared to discuss your pictures with your small group and the class.

**Scenario**

"The clouds became thicker, and it was increasingly difficult to see as we struggled up the narrow, steep path toward the summit. The ground was hot under our feet, but the moisture from the clouds kept us cold and damp, and made the ash stick to our hair and eyelashes. We began to see larger volcanic rocks, some as large as two feet across. Suddenly we came across a large fissure, about one foot wide and 40 feet long. As I leaned over it, a hot blast of sulfur-sulfur air scorching my nostrils. Then, like a warning growl from a watchdog, came a rumble from deep within. This was the moment we had been anticipating with dread..."

Many motion pictures are based on exciting geologic events.

**2**

Can you use your knowledge of volcanoes to make a thrilling, yet informative and scientifically correct movie?

**Chapter Challenge**

Your challenge is to write a screenplay or story, set in your community, that would help audiences understand volcanoes. You need to teach them about volcanic hazards. You also need to help them see volcanoes as part of the Earth system, and to realize that volcanoes affect all communities in some way. Can you use Earth science to create an exciting story and help others understand the hazards and the benefits of volcanoes?

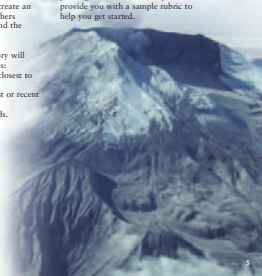
Think about how your story will address the following items:

- Locations of volcanoes closest to your community.
- Evidence that shows past or recent volcanic activity.
- Types of volcanic hazards.

How volcanoes change the atmosphere, hydrosphere, and other Earth systems.

**Assessment Criteria**

Think about what you have been asked to do. Scan ahead through the chapter activities to see how they might help you to meet the challenge. Work with your classmates and your teachers to define the criteria for assessing your work. Record all this information. Make sure that you understand the criteria as well as you can before you begin. Your teacher may provide you with a sample rubric to help you get started.



## 1 Scenario

Each chapter begins with a realistic event or situation. Students might have actually experienced the event, or they can imagine participating in a similar situation at home, in school, or in their community. Chances are they probably never thought about the science involved in each case.

## 2 Challenge

This feature presents your students with a challenge that they can expect to complete by the end of the chapter. As they progress through the chapter they will accumulate all the knowledge needed to successfully complete the challenge.

## 3 Criteria

Before the students begin the chapter and the challenge, the class, along with the teacher, will explore exactly how they will be graded. All will review the criteria and expectations for solving the challenge, and make decisions about how their work should be evaluated.

## 4 Goals

At the beginning of each activity students are provided with a list of goals that they should be able to achieve by completing their inquiry.

## 5 What Do They Already Know?

Before the students start each activity they will be asked one or two questions to consider. They will have a chance to discuss their ideas with their group and the class. Students are not expected to come up with the "right" answer, but to share their current understanding and reasoning.

## 6 Investigate

In *Integrated Coordinated Science for the 21st Century* students learn by doing

**3**

**Criteria**

How will your special effect be graded? What qualities should an effective special effect have? How will your demonstration and supporting documentation be graded? Discuss these issues in small groups and with your class. You may decide that some or all of the following qualities should be graded:

- Demonstration
- Safety
- Quality
- Interest and appeal to audience
- Supporting documentation
- Script – creativity
- Procedure – clarity, safety, accuracy
- Chemistry explanation – accuracy and quantity of chemical principles incorporated

Once you have determined the list of qualities for evaluating the documentation and demonstration, you and your class should also decide how many points should be given for each criterion. How many points should be assigned to the documentation and how many to the demonstration? Should more points go to the chemistry explanation than to the movie script? How many different chemical principles should be incorporated in your special effect? Determining grading criteria might be a time-consuming task, but knowing the point values in advance will help you focus your time and effort on the most important aspects of your special effect documentation and demonstration.

Will each student produce his/her own special effect, will students be required to work in groups, or will both options be offered? Discuss the pros and cons of these possibilities. Keep in mind that if you are going to be working in groups, it is important to discuss before the work begins how each member of the group will be graded. Determine grading criteria that reward each individual in the group for his/her contribution and also reward the group for the final project. You should discuss different strategies and choose the one that is best suited to your situation. Make sure that you understand all the criteria as well as you can before you begin. Your teacher may provide you with a sample rubric to help you get started.

**4**

**Activity B**

**Photosynthesis, Respiration, and the Carbon Cycle**

**GOALS**

In this activity you will:

- Learn how oxygen cycles through photosynthesis and respiration.
- Practice safe laboratory techniques for using chemicals in a laboratory situation.
- Describe the cycling of carbon in an ecosystem.
- Speculate how human activities can affect the carbon cycle.

