## WELCOME TO THE ISLAND ECOLOGY SAFARI PROGRAM

Thank you for choosing the Island Ecology Safari as your field trip! This program is an educational adventure offering participants an opportunity to explore the ecology of Catalina Island, both on land and in the surrounding waters. Students develop a unique perspective and gain in-depth knowledge of this popular Channel Island.

Whether hiking through the coastal sage, finding an ancient lava dome, snorkeling in the calm waters of Little Fisherman's Cove, witnessing a sea lion chasing a flying fish, or attempting to define the physical parameters of the island itself, your students experience science and nature in way they will not forget.

The Island Ecology Safari programs are offered in the fall and spring aboard the Coast Guard certified oceangoing vessels, ***Fury*** or ***R/V Sea Explorer***. All of our instructors have degrees in marine science or a related field and are trained teachers.

This is the preparation package for the Island Ecology Safari. Please take the time to familiarize yourself with these materials and share them with other teachers, chaperones, students, and parents. You will also find important forms that must be completed and returned to the Ocean Institute.

If you have any questions, please contact Catie Graver, the Island Ecology Safari Program Coordinator at (949) 496-2274, extension 317.

Rick Baker
Senior Program Director, Science


Figure 1. Santa Catalina Island

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## A. ADMINISTRATIVE CHECKLIST FOR ISLAND ECOLOGY SAFARI

***Immediately upon receiving this package…***

- ❑ Carefully review the Teacher Preparation Package
- ❑ Mail information letter to parents to arrange a parent orientation
- ❑ Arrange for parent chaperones—one adult for every 12 students, with a maximum of 4 adults
- ❑ Arrange your transportation
- ❑ Distribute T-shirt information to students and adults

***Two months prior to your trip…***

- ❑ Confirm student and adult numbers with the Ocean Institute
- ❑ Fax your T-shirt order 6 weeks before your program to guarantee the requested sizes and a complete order

***One month prior to your trip…***

- ❑ Begin student preparation
- ❑ Collect fees
- ❑ Distribute Chaperone Information Packet to each chaperone and Parent Information Packet to each student
- ❑ Complete the Program Information Form and mail to the Ocean Institute

***Two weeks prior to your trip…***

- ❑ Mail program payment to the Ocean Institute—full payment must be received a minimum of 10 days before your program
- ❑ Collect Acknowledgement of Risk and Waiver, medical forms, and Snorkel Information form
- ❑ Contact parents to remind them to sign and return the Acknowledgement of Risk and Waiver, medical forms, and Snorkel Information Form

***One week prior to your trip…***

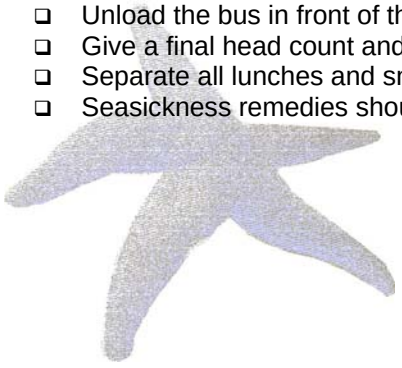
- ❑ Review behavioral expectations with students
- ❑ Comprise a list of students that will be snorkeling
- ❑ Distribute Student Clothing and Supply List
- ❑ Contact the Ocean Institute with any last minute questions or changes

***24 hours to go!!!…***

- ❑ If inclement weather is expected, contact the Ocean Institute for status of the program
- ❑ Prepare nametags for students and adults
- ❑ Complete ship manifest listing ALL students and adults

***When you arrive for the ISLAND ECOLOGY SAFARI…***

- ❑ Unload the bus in front of the Ocean Institute
- ❑ Give a final head count and ship manifest to Ocean Institute staff
- ❑ Separate all lunches and snacks into a single box—NO FOOD IS ALLOWED IN BUNKROOMS!
- ❑ Seasickness remedies should be taken at least 30 minutes prior to departure



## B. DESCRIPTION OF ISLAND ECOLOGY SAFARI PROGRAM

The Island Ecology Safari Overnight expands the already successful Living Systems program from a four hour program off Dana Point to an overnight experience at Catalina Island. This educational adventure offers participants various opportunities to explore the ecology of Catalina Island, both on land and in the surrounding waters, and provides a unique perspective of this popular Southern Channel Island off California.

Students study different ecosystems through observation and analysis of marine and terrestrial plant and animal adaptations. They use scientific testing equipment to define the physical parameters shaping the environment. The program also incorporates earth science concepts as students search for geologic evidence to determine the forces that shaped Catalina Island. An introductory course in snorkeling allows students to explore subtidal and kelp forest communities in a shallow protected cove. The night program includes observation of the nocturnal food chain under a squid light and hands-on station work with plankton and GIS mapping.

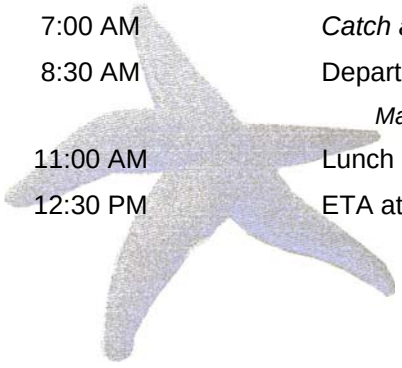
**SAMPLE SCHEDULE (Itinerary is subject to change)**

Day One

| | |
|---|---|
| 6:45 AM | Students arrive at the Ocean Institute |
| 7:00 AM | Load gear aboard vessel |
| 7:30 AM | Depart from Dana Point |
| | *Mapping: Introduction to GPS, Mapping, and Bathymetry* |
| 11:30 AM | ETA to Wrigley Marine Science Center or Isthmus |
| | *Geology Scavenger Hunt* |
| | *Plant Adaptation Hike/Physical Factor Analysis* |
| 2:30 PM | Snack |
| | *Snorkeling* |
| 4:30 PM | *Animal Scavenger Hunt / Mud Flat Activity* |
| 5:30 PM | Board vessel at Isthmus dock/Snack |
| 6:30 PM | Dinner |
| 7:30 PM | Night Program |
| | *Food chain dynamics* |
| | *Properties of light* |
| | *Plankton and GIS Mapping* |
| 9:00 PM | Lights Out |

Day Two

| | |
|---|---|
| 6:00 AM | Wake up |
| 6:30 AM | Breakfast |
| 7:00 AM | *Catch and Release Fishing* at Long Point |
| 8:30 AM | Depart Catalina |
| | *Mackerel and Squid Dissection* |
| 11:00 AM | Lunch |
| 12:30 PM | ETA at Dana Point |



## C. LINKS TO CALIFORNIA SCIENCE CONTENT STANDARDS

***Grade Four***

**Life Sciences**

2.a. Students know plants are the primary source of matter and energy entering most food chains.
2.b. Students know producers and consumers (herbivores, carnivores, omnivores, and decomposers) are related in food chains and food webs and may compete with each other for resources in an ecosystem.
2.c. Students know decomposers recycle matter from dead plants and animals.
3.a. Students know ecosystems can be characterized by their living and nonliving components.
3.b. Students know that in any particular environment, some kinds of plants and animals survive well, some survive less well, and some cannot survive at all.
3.c. Students know many plants depend on animals for pollination and seed dispersal, and animals depend on plants for food and shelter.

