S.O.S.

A Simulation Solving a Scientific Mystery by Understanding the Formation and Motion of Ocean Currents

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The nationwide movement for high standards has not only determined what students should learn, but also has mandated that students demonstrate what they know. S.O.S. is a standards-based unit addressing numerous National Science Education, English Language Arts, National Educational Technology, and Information Literacy Standards. The content and skills taught are targets of most state frameworks for science, writing, and research. In S.O.S. students work in cooperative learning groups to explore ocean currents and characteristics as they solve a mystery. The peer teaching and cooperative problem solving required in S.O.S. also address Applied Learning standards. There are many opportunities to assess student understanding by using the prompts and rubrics provided.

National Science Education Standards

Standard B Physical Science

Properties and Changes of Properties in Matter

- A substance has characteristic properties, such as density, a boiling point, and solubility, all of which are independent of the amount of the sample.

Motion and Forces

- The motion of an object can be described by its position, direction of motion, and speed. That motion can be measured and represented on a graph.

Standard D Earth and Space Science

Structure of Earth System

- Water, which covers the majority of the earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the "water cycle."
- Water is a solvent. As it passes through the water cycle it dissolves minerals and gases and carries them to the oceans.
- Global patterns of atmospheric movement influence local weather. Oceans have a major effect on climate, because water in the oceans holds a large amount of heat.

Earth in the Solar System

- The sun is the major source of energy for phenomena on the earth's surface, such as growth of plants, winds, ocean currents, and the water cycle.

Standard G History and Nature of Science

Science as a Human Endeavor

- Science requires different abilities, depending on such factors as the field of study and type of inquiry. Science is very much a human endeavor, and the work of science relies on basic human qualities, such as reasoning, insight, energy, skill, and creativity—as well as on scientific habits of mind, such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas.

STANDARDS

NCTE Standards for the English Language Arts

Standard 4: Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate with different audiences for a variety of purposes.

Standard 7: Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate, and synthesize data from a variety of sources (e.g. print and non-print text, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience.

Standard 8: Students use a variety of technological and informational resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge.

Standard 12: Students use spoken, written, and visual language to accomplish their own purposes (e.g. for learning, enjoyment, persuasion, and the exchange of information.)

California Applied Learning Standards

Standard 6: Students will understand how to apply communication skills and techniques. Students will demonstrate ability to communicate orally and in writing.

Standard 8: Students will understand the importance of teamwork. Students will work on teams to achieve project objectives.

National Educational Technology Standards for Students

If your students use the Internet for research

Standard 3. Technology productivity tools

- Students use technology to enhance learning, increase productivity, and promote creativity.

Standard 2. Social, ethical, and human issues

- Students practice responsible use of technology systems, information, and software.

Standard 5. Technology research tools

- Students use technology to locate, evaluate, and collect information from a variety of sources.

The Nine Information Literacy Standards for Student Learning

Standard 1: The student who is information literate accesses information efficiently and effectively.

Standard 2: The student who is information literate evaluates information critically and competently.

Standard 3: The student who is information literate uses information accurately and creatively.

Standard 8: The student who contributes positively to the learning community and to society is information literate and practices ethical behavior in regard to information and information technology.

Standard 9: The student who contributes positively to the learning community and to society is information literate and participates effectively in groups to pursue and generate information.

STANDARDS

FOREWARD

Dear Educators:

Children need to be aware of the world around them. They need to realize that the ocean currents connect the whole world. Something happening in one ocean affects oceans in other parts of the world. *S.O.S.* will bring this understanding to your students in a most real way. It begins with a recovered bottle containing a message. This bottle will send your students around the globe on a search and rescue mission.

Within this unit, your students will learn about ocean currents, flotsam, density, plants (flora) and animals (fauna), and geography while solving a realistic dilemma. The unit contains opportunities for exploration, deduction, group decision making, and research science. Your students will have the opportunity to conduct hands-on experiments to determine how density affects ocean currents. They will apply research skills using standard references and Internet technology. The premise of this simulation will keep your students involved in trying to locate one of several stranded families. At the end, they will build a case to present before a fictional international search and rescue group (G.E.T.U.) who will send the rescue ship to save the families.

We have included several detailed background essays about the concepts taught in this unit. However, to keep within the framework of a 15 day unit, we did not cover some concepts (i.e. weather, Coriolis effect), and we limited explanations of other concepts (water cycle, wind currents.). If you have more time, you may introduce and explore these concepts in more depth by supplementing with your own materials.

Sincerely,

Deborah Barone and Janet Stone

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Students are very curious about the ocean, regardless of whether they live along the coast or far inland. Although they may be familiar with tides, most are unaware that the ocean is filled with layers, pools, and rivers of seawater traveling miles and miles within the oceans. We call these rivers within the oceans *currents.* Exploring currents provides a concrete application of the effects of salinity and temperature on the density of seawater. It also explains the effect of winds on currents and the effect of currents on climate.