**5**

**What Do You Think?**

Consider the mass of a seed from a giant redwood tree and the tree itself. It is hard to believe that a giant of a tree began as a small seed.

- From where do the materials come to make up the mass of a mature tree?

Write your answer to this question in your *Active Biology* log. Be prepared to discuss your ideas with your small group and other members of your class.

**For You To Do**

1. Three days before this activity, one plant was placed in the dark. A second plant of the same species was placed in sunlight. Remove one leaf from each plant. Use scissors to cut a small notch in the margin of the one placed in sunlight.

**6**

**Earth's Dynamic Geosphere**

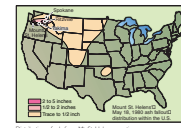
**Investigate**

1. Look at the map of the 1980 eruption of Mt. St. Helens. It shows the pattern of ash. Use the map to answer the following questions:

- How many states showed a trace of volcanic ash?
- In what direction did the ash move?
- Was Canada affected by ash from Mt. St. Helens? Why or why not?
- Would you consider this a small, medium, large, or gigantic eruption? Explain your choice.

2. Make a bar graph of the data shown in the table.

- Plot the name of each volcano on the horizontal axis.
- Plot the volume of volcanic eruption on the vertical axis. Arrange the volumes in order from least to greatest.



**Volumes of Volcanic Eruptions**

Volcano	Date	Volume (cubic kilometers)
Isopango, El Salvador	300	40
Katla, Iceland	1883-84	2.4
Long Valley, California (Bishop Tuff)	745,000 years ago	500
Mauna, Hawaii	4000 B.C.	75
Mt. Rainier, Washington	1920	0.5
Pt. St. Helens, Washington	1980	1.25
Parícutin, Mexico	1952	600
Pinatubo, Philippines	1991	10
Santorini, Greece	1450 B.C.	60
Tambora, Indonesia	1815	150
Yukon-Charley, Alaska	10,000 years ago	300
Yucca, Italy	79	3
Yellowstone, Wyoming (Lake Crater Ash)	650,000 years ago	1000

Note: Volumes are approximate.

science. In their small groups, or as a class, students will take part in scientific inquiry by doing hands-on experiments, participating in fieldwork, or searching for answers using the Internet and reference materials.

## 7 Reading Sections

These sections provide text, illustrations, and photographs that will give students a greater insight into the concepts they explored in the activity. Equations and formulas are provided with easy-to-understand explanations. **Science Words** that may be new or unfamiliar to them are defined and explained. In some chapters **Checking Up** questions are included to guide them in their reading.

## 8 Reflecting on the Activity and the Challenge

Each activity helps to prepare students to be successful in the challenge. This feature gives them a brief summary of the activity. It will help them relate the activity that they just completed to the challenge. It's another piece of the chapter jigsaw puzzle.

## 9 Science to Go

Questions in this feature ask students to use the key principles and concepts introduced in the activity. Students may also be presented with new situations in which they will be asked to apply what they have learned. They are excellent as a study guide, helping them to review and understand what is most important from the activity. Students will also be provided with suggestions for ways they can organize their work and get ready for the challenge.

## 10 Inquiring Further

This feature stretches your students' thinking. It provides suggestions for deepening their understanding of the concepts and skills development. Also, if they're looking for more challenging or in-depth problems, questions, and exercises, they'll find them right here.

## 11 Chapter Assessment

How do your students measure up? Here is their opportunity to share what they have actually learned. Using the activities as a guide, they can now complete the challenge they were presented at the beginning of the chapter.

**7** **Communication Is Anyone Out There?**

7. Set up the two lenses as you did in Step 3. Observe a distant object.

- Record how the object appears through this telescope. Make a drawing for your log.
- Compare the results with those you obtained in Step 4, and with the prediction you made in Step 6. How do the results compare with your prediction?

**FOR YOU TO READ**  
**Refracting and Reflecting Telescopes**

You have made a simple refracting telescope. In a refractor, the light enters the telescope through the objective lens. The focal length of this lens is an important characteristic of the telescope. The longer the focal length, the larger the image. A telescope that observes details of the surfaces of planets, or that measures the parallax of nearby stars, has an objective with a very long focal length. The focal length of the objective lens of the refractor at Yerkes Observatory is 18 m. Imagine building a mount to aim a telescope that long!