**Earth Sciences**

4.a. Students know how to differentiate among igneous, sedimentary, and metamorphic rocks by referring to their properties and method of formation (the rock cycle).
4.b. Student know how to identify common rock-forming minerals (including quartz, calcite, feldspar, mica, and hornblende) and ore minerals by using a table of diagnostic properties.
5.a. Students know some changes in the Earth are due to slow processes, such as erosion, and some changes are due to rapid processes, such as landslides, volcanic eruptions, and earthquakes.
5.b. Students know natural processes, including freezing and thawing and the growth of roots, cause rocks to break down into smaller pieces.
5.c. Students know moving water erodes landforms, reshaping the land by taking it away from some places and depositing it as pebbles, sand, silt, and mud in other places (weathering, transport, and deposition).

**Investigation and Experimentation**

6.a. Students will differentiate observation from inference (interpretation) and know scientists' explanations come partly from what they observe and partly from how they interpret their observations.
6.c. Students will formulate and justify predictions based on cause-and-effect relationships.
6.d. Students will conduct multiple trials to test a prediction and draw conclusions about the relationships between predictions and results.
6.e. Students will construct and interpret graphs from measurements.
6.f. Students will follow a set of written instructions for a scientific investigation.

***Grade Five***

**Life Sciences**

2.a. Students know many multicellular organisms have specialized structures to support the transport of materials.
2.c. Students know the sequential steps of digestion and the roles of teeth and the mouth, esophagus, stomach, small intestine, large intestine, and colon in the function of the digestive system.
2.f. Students know plants use carbon dioxide and energy from sunlight to build molecules of sugar and release oxygen.
2.g. Students know plant and animal cells break down sugar to obtain energy, a process resulting in carbon dioxide and water.

**Earth Sciences**

4.a. Students know uneven heating of Earth causes air movements.
4.b. Students know the influence that the ocean has on the weather and the roles that the water cycle plays in weather patterns.
4.c. Students know the causes and effects of different types of severe weather.
4.d. Students know how to use weather maps and data to predict local weather and know that weather forecasts depend on many variables.

**Investigation and Experimentation**
6.a. Students will classify objects in accordance with appropriate criteria.
6.f. Students will select appropriate tools and make quantitative observations.
6.g. Students will record data by using appropriate graphic representations and make inferences based on those data.
6.h. Students will draw conclusions from scientific evidence and indicate whether further information is needed to support a specific conclusion

***Grade Six***
**Plate Tectonics and Earth's Structure**
1.a. Students know evidence of plate tectonics is derived from the fit of the continents; the location of earthquakes, volcanoes, and midocean ridges; the distribution of fossils, rock types, and ancient climate zones.
1.c. Students know lithospheric plates the size of continents and oceans move at rates of centimeters per year in response to movements in the mantle.
1.d. Students know that earthquakes are sudden motions along breaks in the crust called faults and that volcanoes and fissures are locations where magma reaches the surface.
1.e. Students know major geologic events, such as earthquakes, volcanic eruptions, and mountain building, result from plate motions.
1.f. Students know how to explain major features of California geology (including mountains, faults, volcanoes) in terms of plate tectonics.

**Shaping Earth's Surface**
2.a. Students know water running downhill is the dominant process in shaping the landscape, including California's landscape.
2.c. Students know beaches are dynamic systems in which the sand is supplied by rivers and moved long the coast by the action of waves.
2.d. Students know earthquakes, volcanic eruptions, landslides, and floods change human and wildlife habitats.

**Ecology (Life Sciences)**
5.a. Student know energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis and then from organism to organism through food webs.
5.b. Students know matter is transferred over time from one organism to others in the food web and between organisms and the physical environment.
5.c. Students know populations of organisms can be characterized by the functions they serve in an ecosystem.
5.d. Students know different kinds of organisms may play similar ecological roles in similar biomes.
5.e. Students know the number and types of organisms an ecosystem can support depends on the resources available and on abiotic factors, such as quantities of light and water, a range of temperatures, and soil composition.

**Investigation and Experimentation**
7.a. Students will develop a hypothesis.
7.b. Students will select and use appropriate tools and technology to perform tests, collect data, and display data.
7.c. Students will construct appropriate graphs from data and develop qualitative statements about the relationships between variables.
7.e. Students will recognize whether evidence is consistent with a proposed explanation.
7.f. Students will read a topographic map and a geologic map for evidence provided on maps and construct and interpret a simple scale map.
7.g. Students will interpret events by sequence and time from natural phenomena.
7.h. Students will identify changes in natural phenomena over time without manipulating the phenomena.

***Grade Seven***
**Evolution**
3.a. Students know both genetic variation and environmental factors are causes of evolution and diversity of organisms.

3.e. Students know that extinction of a species occurs when the environment changes and that the adaptive characteristics of a species are insufficient for its survival.

**Earth and Life History (Earth Science)**

4.a. Students know Earth processes today are similar to those that occurred in the past and slow geologic processes have large cumulative effects over long periods of time.

4.b. Students know the history of life on Earth has been disrupted by major catastrophic events, such as major volcanic eruptions or the impacts of asteroids.

4.c. Students know that the rock cycle includes the formation of new sediment and rocks and that rocks are often found in layers, with the oldest generally on the bottom.

4.e. Students know fossils provide evidence of how life and environmental conditions have changed.

4.f. Students know how movements of Earth's continental and oceanic plates through time, with associated changes in climate and geographic connections, have affected the past and present distribution of organisms.

**Investigation and Experimentation**

7.a. Select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests, collect data, and display data.

7.c. Communicate the logical connection among hypotheses, science concepts, tests conducted, data collected, and conclusions drawn from the scientific evidence.

***Grade Eight***

**Investigation and Experimentation**

9.a. Plan and conduct a scientific investigation to test a hypothesis.