S.O.S. also allows students to apply their research skills to a real-life problem. They will determine a specific location on the earth by using their knowledge of plants (flora), animals (fauna), and land forms.

Finally, S.O.S. raises student awareness of the interconnection between all the oceans. When students hear of a tanker sinking off the coast of Europe, they often do not fully understand how this far-away disaster may ultimately affect their own lives. Nor do they understand the danger of pollutants dumped not only into the oceans, but also into the rivers that feed the oceans. A toxic spill (i.e., something like Agent Orange) could have calamitous results worldwide.

In S.O.S., your students will experience the following:

Knowledge

- The sun is the major source of energy for winds, the water cycle, and ocean currents.
- All oceans are connected by ocean currents.
- There are currents throughout the ocean that can carry floating objects great distances over the globe.
- Surface ocean currents are formed from wind.
- Deep ocean currents are formed by the density of seawater.
- Salinity and temperature affect the density of seawater.
- Density is defined as mass per unit volume.
- Salinity is defined as the amount of dissolved salts in water.
- Certain plants (flora) and animals (fauna) are found in specific ecosystems.
- Constellations can be seen in specific hemispheres at specific times of the year.
- Stars and constellations can be used as navigational tools.

Skills

- Reading an ocean current map
- Using resource books such as encyclopedias and search engines on the Internet to find the answers to their questions
- Determining the hemisphere of a given location
- Finding a location using longitude and latitude
- Determining the relative density of a liquid
- Identifying plants (flora) and animals (fauna) based on their corresponding ecosystems

PURPOSE

PURPOSE

- Researching clues and continuing research from the clue answers
- Using reasoning to reach a conclusion
- Working together towards a common goal
- Preparing and presenting facts/evidence to support a conclusion
- Preparing and delivering an organized oral presentation

Attitudes

- Appreciate the vast distances that currents travel
- Appreciate the enormous differences in flora, fauna, and landforms that exist throughout our planet
- Become aware that all things on earth are connected
- Appreciate that pollution spills in an ocean can be devastating to the whole world
- Appreciate the uniqueness and individuality of plant and animal species
- Appreciate the value and efficiency of group work

Phase One (6 days)
In this phase, students read the Introduction, and learn about their Roles and Responsibilities. They also learn about ocean currents and current maps, density, and density's effect on ocean currents.

On Day 1, student teams are invited by the Global Emergency Travel Unit (G.E.T.U.) to try to locate stranded families. To begin, student teams pull a bottle from a bucket of water. On the bottle is an ID tag telling where the bottle was found. Inside each bottle is a note from a different family stranded and waiting for rescue. The notes give clues that help the teams determine where each family is. However, the task is made more difficult because unfortunately, the bottles have leaked and the clues are blurred and illegible. Over the next five days, students read background essays, respond to questions, and conduct experiments as they learn about warm and cool ocean currents, flotsam and jetsam, and how temperature and salinity affect density.

Phase Two (5 days)
During Phase Two, the local Crime Scene Investigations (CSI) unit not only deciphers what was written but also recovers additional clues. They give the clues to the teams, one per day. While waiting for the clues, teams learn how wind and density cause ocean currents. The students use their knowledge of the ocean currents to backtrack their bottle's journey from the place it was found to the place it was most likely dropped into the ocean. Using the Internet and other sources, they research the clues given by the CSI unit and try to confirm where the families are waiting.

Phase Three (4 days)
The students prepare and make a presentation to the Global Emergency Travel Unit (an audience of parents and/or peers) convincing them where to send the rescue ships.

Special Needs Students
Like all Interact units, S.O.S. provides differentiated instruction through its various learning opportunities. Students learn and experience the knowledge, skills, and attitudes through all domains of language (reading, writing, speaking, and listening). Activities offer students the opportunity to demonstrate their knowledge through several of Gardner's Multiple Intelligences including Interpersonal, Intrapersonal, Spatial, Kinesthetic, and Verbal. Adjust the level of difficulty or challenge to best fit your students. Support special needs students in the various roles. Utilize their strengths and allow them to succeed. Work together with the Resource Specialist teacher, Gifted and Talented teacher, or other specialist to coordinate instruction.

OVERVIEW

SETUP DIRECTIONS

15+ days

1. **Before you Begin**
   Read this entire Teacher Guide and the Student Guide. Decide how you will use S.O.S. in your classroom and curriculum.