Unfortunately, in a large image, the light is spread out so much that the image becomes very dim. To make a brighter image requires more light. That means the objective lens must be larger in diameter, to let in more light. The refractor at Yerkes Observatory has a diameter of about 1.0 m. Imagine making a lens that large!

The difficulty of making large lenses led to the need for the reflecting telescope. In a reflector, a large concave mirror makes an image. The astronomer observes the image through an eyepiece lens. Modern astronomical telescopes are reflectors.

**Active Physics**

**8** **Activity 4 Volcanic Hazards: Airborne Debris**

- Use your graph and the table to answer the following questions. Record your answers in your notebook.
  - Can you group the eruptions by size (small, medium, and so on)? Mark the groups on your plot. Explain how you chose the groups.
  - What group does the 1980 eruption of Mt. St. Helens fit into?
  - Suppose you wanted to predict the area that would be covered with ash by each eruption. What other information (besides volume erupted) would help you to predict how far the ash would go?
- The following map shows the areas covered by five of the eruptions in the data table. Use the map, data table, and your bar graph to do the following:
  - Rank the areas of eruptions in order from smallest to largest. Record your rankings.
  - Compare the areas to the volumes. Describe any relationships.
  - Compare the location of each volcano to the path of the ash. Describe any patterns. What might explain any patterns you see?

**Reflecting on the Activity and the Challenge**

This activity gave you a chance to explore factors that affect the movement of volcanic ash. How did this change your ideas about the areas that can be affected by an erupting volcano? Be sure to include the effect of airborne volcanic hazards into your story line.

**EarthComm**

**9** **Activity 4 Factors Affecting Population Size**

**Biology to Go**

- How do each of the four limiting factors affect population growth?
- Explain how limiting factors could play a role in the extinction of a population. Distinguish between an open and closed ecosystem. Use examples to illustrate your answer.
- Scientists studying an area of the tundra reported that they found 5 lemmings per hectare. They returned the following year and discovered that the density of the lemmings in the same area were 20 per hectare. What is the rate of growth of lemmings in the area, expressed as a percentage?

According to the U.S. Census Bureau, the population of the United States is influenced by the following:

- 1 birth every 8 s;
- 1 death every 13 s;
- 1 immigrant every 22 s.

Use these figures to determine the time, in seconds, it takes for the net gain of one person. (Hint: Start by calculating the number of births, deaths, and immigrants every minute. Round off to whole numbers.)

**10** **Inquiring Further**

- Population growth in different parts of the world
 

Research a place in the world where population growth is a problem today. How is it a problem? Research a place in the world where population growth is not a problem today. Why is it not a problem?
- The truth behind lemming suicide
 

During the filming of the 1958 Disney nature documentary *White Wilderness*, the film crew induced lemmings into jumping off a cliff and into the "sea" in order to document their supposedly suicidal behavior. Research and report on the truth of this statement and the truth about lemming "suicide."

**Active Chemistry**

## 12 Science at Work

Science is an integral part of many fascinating careers. This feature introduces some people working in different fields that involve the principles of science.

**11** **Chapter 6 Assessment**

All the activities you have done in this chapter were designed to give you the information, knowledge, and understanding to complete the chapter challenge. With what you have learned, you will be able to:

- Outline a plan for how you would communicate with extraterrestrial life-forms you might discover. 25 points
- Decide what to say to extraterrestrial beings using science that they can understand and presenting them with important information about human life and Earth. 25 points
- Write an essay describing what could be learned from contact with extraterrestrial beings. 25 points

Participate in a mock hearing of the Space Committee of the United States Senate regarding a request from scientists for \$3 billion for a project to search for extraterrestrial life-forms.

What do you think? Is there anyone out there listening to your communication? Review the criteria for grading which you and your class developed at the beginning of this chapter. Do you wish to further modify the suggested grading scheme?

**Part 1:**

- Choice of methods to communicate: 40 points
- Explanation of the science: correct statement of science concepts: 25 points

**Part 2:**

- Choice of language for communication; discussion of how extraterrestrials will be able to understand the science: 25 points
- correct statement of science used in communication: 25 points
- how extraterrestrials might use the science in a message: 25 points
- Choice of message content: 25 points
- Descriptions of how the content is important: 25 points

**Physics You Learned**

- Distances in the universe
- Communication with extraterrestrial life
- Light-years
- Electromagnetic radiation
- Interference of light
- Spectra
- Doppler shift
- Red shift
- Concave and convex lenses
- Real and virtual images
- Focal length
- Telescopes
- Analog and digital recordings
- Digital images
- Information storage

**Active Physics**

**12** **Chemistry at Work**

**Marc Pollack**  
President, Flex FX

"Everyone talks about 'Movie Magic,'" says Marc Pollack, president of the production Hollywood special effects company Flex FX. "I guess that makes me a magician." But Pollack is clearly more comedian than magician. The "magix" he creates for movies like *Blackhawk Down*, *Men in Black* and *Car Army*, in addition to scores of television commercials, museum installations and Las Vegas casinos, is the product not of mysterious hocus-pocus but rather fundamental principles of science.