## D. ADMINISTRATIVE INFORMATION AND PREPARATION

### ADMINISTRATIVE CONTACT

For questions regarding the Catalina Island Ecology Safari Program, please contact:

Rick Baker, Senior Program Director, Science
Telephone Number: (949) 496-2274, extension 311
E-mail: rbaker@ocean-institute.org

Catie Graver, Island Ecology Safari Program Coordinator
Telephone Number: (949) 496-2274, extension 317
E-mail: cgraver@ocean-institute.org

### INTRODUCTION

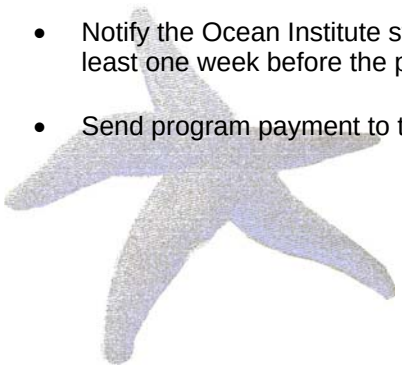
Thank you for choosing the Ocean Institute as your field trip destination. We appreciate the time and effort it takes to prepare your students for their program, and we will do everything we can to make their experience as rewarding as possible.

Please make sure that all of the participating teachers have a copy of these teacher materials. The information contained here can help you find answers to your questions, develop your preparation timeline, and prepare both your students and chaperones. This packet also contains directions to the Ocean Institute as well as contact phone numbers—please call us at any time with any questions you may have about your field trip.

### TEACHER INFORMATION: BEFORE YOUR PROGRAM

You can do several things before you arrive to help make your program run as smoothly as possible:

- Review the program goals, station activities, and expected student behaviors with the students before you arrive. Complete the classroom activities with your students, and make sure they have a clear understanding of the educational concepts they will explore during the program
- Provide each student with a copy of the Parent Information Packet. This packet includes a Welcome Letter, the Things to Bring List, the Acknowledgement of Risk and Waiver, the Student Medical Form, the Administration of Medication forms, and the Snorkeling Information Form
- Spend some time choosing and preparing your parent chaperones. Review the program goals, station activities, and expected student behaviors with them before you arrive. Please provide each chaperone with a copy of the Chaperone Information Packet. This packet includes the Acknowledgement of Risk and Waiver and Adult Medical form
- Have a signed Acknowledgement of Risk and Waiver for each student and chaperone before boarding the bus
- Have a completed Manifest with the names of all students and adults
- Notify the Ocean Institute staff of students with any special health, behavioral, or dietary considerations at least one week before the program
- Send program payment to the Ocean Institute at least 10 days before the scheduled date of your field trip



**TEACHER INFORMATION: DURING YOUR PROGRAM**
Ocean Institute instructors are all well trained to work with students of different ages and abilities. Both you and the adult chaperones can help the instructors monitor student behavior and safety. There are several things that you can do to help facilitate the smooth running of your educational program:

- Work cooperatively with Ocean Institute instructors and your parent chaperones to manage students during the program
- Work cooperatively with Ocean Institute instructors and your parent chaperones to solve student and chaperone management problems
- Report any problems (including facilities and management) to the Ocean Institute staff as soon as possible

**CHAPERONE RECRUITMENT**
Your recruitment of chaperones is very important. Their support and enthusiasm are vital to a successful adventure. We require one adult chaperone for every twelve students, with a maximum of four adults including the teachers. If you will be spending the night in tents, please bring enough chaperones to have one adult in each tent. Chaperones may be teachers, parents, grandparents, college students, or older brothers or sisters of students. They should be at least 18 years old, in good physical condition, and supportive of the Island Ecology Safari program goals. Please meet with your chaperones before your trip to make sure that they have a complete understanding of their responsibilities, and distribute the Chaperone Introduction information that is included in this preparation package.

Please remember that the Island Ecology Safari program experience is designed for the students. While parent participation is important, too many parent chaperones shift the focus of the information away from the students, and because of this, we can only accommodate a maximum of four (4) chaperones, including the teacher.

**PAYMENT**
Payment must be received 10 days before your program date. Please mail a single check for the total amount of the program minus the deposit you have already paid. Please make checks payable to Ocean Institute.

**FINAL COUNT**
Call the Ocean Institute two days before your program if the number of students or adults changes. When you arrive at the Ocean Institute for your program, you must have an accurate count of total students and adults participating in the program. If the number of participants listed on your Confirmation Form is not accurate, call the Ocean Institute immediately. The ***Fury*** can hold a total of 40 participants, including chaperones and teachers.

**STUDENT AID**
The Ocean Institute maintains a student aid fund for students who are unable to obtain sufficient funding to attend the program. Please call (949) 496-2274, extension 0 for more information and to receive the necessary forms for student aid.

**TRANSPORTATION**
Student transportation should be arranged well in advance. It is important that you arrive on time. Please schedule yourself to arrive at least 15 minutes before your scheduled program start time. If you arrive late, your program time may need to be shortened.

Buses can unload in front of the Student Services building. After the students have unloaded, the drivers will be notified of where to park the buses.

Student transportation should be arranged well in advance. The transportation schedule is as follows:

| | | |
|---|---|---|
| **7:00 am departure** | Day 1: | Arrive at the Ocean Institute by 6:45 AM |
| | Day 2: | Pick up at Ocean Institute at 12:30 PM |

**SNORKELING GROUPS AND WETSUITS**
Once you have a final roster of participating students, divide them into three snorkeling groups. Use the snorkeling group form to help organize your groups. The Ocean Institute staff will try to supply each student and chaperone with a wetsuit, mask, snorkel, and fins. If a student or adult has their own snorkeling gear, they should bring it with them.

**INFORMATION PACKETS**
We have included packets with information and forms for the teachers, chaperones, and parents. They contain copies of information and forms that must be completed by parents, chaperones, and teachers before arriving for the program. **IT IS IMPORTANT THAT YOU ARE FAMILIAR WITH ALL THE INFORMATION AND FORMS FOUND IN EACH PACKET.** These packets are ready to be copied and distributed to the appropriate participants. Information on each of the forms is in the next section.

**Please make sure that you provide chaperones with copies of the Chaperone Information Packet and the Parent Information Packet.**

**FORMS**
The following forms are included in the information packets found at the back of this booklet. Please make sure that all of the forms are completed before you arrive for the Island Ecology Safari. Make sure that you use the forms from this packet—they are the most updated forms.

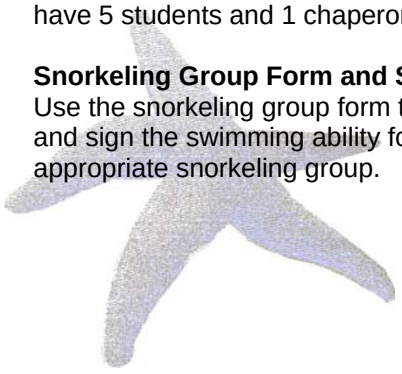
**Acknowledgement of Risk and Waiver**
Each student must have this form signed by a parent or guardian to participate in the Island Ecology Safari program. Please make sure that you have one signed form for each student and adult chaperone when you check in with the Ocean Institute staff.