2. **Using the Teacher Guide**
   Throughout the Teacher Guide Interact employs certain editorial conventions to identify materials.
   a. In preparing materials, *class set* means one per student.
   b. One *Day* on the Unit Time Chart is the length of a normal class period—45 minutes to one hour.
   c. All transparency masters and student handouts are listed by name using ALL CAPITAL LETTERS.
   d. Teacher reference pages are named in **Bold**.
   e. Special events are named using Italics (e.g., *Rescue Day*).

3. **Using the Student Guide**
   The Student Guide introduces students to the simulation. It includes the **Roles and Responsibilities** and the **Cooperative Group Work Rubric**. It also includes charts that students use to collect important information and directions to prepare for *Rescue Day*. In the middle of the Student Guide, there is a two-page **Ocean Currents Map**.

4. **Using S.O.S. Within Your Curriculum**
   S.O.S. is designed to be a complete unit within a science curriculum. However, it also provides an opportunity for an integrated unit with the social studies and/or language arts teacher.

5. **Planning your Schedule**
   The daily lesson plans describe 15 days of lessons. This is only a recommendation. Adjust the timeline to accommodate your own teaching objectives and the needs and capabilities of your students.
   a. To shorten the time, allow students to work at home or work in other classes, such as their language arts or social studies class.
   b. If your students already are familiar with the effect of temperature and salinity on density, skip the experiments.
   c. To extend the time, include one or more of the optional activities or allow students more time to research using additional sources.

d. Also, extend time if your students need more time to understand concepts that are unfamiliar. Applying map skills, understanding science concepts, and researching may take your students more time.

6. **Grouping Students**
Students work in teams of four or five. Each team is identified by the name of the stranded family they are trying to locate. Students assume a role while working in their teams. Consider the following information when making role assignments.
   - **Supervisor**—organizes the team and delegates/directs individuals as needed. The Supervisor also keeps the team motivated and on task and submits the Team Folder to the teacher at the end of each day.
   - **Reader**—reads handouts and CSI clues to the group, clarifies and repeats as necessary.
   - **Recorder**—maintains the DAILY DISCOVERY LOGS, checks that teammates have reported all research, and organizes the Team Folder.
   - **Manager**—collects and returns supplies and materials needed for the team experiments and daily work. Returns all reference texts.
   - **Technician**—for teams with more than four members, add a technician who assumes the role of any team member who is absent. If no one is absent, the technician assists other team members with their tasks.
   - **All team Members**—maintain a bibliography of all sources that they use (using WORK CITED RECORDING BLANKS), share the research responsibilities, and complete their own **Verified Team Information Chart** on pages 6 and 7 of the Student Guide.

Teams of four or five

7. **Preparing your Classroom**
   a. Use the transparency of OCEAN CURRENTS MAP (page 64) to make a large wall map that shows the currents. This will prove helpful during the unit and can be used at the end of the unit when students present their case to G.E.T.U.
   b. Set up a large bulletin board to display maps, pictures, and/or articles relating to ocean currents, islands, shorelines, etc. Use the Internet to find pictures to download. Be sure to cite URL sources. Students may add pictures of plants (flora) and animals (fauna) that they research.

c. Ask your school media specialist to prepare a classroom set of books on oceanography, animal books, sea life books, at least one set of encyclopedias, etc. Students may use these when the Internet is unavailable.
d. Students generally work in teams of four or five. Consider using a double-desk arrangement or a 4–square desk arrangement so that they can all hear the discussions and share information.
e. Insist that students collect all their materials and store them safely at the end of every class period. In Phase Three, the presentation props may be bulky. Consider putting them all in large shopping bags marked with the team's family name.
f. For *Rescue Day* (Day 14), arrange your room so that students have a presentation space. Arrange the chairs so the audience can hear what the students are saying.

8. **Teacher Reference Pages**
These pages provide background information or demonstrate charts or materials used in the simulation. There are also answer keys for checking student work. These are listed in order of use.
- **Answer Keys**
  - **— Pretest**
  - **— Ocean Currents**
  - **— Ocean Currents Questions**
  - **— Climate and Ocean Currents**
  - **— Surface Currnts and Climate**
  - **— Density Labs**
  - **— Team Tests (optional)**
  - **— Posttest**
  - **— Debriefing Questions**
- **Bottle A—Smith Family—Tasmania**
- **Bottle B—Alvarez Family—Galapagos**
- **Bottle C—O'Neill Family—Hokkaido**
- **Bottle D—Mello Family—Brazil**
- **Bottle E—Chung Family—Greenland**
- **Bottle F—DiLibero Family—Java**
- **Bottle G—Farley Family—Jamaica**
- **Bottle H—Caputo Family—Sicily**
- **Bottle I—Lawless Family—Madagascar**

Create a folder for each bottle and include the Teacher Reference information within the folder for quick reference. Additionally, consider including a copy of the appropriate CSI clues within each folder.