"One of the most important aspects of our work," he continues, "is to push the limits of how chemicals are designed to be used." Among other things, Pollack and his crew at Flex FX use vacuum-forming thermoplastics to make on-based silicon molds for everything from prosthetic creatures to futuristic robots. Through a combination of trial and error experimentation and traditional research science, they've perfected the process. "Silicon is what we call an R.T.V.," Pollack explains. "That stands for room temperature vulcanization. So depending on the type and amount of catalyst we use, the mold will cure at different rates and with slightly differing properties." By manipulating the ratio of silicon to catalyst they can make strong, realistic molds in the most efficient way possible. "Increasing the amount of catalyst will speed up the curing process but too much catalyst will shorten the life of the mold," he says. "Every job is different so determining that balance is one of our many challenges."

Pollack, who is now a master in the art of using chemicals like silicon, polypropylene, urethane and urethane elastomers, is not a chemist by trade. He actually graduated from film school at SUNY Purchase in the hopes of becoming "the next Steven Spielberg." Then, through a twist of fate, he became a special effects art and eventually founded Flex FX in 1990. "Now," Pollack says, "Spielberg may one day come to me."

Special effects — Pollack creates both mechanical and physical — is an industry in a constant state of transformation. "The industry is always trying new stuff and that's exciting," Pollack says. "For instance, someone just developed a great water-based breakaway glass for stunts called Smash Glass. It's similar to fiberglass without the dangerous elements associated with that material and can be made to break into either large chunks or tiny little pieces. I can't wait to get my hands on it and break it over someone's head. That's part of my job these days and I love it."

**Integrated Coordinated Science for the 21st Century**

**13** **Making Connections**

You are about to begin a very active year continuing your exploration of science. This year, you will get chances to explore the world around you in a very meaningful way. *Integrated Coordinated Science for the 21st Century* includes *EarthComm*, *Active Physics*, *Active Chemistry*, and *Active Biology*.

To organize the understanding and investigation of the world, scientists have made up categories like Earth science, biology, chemistry, and physics. All of these fields are related. There are now fields like biochemistry, physical chemistry, and environmental science, which require an understanding of more than one branch of science.

**What Do You Think?**

- What is science?
- How are Earth science, physics, chemistry, and biology similar? How are they different?

Record your ideas about this in your log. Be prepared to discuss your response with your small group and the class.

**For You To Try**

- Bertrand Russell (1872-1970) an English philosopher and mathematician said that, "Science is what you know. Philosophy is what you don't know." Research to find quotes from other famous people about what they think that science is. Which one do you think comes closest to what you think that science is?
- Rarely does a week go by without a new scientific study or discovery being reported in the media. Review the news for the last few months to find what new studies or discoveries have been made recently. Research and report on one of these.

**EarthComm** **Active Physics** **Active Chemistry** **Active Biology**

## 13 Making Connections

This feature at the beginning of each unit shows students how each science is connected. It also sets the stage for preparing and exciting the students for their next discipline.



***Integrated Coordinated Science for the 21st Century***,™ is an innovative core curriculum assembled from four proven inquiry-based programs. Each program has been edited in the same instructional model to form one cohesive course. It is supported by the National Science Foundation and developed by leading educators and scientists. The *EarthComm*, *Earth System Science in the Community*, Unit 1, was developed by the American Geological Institute under the guidance of Dr. Michael Smith, Director of Education and Outreach, and Dr. John Southard of MIT. Unit 2, *Active Physics*, was developed by the American Association of Physics Teachers, and the American Institute of Physics.

Both the *Active Physics*, and *Active Chemistry*, Unit 3, are projects directed by Dr. Arthur Eisenkraft, past president of NSTA. Unit 4, *Active Biology*, was derived from materials that were originally developed by Biological Sciences Curriculum Study (BSCS). Each unit of this course has been designed and built on the National Science Education Standards... the same instructional model... and the same project-based, guided inquiry approach to science.



The success of this coordinated curriculum for integrated science, can also be attributed to the use of ***The Active Learning System***™ approach for its professional development and lab equipment. The system incorporates decades of research on how students best learn and how educators can best facilitate this process in the classroom.



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