**Medical Forms**
You will find **three different medical forms** in the Appendix. You must have a completed and signed medical form for each student and adult participating in the Island Ecology Safari program. In order for a child to receive any prescription or non-prescription medication during the Island Ecology Safari program, the Administration of Medication form must be completed and signed by the parent or guardian and the child's physician.

**Manifest for the *R/V Sea Explorer or Fury***
A Manifest for the ***R/V Sea Explorer*** or ***Fury*** must be completed before you arrive for the Island Ecology Safari program. The Coast Guard requires us to have a completed Manifest in order to account for all passengers before we leave the dock. Please have it completed before you arrive at the Ocean Institute--we will lose valuable instructional time if the Manifest needs to be completed when you arrive. It is important that the Manifest is accurate and includes the first and last names of ALL students, teachers, and chaperones. Your Ocean Institute Floating Laboratory Specialist will take a head count before boarding the vessel and the number of this count must match the number on the Manifest.

**Tent Assignment Form**
If your program is taking place on the ***R/V Sea Explorer***, you will be spending the night in tents on Catalina Island. Once you have a final roster of participating students, divide them into tent groups. Each tent should have 5 students and 1 chaperone.

**Snorkeling Group Form and Snorkeling Information Form**
Use the snorkeling group form to list each student that will snorkel. Please have a parent/guardian complete and sign the swimming ability form. This form will help you and the instructors place each student in the appropriate snorkeling group.



**Program Information Form**
The program information form should be completed and mailed to the Ocean Institute at least one month before your program. This information will help us prepare for your program and accommodate any special needs your group may have.

**MEDICAL ISSUES**
**The medical forms included in this package must be completed for each student attending the Island Ecology Safari program.** Please carefully review the completed forms to ensure that they have been properly filled out and signed. The teacher-in-charge will be responsible for storing and distributing routine student medications (both prescription and non-prescription). He or she will also keep all of the medical release forms. Please notify the Ocean Institute in advance of any students with special dietary needs or physical limitations. Please be aware that there is no medical doctor or nurse on site. In addition, there is no housing for ill students. Parents of ill or injured students will be notified immediately, and if necessary, arrangements will be made for their transportation to the hospital in Avalon on Catalina Island or home.

**STUDENT PREPARATION**
We have found that the more familiar the students are with program concepts and content before they arrive, the more they will benefit from and enjoy their experience. We have included background information and classroom activities to introduce important concepts to your students before they arrive for their program.

**STUDENT BEHAVIORAL EXPECTATIONS**
Please take time to discuss the academic nature of their field experience with your students before arriving at the Ocean Institute. During the program, we expect that your students will follow the same behavioral rules you have in your classroom.

**STUDENT SAFETY RULES**
All teachers, chaperones, parents, and students must understand these safety rules before the start of the program. Please review these rules with the students before the program begins.
- Remain within visual sight of an adult at all times.
- Never go anywhere alone...always stay with your hiking/snorkeling group.
- Always walk on designated trails; follow behind the instructor(s).
- Never pick leaves, flowers, or stems from any plant unless otherwise told.
- Do not skip or throw rocks.
- No gum allowed.

**While onboard the vessel…**
- Wear shoes on board the vessel at all times.
- Do not enter any bunk other than your own.
- Always walk—no running on deck, keep both feet on the deck at all times, do not sit on the rails.
- Do not operate or touch any onboard equipment unless otherwise told.
- Report any illness or injury to an instructor or chaperone immediately.

**While Snorkeling, Chaperones Should…**
- Assist students with fitting of masks, fins, and wetsuits
- Supervise students not participating in the snorkeling activity
- Assist instructors with snorkeling groups in the water
- Assist instructors in helping students that need to return to the beach
- Assist instructors with the enforcement of all safety rules during the snorkeling activity

**While Snorkeling, Students Should…**
- Stay with the group, and follow all safety rules outlined by the instructors

In the event of a student injury, a chaperone may be asked to supervise a hiking group, or to accompany a student back to either Wrigley Marine Science Center or Isthmus Cove for help.

**CHAMBERS GIFT AND BOOK STORE**
The Chambers Gift and Book Store is a non-profit museum store and is open daily from 9:00 AM to 5:00 PM. The revenue is directed toward lowering tuition for schools that participate in Ocean Institute programs.

You and your class are encouraged to visit the store. To help accommodate all of the schools that would like to shop each day, please have one teacher from your school check-in with a store staff member before your students begin shopping. We limit the number of students allowed to shop at one time. There is also a three-minute time limit for each student. This is to ensure that all of your students will have time to shop. Please have two or three chaperones in the store to help supervise your students. One chaperone should stand at the door to monitor the students waiting in line. The other two adults should supervise the shoppers and remind them they must make their selections quickly. Please ask the students to leave food, drinks, and backpacks outside with a friend while they are shopping.

Please remind your students that sales tax will be added to their items.

**DIRECTIONS TO THE OCEAN INSTITUTE**
The address of Ocean Institute:
24200 Dana Point Harbor Drive
Dana Point, CA 92629
(949) 496-2274

**Directions from Los Angeles:**

- Travel south on Interstate 5
- Exit on the Pacific Coast Highway Exit
- Stay in the right lane of the exit ramp and go north on P.C.H.
- Turn left onto Dana Point Harbor Drive
- The road ends in the Ocean Institute parking lot

**Directions from San Diego:**

- Travel north on Interstate 5
- Exit on the Beach Cities Exit
- Stay in the left lane of the ramp and go north on P.C.H.
- Turn left onto Dana Point Harbor Drive
- The road ends in the Ocean Institute parking lot

## G. RESOURCE MATERIALS FOR THE ISLAND ECOLOGY SAFARI

**Catalina Island Ecology**
Catalina Island has an ecosystem similar to the coastal sage/chaparral ecosystem on the mainland. Many of the plants in the field guide are found both on the island and on the mainland. Some of the plants and animals on the island are non-native; meaning humans brought them to the island. When animals and plants colonize an island by natural means, seed dispersal, or rafting, they are considered native. When a native species adapts to the island environment and forms a new species, occurring only on the island, it is called endemic.

**The Island Ecosystem**
The plants and animals of Catalina Island are unique from mainland species because of the geographic isolation of the island itself. Millions of years ago, the island was born through volcanic activity on the ocean floor. Over the millennia, uplifting and subsidence, sedimentation and erosion created the island of today.

Many of the plants and animals on Catalina are ***native***, or arrived by natural means (not through human activity.) A few very special species have evolved specifically to Catalina Island and are found nowhere else on Earth and are called ***endemic***. Recently, human activity has brought new species to the island, with terrible results. These ***non-native*** species out-compete native and endemic species and even introduce diseases that are detrimental to the ecosystem. The removal of non-native species from Catalina Island is a top priority.