9. **Organizing Team Folders**
   - Prior to beginning the simulation, prepare folders for each team of students. These may be pocket folders, manila or construction paper folders, or large envelopes.
   - Choose one bottle/family for each team. Duplicate the TEAM FOLDER COVER and glue it to the outside of each folder.
   - Decide if you will assign team roles or allow students to select. Decide if you will assign bottles to teams or allow students to select a bottle on Day 1. If you assign roles and bottles, complete the cover sheet ahead of time. If not, leave this information blank and have teams complete on Day 1.
   - Place one Student Guide for every team member in the folder.
   - Glue, or have teams glue, the OCEAN CURRENTS MAP inside the folder.
   - Laminate the folders for durability once the cover information is completed.

The choice of nine families generally allows you to run the simulation year to year because you may choose any combination of the family names. However, you may feel that students with older siblings who have participated in the simulation have an edge. If that is the case, change the names of the families year to year.

10. **Duplicating Simulation Materials**
    Student pages are listed in the order used within the simulation. Copy in the quantity indicated in Italics.
    - ID TAGS — *one per bottle*
    - HELP LETTER — one per bottle
    - TEAM FOLDER COVER — *one per team*
    - OCEAN CURRENTS MAP — *one per team + transparency*
    - PRETEST — *class set*
    - COOPERATIVE GROUP WORK RUBRIC — *one to post + transparency*
    - COOPERATIVE GROUP WORK RUBRIC (four per page) — *as needed for evaluations*
    - OCEAN CURRENTS OVERVIEW — *class set + transparency (optional)*
    - OCEAN CURRENTS AND THE SUN — *class set + transparency (optional)*
    - OCEAN CURRENTS QUESTIONS — *class set (optional)*
    - WIND AND SURFACE CURRENTS — *class set + transparency (optional)*
    - CLIMATE AND OCEAN CURRENTS — *class set + transparency (optional)*
    - SURFACE CURRENTS AND CLIMATE — *class set + transparency (optional)*
    - FLOTSAM AND JETSAM — *class set + transparency*
    - FLOTSAM AND JETSAM ACTIVITY — *class set*
    - CSI FLOTSAM/JETSAM FACTS — *one per team*
    - FLOTSAM/JETSAM ITEMS — *two items per team*
    - TEAM TESTS (three) — *class set*

Using transparencies helps students when you give directions. However, if you cannot make transparencies, draw chart facsimiles on the board or chart paper to show students how to use the charts.

Consider making a large poster of the COOPERATIVE GROUP WORK RUBRIC to hang at the front of the class. Use the smaller versions to evaluate students on a daily or as-needed basis. The Rubric is also included on page 2 of the Student Guide.

Have each student complete a LAB REPORT for homework after the class does an experiment.

- DENSITY LAB #1: Temperature — *one per team*
- DENSITY LAB #1 SUMMARY: Temperature — *class set + transparency (optional)*
- DENSITY AND TEMPERATURE — *class set + transparency (optional)*
- LAB REPORT — *class set (optional)*
- DENSITY LAB #2: Salinity — *one per team*
- DENSITY LAB #2 CHART — *one per team + transparency (optional*
- DENSITY LAB #2 SUMMARY: Salinity — *class set + transparency (optional)*
- DENSITY, TEMPERATURE, AND SALINITY — *class set + transparency (optional)*
- DAILY DISCOVERY LOG — *five class sets*
- DAILY DISCOVERY LOG SAMPLE — *one per team*
- CSI INSIGNIA — *four to five per team*
- CSI CLUES (four for each family) — *one of each per team*
- CSI NEWS FLASH (one for each family) — *one per team (optional)*
- WORK CITED RECORDING BLANKS — *class sets + as needed (several per day, depending on resources used)*
- RESCUE DAY INVITATION — *approximately two class sets (optional)*
- PRESENTATION INSTRUCTIONS AND CHECKLIST — *one per team*
- CONTENT RUBRIC (four per page) — *as needed*
- PRESENTATION RUBRIC (four per page) — *as needed*
- POSTTEST — *class set*

Awards

- EXEMPLARY TEAM PRESENTATION — *as needed*
- EXEMPLARY INDIVIDUAL PRESENTATION — *as needed*
- EXEMPLARY RESEARCH — *as needed*
- EXEMPLARY COOPERATIVE WORK — *as needed*

There are two pages of CSI CLUES for each bottle. You need these clues only for the bottles you use. There are clues for two days on each page. Cut the pages in half for each day. (See ***Setup Directions #15, CSI Clues*** *on page 10 for more information on preparing the clues).*

Distribute at least one set of WORK CITED RECORDING BLANKS per student on Day 8. After that day, keep a stack of extra blanks in a central location for students to take as they need them. The Reference Book and Internet blanks may disappear more rapidly than other forms.