**Native Animals**
*bald eagle*
*Southern pacific rattlesnake*
*Beechey's ground squirrel*

**Non-Native Animals**
*mule deer*
*bison*
*cats and dogs*

**Endemic Animals**
*Catalina island fox*

**Native Plants**
*coastal sage*
*Lemonadeberry*
*Prickly pear cactus*
*toyon*

**Non-Native Plants**
*sweet fennel*
*wild mustard*

**Endemic Plants**
*Catalina liveforever*
*St. Catherine's lace*

**The Intertidal Ecosystem**
The intertidal ecosystem is found along the seashore between the high and low tides. Plants and animals living in this region must survive waves, exposure to air and heat during low tides, and competition for space.

Plants of the intertidal are different from terrestrial plants. Most intertidal plants (for example sea palms, feather boa kelp, and codium) have a rubbery texture that is well suited to moving with the waves. Plants in the intertidal have no roots. Instead, nutrients are absorbed throughout the entire plant. Many plants in this ecosystem remain extremely small and may appear as "fur" on the rocks.

Animals, like barnacles and mussels, actually glue themselves to rocks to survive large waves. These animals, while attached, filter the seawater for microscopic organisms. Crabs are scavengers and eat anything they can find. They avoid waves by hiding in the cracks in rocks. Many clams burrow deep into the sand to avoid being washed away. Like plants, most intertidal animals remain small.

**Common Animals**
*limpet*
*sea urchin*
*bat star*
*chiton*
*mussel*
*knobby sea star*

**Common Plants**
*feather boa kelp*
*codium*
*sea palm*
*rock weed*
*coralline algae*
*sea grass*

**The Kelp Forest Ecosystem**
The kelp forest provides habitat for many different animal species. Kelp rises from up to a hundred feet from the bottom of the ocean, where a root-like structure called a holdfast anchors it to rocks. The holdfast is a refuge for a diverse community of brittle stars, worms, crabs, and other invertebrates. Up among the blades of the kelp, brightly colored and camouflaged fish and invertebrates hide, hunt, and seek mates. Kelp influences everything that lives among it, helping feed its entire community and breaking the force of the rolling waves.

| Common Animals | Common Plants |
|---|---|
| *garibaldi* | *feather boa kelp* |
| *sea urchin* | *giant kelp* |
| *blacksmith* | *sea palm* |
| *kelp bass* | *elk kelp* |
| *senorita fish* | *sea grass* |
| *knobby sea star* | |

**The Pelagic Ecosystem**
The pelagic ecosystem describes the plants and animals that live in the open ocean. The most outstanding physical feature of this environment is the water itself. Plants and animals that live in this environment must adapt to strong currents, sunlight penetration of less than 300 meters, and vast amounts of space.

Most plants in this pelagic ecosystem are microscopic and drift freely with the ocean currents. These plants, called phytoplankton, float near the surface of the water where sunlight is plentiful.

There is a variety of animals found in the pelagic ecosystem. Microscopic animals called zooplankton float in large numbers with the currents. Some animals, like crabs, and barnacles, spend a part of their lives as zooplankton. Jellyfish drift around the ocean capturing food in their tentacles. Whales, sea lions, fish, and squid have streamlined bodies to swim against the ocean currents.

| Common Animals | Common Plants |
|---|---|
| *copepods* | *diatoms* |
| *jellies* | *dinoflagellates* |
| *common dolphin* | |
| *sea lion* | |
| *mackerel* | |
| *squid* | |
| *flying fish* | |

## Island Ecology Safari Equipment

*Plant Adaptation Hike/Physical Factor Analysis*

### Thermometer


A definition of a thermometer

A thermometer is an instrument that measures heat. A small amount of colored liquid is contained within the thermometer, and as the temperature rises, the liquid will expand and fill more of the tube.

Celsius vs. Fahrenheit
In the United States, we usually use the Fahrenheit scale to measure temperature. Many other countries use the metric system, which incorporates the Celsius scale. Here is a formula to help you convert temperatures from one scale to the other:

- To change the temperature from Fahrenheit to Celsius, take your number, subtract 32 degrees, and divide the remaining number by 1.8.
- To change the temperature from Celsius to Fahrenheit, multiply your number by 1.8 and add 32 degrees.

### Wind Meter

A definition of a wind meter

A wind meter is used to determine the approximate speed of the wind. A compass can then be used to find the wind direction (wind direction is always expressed as the direction the wind is coming from). Hold the wind meter up into the wind, and watch the small white ball rise. Record the highest number the ball reaches and this will tell you how many miles per hour the wind is currently blowing.

### Soil Moisture / Solar Radiation Meter


A definition of a soil moisture / solar radiation meter

A soil moisture meter is used to determine how much water is in the soil of an area. This can give scientists information about the amount of rainfall, average daily sunlight, types of plants found in the area, and how much water and sunlight these plants need.

How a Plant Drinks Water:
Many plants have special adaptations to help them survive and maximize water use. Plants absorb water through their roots, and often these root systems are very elaborate and far-reaching.

A solar radiation meter is used to determine how much direct sunlight an area gets. The amount of sunlight has an effect on the area plant distribution and the type of ecosystem.

Sunlight and Plants
All plants require sunlight to make their food through photosynthesis, and many plants have special adaptations to help them get the ideal amount of sun exposure. Plants in woodland areas have large, dark colored leaves to help them absorb sun and many are vines or climbing plants. A plant in a dark area will grow towards the sunlight as far as possible.

*General Equipment*

## GPS (Global Positioning System)


A definition of GPS

GPS is a radio-navigation system used around the world to locate your exact location on the planet Earth. GPS uses 24 satellites orbiting Earth, and 5 ground stations to send signals back and forth and determine your exact position on the planet. This is a useful navigational tool, and is also used by scientists to record locations for study.

GPS at Sea

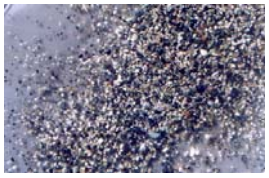
Imagine you are in the middle of the ocean, and your boat breaks down. You need to notify the Coast Guard, and give them your coordinates so they can find you! Most boats have a GPS system on the bridge that is constantly transmitting updated location information. You can simply read the coordinates off the GPS unit, and soon the Coast Guard will be on its way to rescue you!

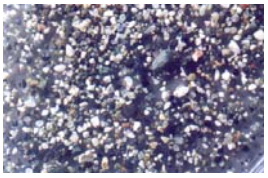
## Microscope

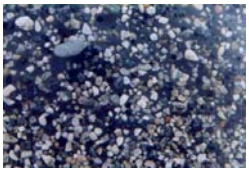
A definition of a microscope

A microscope is an instrument consisting of a combination of lenses for making small organisms look larger.

**Magnification: Dark sand sample under increasing levels of magnification**







## Snorkeling Gear

Wetsuit
When snorkeling offshore of California and Catalina Island, it is usually a good idea to wear a wetsuit, since the water can be anywhere from 50-70 degrees Fahrenheit! A wetsuit helps to keep you warmer in the water because it conserves body heat. When the suit first gets wet, it is very cold. Then your body starts to warm up the water trapped in the suit and within five minutes, you will be warm and comfortable. The wetsuit will also make you buoyant, so you will float very easily in the water!

Mask and Snorkel
After putting on your wetsuit, you need to choose a mask and snorkel. To ensure that the mask fits your face, press it against your face (but do not put the strap on), breathe in, and look down. If the mask stays sealed to your face when you look down, you know it's a good fit! The snorkel fits in your mouth, and the tube will allow you to continue breathing air from the surface. If you do dive underwater, it's a good idea to blow out hard through the snorkel when you surface to make sure you clear any remaining water from the snorkel before taking a breath!

Fins
Don't put your fins on until you have entered the water, and always walk backwards or sideways while wearing fins so you don't trip and fall! Your fins will help you to swim faster and use less energy when you move in the water.

## H. Classroom Activities

### ACTIVITY #1: *Science Processes*

**Introduction**
Students locate and describe in their field notes an object in the classroom. They exchange field notes to identify the unknown objects. This will help them practice the science processes of observing, comparing, and communicating.

**Materials**
- ❑ Paper and pencils

**Background**
*Observing:* The scientific thinking process from which fundamental patterns of the world are constructed.
*Communicating:* The scientific thinking process that conveys ideas through social interchanges.
*Comparing:* The scientific thinking process that deals with concepts of similarities and differences.

**Student Challenge**
*You are scientists who have observed an unidentified organism during your field research. If you carefully describe it, other scientists will be able to identify the organism based on your field notes.*

**Procedure**
1. Choose an object in your classroom, and describe it in your field notes. Be as descriptive as you can without actually identifying it. You may also wish to sketch it.

2. When you have completed your field notes, swap your description with that of another scientist. Try to identify the unknown object based on their observations!

3. Were you able to identify the object that was described by another scientist? Were you surprised at the details you noticed about the object? Have you ever used these skills before in your science classes?

## ACTIVITY #2: *Where on Earth?!*

**Introduction**
Students identify locations on a map using latitude and longitude coordinates.

**Materials**
- ❑ (1) copy of the worksheet
- ❑ Pencil
- ❑ Globe or map (optional)

**Background**
We can find a place on a large map or chart by using a grid of imaginary lines called ***latitude*** and ***longitude***. Lines of longitude, or ***meridians***, run up and down the map or chart. They are measured in degrees east or west on a line drawn through Greenwich, England (an agreement was reached by most nations to come up with that point). Lines of latitude, or parallels, are measured in degrees north or south of the Equator, and imaginary lines that circles the middle of the Earth.

A GPS (Global Positioning System) is used to help navigate. GPS uses satellite signals to determine location. It displays two numbers—these are measurements of longitude and latitude.

**Student Challenge**
*List the coordinates of each city identified on the map. Label the longitude with a W or an E and latitude with na N or an S.*

**Procedure**
1. Point to a position in the middle of an ocean on a map or globe. Ask the students how they would give directions to get to this point. How would they identify the location? Define latitude and longitude.

2. Hand the students the worksheet and have them identify the latitude and longitude of New York, Sydney, and Cabo San Lucas.

3. Why is it important to know both the longitude and the latitude? What would happen if one of the coordinates were missing?

4. Use a local map to have the students find the latitude and longitude of their city, of Dana Point, and of Catalina.

# Where on Earth?! Worksheet

**INTRODUCTION**

We identify locations on maps and charts by using a grid of imaginary lines called **latitude** and **longitude**. Lines of longitude, or meridians, run up and down the map or chart. They are measured in degrees east or west of a line drawn through Greenwich, England. Lines of latitude, or parallels, are measured in degrees north or south of the Equator, an imaginary line that circles the middle of the Earth. We use lines of latitude and longitude to give the position of a city in the same way that we use a grid reference.

A GPS (global positioning system) unit can be used to navigate around the globe. GPS uses satellites signals to determine location. If you are looking at a GPS display, you will see two numbers. These are measurements of longitude and latitude.

**THE CHALLENGE**

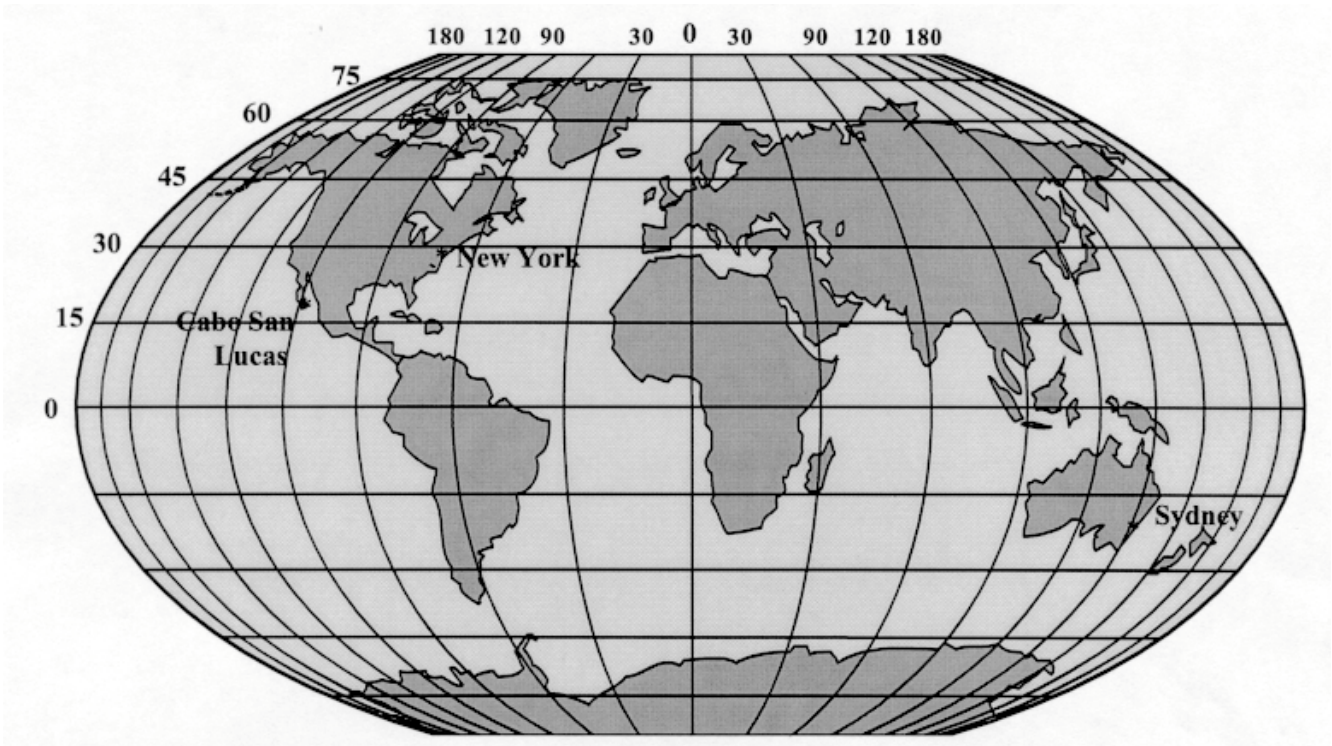
Label all the longitude lines west of Greenwich, England (0° longitude) with a **W** and all the longitude lines east of Greenwich, England with an **E.** Label all the latitude lines north of the Equator (0°) with an **N** and all the latitude lines south of the Equator with an **S**.