If you decide to invite others to Rescue Day, *have students fill out the RESCUE DAY INVITATIONS on Day 9.*

11. **Organizing Duplication Materials**
    Duplicate all the materials needed for the unit before starting the unit. It is a good idea to store each set in its own manila file folder. (You may decide to duplicate as you go along.)
    a. Store the duplication sets in the order that they are used. (See **Daily Directions** or **Unit Time Chart**.) If a set is used more than once, you may make two separate folders, or just move the folder to its new position after you use it the first time.
    b. The number to be duplicated is a minimum. Make a few extras in case some are misplaced.
    c. Be sure to return the originals to the Teacher Guide.

d. Some teachers like to have a transparency of a handout to clarify procedures and directions.
e. It is essential that teams get the right clues. It would be wise to make a folder for each bottle and store the clue pages for each bottle in a separate folder.

Transparencies are optional.

12. **Lab Supplies**

Density Lab #1: Temperature

- Baby food jars (4–ounce; the rims of both jars must be the same size) — *two per team*
- Colored pencils or crayons — *one set per team*
- Index cards (3" x 5") — *three per team*
- Paper towels — *two to three per team*
- Smocks/old shirts for team members handling jars (food coloring stains clothes) — *class set*
- Tray or large bowl to catch overflow of water — *one per team*
- **Filling Station**
  Block of ice (or ice cubes) — *one*
  Container (64–oz) — *two*
  Food coloring (blue and red) — *one of each*
  Measuring cup (one-half cup) — *at least two*

Density Lab #2: Salinity

- Coffee can filled with tap water — *one per team*
- Colored pencils or crayons (red, blue, green, yellow) — *one of each per team*
- Eyedropper — *one per team*
- Food coloring — (four colors: red, green, yellow, blue) — *one set*
- Paper cup for discarded samples — *one per team*
- Paper cup weighted with sand, lentils, etc. in which to stand the test tube — *one per team*
- Small test tube (75-mm) — *one per team*
- Solution samples in baby food jars with lids (four colors) — *one of each*

13. **Other Materials**

- Art supplies (markers, crayons, colored pencils, scissors, paste, rulers) — *class sets or to share*
- Candle wax — *optional if you want to seal the bottles*
- Chart paper — *several sheets (optional, for questions)*
- Computers with Internet access — *several (optional)*
- Construction paper or oak tag (white or manila, 9" x 12")
  — *two class sets*
  — *class set + extras as needed*

If students do not have their own art supplies, create at least one set for each team to share. Ask students to make certain that all the art supplies are collected and stored properly. Group members should all help, but the Manager each day is responsible. Remind them of the standards outlined in the COOPERATIVE GROUP WORK RUBRIC.

- Envelopes (business size) — *five per team*
- Highlighters or crayons (yellow) — *class set*
- Large shopping bags (for storing bulky items for presentations) — *one per team*
- Lined paper (8.5" x 11") — *four class sets + extras for brainstorming*
- Manila folders — *as needed for duplication pages (optional)*
- Overhead projector — *one*
- Permanent marker — *one or two*
- Plastic water bottle (empty; for demonstration) — *one (optional)*
- Pocket folders or large envelopes (9" x12") — *28 + one per team*
- Printer (color and/or black and white) — *one per class (optional)*
- Props, materials, objects for *Rescue Day — students gather*
- Reference materials — *as needed*
- Sand, pebbles, pieces of bone, feathers, plant material — *one quarter cup per bottle*
- Scrap paper (8.5" x 11") — *two class sets*
- String (4" to 6" length) — *one per bottle*
- Video camera — *as needed (optional)*
- Water bucket (large) — *one per class*
- Wine bottles — *one per team (corks optional)*
- World maps, globes, and atlases — *as needed (optional)*

Collect chicken bones or fish bones to cut for bone fragments and go to a pet store for feathers.

14. **Creating the Bottles**
    a. Duplicate one HELP LETTER and one ID TAG for each bottle.
    b. Add sand, pebbles, and pieces of bones, pieces of feathers, and/or pieces of plants to each bottle.
    c. Roll up the note and place it in the bottle (leaving the note sticking out of the bottle for easy access).
    Note: Do **not** put the note all the way in the bottle, it is difficult to get back out.
    d. Tie an ID Tag to the neck of the bottle.

What you put in the bottles is up to you. Students will not analyze the contents of the bottle.

To make the bottles more authentic, consider sealing the bottles with corks using wax. If you do this, roll up the notes and attach a string or place an elastic band around the note for easy retrieval.