Give the coordinates of the cities listed below. Remember that longitude lines run up and down while the latitude lines run left and right.

**New York, USA**: _____ Latitude; _____ Longitude

**Sydney, Australia**: _____ Latitude; _____ Longitude

**Cabo San Lucas, Mexico**: _____ Latitude; _____ Longitude



## ACTIVITY #3: *Reunite Pangaea*

**Introduction**
Students cut out and fit together the continent to create the super-continent called Pangaea.

**Materials**
- (1) copy of the Pangaea Puzzle for each student
- Paper on which to glue the puzzle for each student
- Scissors
- Glue or glue sticks

**Background**
Geologists believe that a super-continent composed of all of the present day continents existed on the planet 200 million years ago (at the same time dinosaurs were on earth). Geologists call this super-continent **Pangaea**. Because there was only one continent, there was only one ocean called ***Tethys***.

However, no sooner was this landmass formed, than it began to break up. A large valley (called a rift valley) formed in the interior of this large landmass. Molten rock pushed up from deep in the earth's mantle along the rift valley eventually pushing the continent apart and producing two continents. As more molten rock came to the surface, the continents were pushed farther and farther apart, and the new ocean between them grew wider and wider. Another new rift valley formed, again splitting the continents. The areas where new crusts form are called ***spreading centers***.

Today the continents are distributed evenly around the planet; however, sometime in the next 50 million years, they will collide again forming another super-continent.

In the early 1900's, geologists discovered that large rock formations, which covered hundreds of miles on one continent, were identical to formations on adjacent continents. Scientists developed the latest tectonic theory, that the continents were together at one time, based on this evidence.

**Student Challenge**
*How is it possible that tropical plant fossils have been found in Antarctica? Cut out each continent, fit the pieces together, and glue them to the paper.*

**Procedure**
1. Cut out the puzzle pieces and fit them together.

2. Glue the completed puzzle onto the piece of paper.

3. What does this puzzle tell you about crustal plate movement? How can you use the evidence of plate tectonics to explain how fossils of identical animals are found on different continents? What do you think the Earth will look like in 10 million years? Why?

# Pangaea Puzzle

## ACTIVITY #4: *Life in the Chaparral*

### INTRODUCTION

What is life in the Chaparral ecosystem like? Read the abiotic (non-living) factors listed below, and circle the words that describe the Chaparral ecosystem.

| | | | | |
|---|---|---|---|---|
| Hot air | Dry | Rocky soil | Sunny | Strong currents |
| Cool air | Moist | Sandy soil | Shady | Waves |

### THE CHALLENGE

Design an imaginary plant that is adapted to survive in the Chaparral ecosystem. Use the abiotic factors you circled to help you. Create adaptations for the following features of the plant: leaf size, leaf shape, color, texture, overall size, and root system. When you have finished drawing and labeling your plant, write a description.

**Drawing**

**Description**

## ACTIVITY #5: *Predicting the Weather*

**Introduction**
Students use the weather page from a newspaper to predict the ocean conditions for their field trip to the Ocean Institute.

**Materials**
- ❑ Internet or daily newspaper with weather and sea conditions from three days before your trip
- ❑ **Predicting the Weather** data sheets

**Background**
Data on wind, weather, waves, and water temperature are important for ocean researchers as well as recreational travelers. Scientists use this data to predict both short- and long-term weather patterns. Note the following information found on the weather page:

*Air Pressure*
Air pressure refers to the downward force exerted by the weight of air. Air molecules are squeezed together by the weight of the air above. This makes the air denser near the bottom of the atmosphere than it is at higher altitudes. Air density and pressure are greatest at sea level. Heat also makes air less dense (and thus less heavy) by moving its molecules. The warmer the air, the lower the pressure. Check the newspaper for the following information on air pressure.

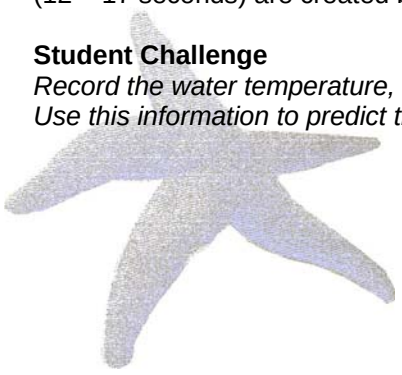
- Changes in the position of high and low pressure ridges (change seasonally)
- Movement of the Jet Stream—a band of extremely strong, generally westerly winds in the upper atmosphere
- Pressure gradients—a very low-pressure system anywhere in the Pacific Ocean might send us weather or waves. If there is a low-pressure system over Dana Point, we might have clouds, wind, or rain.

*Surface Water Temperature*
The water temperature at the surface changes seasonally. The sunlight is more intense during the summer and less intense during the winter. Winter storms mix the warm surface water with the colder bottom water causing the temperature at the surface to decrease. Surface water temperature increases during the summer because there is little storm activity and, consequently, less mixing with the colder bottom water.

*Wind Direction and Speed*
Wind direction is noted in the direction from which it is coming. Winds can cause cold deep bottom water to rise to the surface, which causes the surface temperature to cool. This is called **upwelling**. Strong local winds can create wave "chop" on the ocean surface. These "seas" are different from wave swell.

*Waves*
Waves and swell are created by wind. When the wind blows over the ocean, it creates small ripples on the surface. As these ripples grow, the wind gets better friction on the ocean surface. After a time, these ripples grow into small waves or chop on the water. As the wind increases and continues to blow, the chop transforms into small waves, then into larger waves and then, if all goes well, into huge waves. Long period wave swells (12 – 17 seconds) are created by winds generated from storm cells far off in thee Pacific Ocean.