15. **CSI Clues**
    Prior to Day 8 prepare envelopes of CSI clues for each team.
    a. Glue one CSI INSIGNIA on each envelope (each team will use four–five envelopes).
    b. On the outside of the envelope write the following:
    — CSI Clue number (1, 2, 3, 4, or News Flash)
    — Bottle letter (A, B, C, D, E, F, G, H, or I)
    c. Duplicate one set of CSI clues for each bottle you are using. Cut apart.
    d. Place each team's individual CSI Clues inside the appropriately labeled envelopes.

e. Distribute the clues beginning on Day 8 (distribute clues in order; Day 8 = CSI Clue #1, Day 9 = CSI Clue #2, etc.).
f. The CSI NEWS FLASH has additional information for teams still struggling with locating their families. Decide if you will distribute all news flash clues or just to those teams needing the additional assistance.

16 **Culminating Event—*Rescue Day***

Rescue Day is the culminating activity on Day 14.

a. Decide how big an event *Rescue Day* will be.
   - Keep it small and ask teams to share their work just within their class or with one other class.
   - Make this a bigger event by inviting school administrators, parents, and other guests.
b. Organize some refreshments to celebrate even a modest affair. Be sure that students understand any responsibilities assigned.
c. Make the guest list on Day 9 or 10 and send invitations shortly after to give guests a chance to arrange their schedules (see RESCUE DAY INVITATION).
d. Arrange your schedule.
   - Schedule enough time in Day 14's schedule so students can ready visual aids needed before each team presents.
   - Arrange the order of the presentations so that *Rescue Day* runs smoothly. Make sure each team knows the order of the presentations so they will be ready to step to the front.
e. Arrange the physical space.
   - Create a presentation space.
   - Rearrange the room well in advance of arrival of guests.
   - If desks need to be removed from the room, make arrangements so it doesn't conflict with the arrival of guests.
   - Arrange with your building's custodial staff for additional seats needed for guests.
f. ***Optional*** Arrange for videotaping. *Rescue Day* is an authentic assessment. Consider asking an aide or parent volunteer to be your camera person.

17. **Awards**

Look for ways to recognize both group and individual effort and performance. There are certificate awards beginning on page 132 of the Teacher Guide.

18. **Using the Internet**
Students do not need to have access to the Internet or printers to complete this unit. However, if you have access to the Internet, your students will benefit because they can expand their research and can download images for their presentation on *Rescue Day*. Before using the Internet, become familiar with your school's Acceptable Use Policy. Always preview any web site you make available to your students. If your students do not have classroom access to the Internet, you may access the Internet and build a notebook of information printed off the various web sites you locate.
    a. Advise your students that they may find both reliable and unreliable information on the Internet. Suggest that they check source information carefully.
    b. Remind students also, that they must cite the web pages they used for research and acknowledge where they found the pictures and maps.
    c. Allow students one day to create a file of maps or pictures that they clipped and pasted from the web. It is more efficient to create this file directly in a word processing file, than creating individual jpeg images. Require students to cite the URL of the site where they copied the pictures.
    d. To save time, create a file that contains URLs and their links to safe sites.

Students may need to return to the web site to collect pictures for their presentations.

19. **Use Computer Time and Resources Effectively**
    a. Plan Ahead!
        - Sign up for the computer lab as much in advance as is allowed. Students will need at least four days for research and one day to prepare presentation materials.
        - Create a file of URLs for helpful research sites. (Ask Jeeves®, Google®, etc.) This is especially helpful when there are problems arranging lab time or when there are fewer computers available. It also helps students stay focused on their task rather than getting caught up in the technology.
        - If not all your students are familiar with computers and Internet research, designate students with good technology skills to be Technology Helpers. This will prevent a group from wasting a class period trying to solve a simple problem.

b. Don't Waste Time with Unnecessary Trips to the Internet
   - Tell students to create a file in which they can copy and paste pictures of plants, animals, or other important graphics. They can copy/paste images into this file as they do their research.
   - These selected images should relate to their presentation on *Rescue Day*.
   - Students must always cite the sources they used by copying the URL. Show them how to copy it from the address window at the top of their screen.

c. Save Paper
   When students begin to download pictures for *Rescue Day*, tell students to begin in the upper left corner of the document and stay close to the margins.
   - Students can place multiple small items into one document before printing in order to save paper.
   - Even if different teams are working on separate computers, you or they can use the Select All, Copy, and Paste operations to gather the work of several students into one document.

Check the arrangement of imported images before printing. This will save lots of paper. View the page at 50 percent to see how the whole page looks.

The philosophy of standards-based assessment and instruction requires that students correct work until it "meets" the standard. At first this may seem problematic with the heavy correcting load most teachers carry. However, once students know that you will not accept work that does not meet your expected standard and will require them to redo it, they begin to do their best the first time. Also, only by warranting that students really do understand content or a skill, can you confidently move on to new subject material that builds on what you have taught.