**Student Challenge**
*Record the water temperature, wave swell, wind speed, and wind direction for three days before your field trip. Use this information to predict the weather on the day of your field trip. How accurate were your predictions?*



**Procedure**

1. Check the weather section of the newspaper three days before your field trip, and fill in the **Predicting the Weather** data sheet.

2. Record the same information on the data sheet two days before your trip and again one day before your trip. Use this information to predict the weather conditions on the day of your trip. Fill in the **Prediction** column on your data sheet.

3. Bring your data sheet with you on your field trip, and complete the **Actual** column. Compare your predicted data to the actual condition recorded during your program.

## *Predicting the Weather* Data Sheet

**Instructions:** Use the daily weather data from your local newspaper to complete the graphs below. You will need the begin recording the weather data at least three days before your program. Use your weather skills to fill in the **Prediction Column** the day of your program. Bring this data sheet with you when you come on your field trip and complete the actual column.

| | Day 3 | Day 2 | Day 1 | Prediction | Actual |
|---|---|---|---|---|---|
| Water Temp (°F)<br>75<br>73<br>71<br>69<br>67<br>65<br>63<br>61<br>59<br>57<br>55<br>53 | | | | | |
| Wave Swell (in feet)<br>12<br>11<br>10<br>9<br>8<br>7<br>6<br>5<br>4<br>3<br>2<br>1 | | | | | |
| Wave Period | | | | | |
| Swell Direction<br>(draw direction with an arrow) | N S | N S | N S | N S | N S |
| Wind Speed (in knots)<br>48 - 55<br>41 - 47<br>34 - 40<br>28 - 33<br>22 - 27<br>17 - 21<br>11 - 16<br>7 - 10<br>4 - 6<br>1 - 3<br>0 - .9 | | | | | |
| Wind Direction<br>(draw direction with an arrow) | N S | N S | N S | N S | N S |

**CIRCLE ONE**

Which of the following activities can best be done under the prevailing weather conditions on the day of your program?

**Surfing**

**Wave swell:** minimum of 3-4 ft
**Wave period:** greater than 7 sec
**Water temperature:** N/A
**Wetsuit?:** Yes No
**Wind speed:** <10 knots
**Wind direction:** prefer NE offshore

**Sailing**

**Wave swell:** N/A
**Wave period:** N/A
**Water temperature:** N/A
**Wetsuit?:** Yes No
**Wind speed:** minimum 7-10 knots
maximum 22-27 knots
**Wind direction:** N/A

**Marine Science**

**Wave swell:** N/A
**Wave period:** N/A
**Water temperature:** N/A
**Wetsuit?:** Yes No
**Wind speed:** maximum 22-27 knots
**Wind direction:** N/A

**Snorkeling**

**Wave swell:** maximum of 2 ft
**Wave period:** N/A
**Water temperature:** prefer 68
**Wetsuit?:** Yes No
**Wind speed:** maximum of 6 knots
**Wind direction:** prefer NE offshore

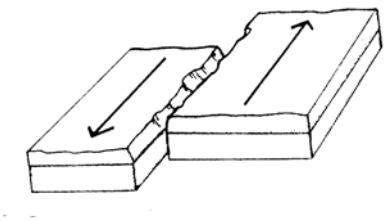
## ACTIVITY #6: *Where Crustal Plates Collide*

**Introduction**
Students identify different faulting zones, subduction zones, and spreading centers on a map of the Pacific Ocean.

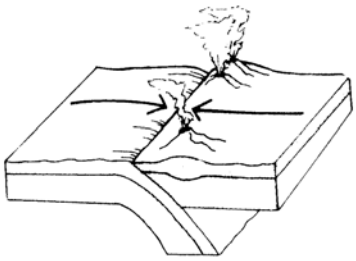
**Materials**
- (1) copy of the tectonic map for each student or group
- crayons

**Background**
The Earth's crust is actually divided into many individual plates. These crustal plates float on top of a liquid layer called mantle and carry the continents with them. When these plates collide, the rocks along the edge of the plates are either melted back into the mantle, changed to a different kind of rock, or squeezed up from the mantle to create new crust. The type of plate interaction determines the kind of rock that is formed.

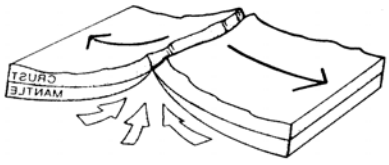
The area where two plates touch is called a ***plate boundary***. There are three types of plate boundaries—***faulting zones***, ***subduction zones,*** and ***spreading centers***.



**FAULTING ZONE (Color: Red)**
This is where two plates move along side of each other producing a fault zone. California sits at the juncture of two such massive plates called the Pacific Plate and the North American Plate. The San Andreas Fault accounts for many of the earthquakes occurring in Southern California. The part of California to the west of the fault (including Dana Point and Catalina) is part of the Pacific Plate and is moving northward. The part of California to the east of the fault (including Lancaster) is on the North American Plate.



**SUBDUCTION ZONE (Color: Blue)**
This is where two plates collide with each other head to head. Usually the crust of the ocean floor collides with the crust of a continent. When this happens, the ocean floor and the sediments on them bend downward under the continent and form a deep trench. These trenches are some of the deepest spots in the ocean. The ocean rocks, when deep under the continent, melt under the heat and pressure of the mantle. This molten rock finds its way to the Earth's surface and forms volcanoes. Volcanoes near a continent tell geologists that there is a subduction zone offshore. This figure shows island arcs and a trench at the boundary between the continent and ocean basin.




**SPREADING CENTER (Color: Yellow)**
This is where two crustal plates move away from each other. As the gap between them widens, new ocean crust emerges from deep in the earth. These crust-producers are actually mammoth mountain ranges. If you could remove all the water from the oceans and look at the earth from outer space, these would be the largest mountain ranges on earth. At the crest of each mountain is a small rift valley that runs the length of the range. At the bottom of the small valley, magma flows to the surface along the entire length of the rift. The volcanic action pushes the two crustal plates away from each other. This force moves all the crustal plates on the planet.

**Student Challenge**
*Use a crayon to color each plate boundary around the Pacific Ocean. Color the faulting zones red, the subduction zones blue, and the spreading centers yellow. Remember that as a plate moves, it will run into and under another plate (subduction), along side another plate (faulting), or move away from another plate (spreading).*

**Procedure**
2. Describe the types of plate boundaries to the students.

3. Hand out the tectonic maps and have the students color the plate boundaries.

4. Have the students note the locations of volcanoes. How does the location relate to the type of plate boundary? Where do we find mountain ranges? Where do earthquakes occur? How do these geologic events relate to plate boundaries?

5. Use the map to discuss where California may be in 10 million years.

## Where Crustal Plates Collide: Tectonic Map