When completing performance assessments, focus on the "student work." This work is *not* limited to written work. It includes demonstrated skills, oral exchanges, individual and cooperative group behavior, processes, strategies, and any other evidence that proves that the students have learned the targeted content or skill and can apply what they know.

1. **Individual Accountability**
   a. Use the PRETEST to determine initial pre-knowledge. You may decide to devote more time and activities if it becomes obvious that all or some of your students do not have the necessary skills or concepts in place.
   b. Informally assess individual student work daily. Walk around asking questions as the class works. Ask students to "think out loud" so that you can evaluate their understanding.
   c. Use the rubrics provided to assess the student work for specific activities including labs and the final presentation.
   d. Use the DAILY DISCOVERY LOGs to assess individual work and comprehension.
   e. Administer the POSTTEST at the end of the unit to assess what students have learned. Decide how many correct answers your students must know to "meet" the standard for this unit.

2. **Cooperative Group Accountability**
   a. There are specific roles and responsibilities. You may assess individual work and effort. However, when the team is working together, more than one student is responsible for a piece of work. (i.e., the oral presentation to G.E.T.U. on *Rescue Day*). The COOPERATIVE GROUP WORK RUBRIC clearly describes cooperative behavior needed to meet or exceed the standard.

S.O.S. is appropriate for grades 4–7. You need not hold a class of fourth graders to the same standard as you would hold a class of seventh graders.

b. Be certain that students understand they have a responsibility to their teammates. However, if one student sabotages the work of a team, hold harmless the other student(s). Monitor the teams regularly so you can recognize when a student is not doing his/her share.
c. When assessing cooperative group work, remind students of the COOPERATIVE GROUP WORK RUBRIC (also on page 2 of the Student Guide). At first you may assess daily, but as students become more aware of their responsibilities, you can assess less frequently. Use the rubric as necessary to reinforce good behavior and redirect disruptive behavior.
d. Remind students that in the world of work, having good cooperative skills is a valuable asset.

3. **What do Rubric Scores Mean?**
Rubrics help teachers and students to describe student work. The student's goal is the create work or perform a skill at an "expected" level to meet a standard. The teacher's goal is to fairly and reliably describe student work or performances referencing a standard.

4 — Exemplary — Generally this rating describes work that exceeds the standard for the activity. The descriptor includes words such as "very," "consistently," "complete," "with detail," "actively," and "willingly." Students who earn a "4" demonstrate leadership and knowledge when participating in the unit activities. Their work is significantly better than was assigned or expected.

3 — Expected — Generally this rating describes work that meets the standard with quality. The descriptors lack some of the positive adjectives of a "4," but this student has mastered the content or skill and can demonstrate his/her understanding in an application setting.

2 — Nearly There — Generally this rating describes work that almost meets the standard. Sometimes inconsistent effort or a misconception of the content will result in a "2" rating. This student needs to try a little harder, or needs to revise his/her work in order to meet the standards described.

1 — Incomplete — Generally this rating describes work that has not yet met the standard in content and/or skill. This student will require more instruction and another opportunity to demonstrate a knowledge or skill, or will require alternative instruction and assessment.

Remember, group work can be frustrating to some students, especially those academically strong students with task commitment. Cooperative group work can bring out the best in students. However, to expect a group of students to have the skills and experience necessary to modify the performance of a poorly-motivated or disabled student is unrealistic. Therefore, monitor the groups closely and give them the support they need.

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UNIT TIME CHART

PHASE ONE

DAY 1

- Take a pretest
- Form teams; select bottles and locate where they were found on world map
- Introduce simulation and Roles and Responsibilities

- Team Folders
- HELP LETTER
- ID TAGS
- PRETEST
- COOP GROUP WORK RUBRIC

DAY 2

- Introduce ocean currents and ocean currents map
- Understand role of the sun in creating ocean currents
- Open bottles and read "Help Letter"
- Create a collage/poster depicting ocean currents (optional)

- OCEAN CURRENTS MAP
- OCEAN CURRENTS OVERVIEW
- OCEAN CURRENTS AND THE SUN
- OCEAN CURRENTS QUESTIONS (optional)

PHASE ONE

DAY 3

- Understand that winds drive surface ocean currents
- Understand where warm and cool ocean currents originate

- WIND AND SURFACE CURRENTS
- CLIMATE AND OCEAN CURRENTS (optional)
- SURFACE CURRENTS AND CLIMATE

DAY 4

- Understand the meaning of flotsam
- Understand that flotsam may drift from one current to another
- Understand that flotsam proves that currents connect the world oceans
- Understand that ships routinely drop flotsam overboard
- Understand that some flotsam may be harmful

- FLOTSAM AND JETSAM
- FLOTSAM AND JETSAM ACTIVITY
- CSI FLOTSAM/JETSAM FACTS
- FLOTSAM/JETSAM ITEMS
- TEAM TEST 1 (optional)

PHASE ONE

DAY 5

- Learn that temperature affects density
- Demonstrate that warm water will float on top of cold water
- Answer comprehensive questions concerning temperature and density
- Relate density experiment to the real world
- Perform a multi-task experiment in a cooperative team

- DENSITY LAB #1: Temperature
- DENSITY LAB #1 SUMMARY: Temperature
- DENSITY AND TEMPERATURE
- LAB REPORT (optional)
- TEAM TEST 2 (optional)

DAY 6

- Learn that salinity affects density
- Conduct experiment and answer questions about density
- Apply understanding of salinity and density to the real world

- DENSITY LAB #2: Salinity
- DENSITY LAB #2 CHART
- DENSITY LAB #2 SUMMARY: Salinity
- LAB REPORT (optional)

UNIT TIME CHART

PHASE TWO		
DAY 7	**DAY 8**	**DAY 9**
• Understand how changes in density create ocean currents and how currents affect surface nutrients • Learn to use DAILY DISCOVERY LOGS • DENSITY, TEMPERATURE, AND SALINITY • DAILY DISCOVERY LOG • DAILY DISC LOG SAMPLE • TEAM TEST 3 (optional)	• Research CSI Clue #1 using technology and print resources • Teams share information • Record data on DAILY DISCOVERY LOG • CSI CLUES #1 (Landforms) • DAILY DISCOVERY LOG • WORK CITED RECORDING BLANKS	• Research CSI Clue #2 using technology and print resources • Teams share information • Record data on DAILY DISCOVERY LOG • CSI CLUES #2 (Plant Life—flora) • DAILY DISCOVERY LOG • RESCUE DAY INVITATION

PHASE TWO		PHASE THREE
DAY 10	**DAY 11**	**DAY 12**
• Research CSI Clue #3 using technology and print resources • Teams share information • Record data on DAILY DISCOVERY LOG • CSI CLUES #3 (Animal Life—fauna) • DAILY DISCOVERY LOG	• Research CSI Clue #4 using technology and print resources • Teams share information • Record data on DAILY DISCOVERY LOG • CSI CLUES #4 (Latitude) • CSI NEWS FLASH (optional) • DAILY DISCOVERY LOG	• Decide where to send the rescue ship • Prepare team presentation for G.E.T.U. • PRESENTATION INSTRUCTIONS AND CHECKLIST

PHASE THREE		
DAY 13	**DAY 14**	**DAY 15**
• Document supporting facts and visual aids • Rehearse oral presentation for *Rescue Day*	• Participate in *Rescue Day* • Awards as needed	• Complete the POSTTEST • Participate in *Debriefing* • POSTTEST

Cooperative Groups
Students need a common workspace to use in teams. Two student desks arranged together works well.

Phase One—Day 1

Objectives

- Take a pretest
- Form teams
- Introduce simulation and Roles and Responsibilities
- Choose a bottle and locate where the bottle was found on a world map

Materials

- Student Guides — *class set*
- Team Folders — *one per team*
- Wine Bottle — *one per team*
- ID TAGS — *one per bottle*
- HELP LETTER — *one per bottle*
- PRETEST — *class set*
- COOPERATIVE GROUP WORK RUBRIC — *one to post + transparency*

Preparation

1. Prepare one bottle per team. See **Setup Directions #14, Creating the Bottles** on page 10 of the Teacher Guide.

2. Place prepared bottles in a bucket of water on a table/desk. Place the bucket in the front of the room.

3. Prepare one Team Folder per team. See **Setup Directions #9, Organizing Team Folders** on page 7 for more information. Place one Student Guide per team member in the Team Folder.

Remind students not to worry if they don't know the answers because a pretest just helps you know what pre-knowledge your students have.

Procedure

1. Distribute the PRETEST. Allow students 5–10 minutes to complete the pretest.

2. Group students into their teams and ask students to sit with their teammates (see **Setup Directions #6, Grouping Students** on page 5 for more information). Distribute Team Folders.

3. Read or tell:

   "These bottles have been found in various areas around the globe. They were tagged where they were located and turned into the Global Emergency Travel Unit (G.E.T.U.). The G.E.T.U. has sent us a letter. Follow along in your Student Guides as I read it aloud to you."

4. Read the letter on the front of the Student Guide out loud (Student Guides are located in the Team Folders). Answer any questions that the students may have at this time.

5. Before asking teams to choose a bottle, go over the **Roles and Responsibilities** on page 2 of the Student Guide. Also review the **Cooperative Group Work Rubric** on the same page. Tell students that you will be using the Cooperative Group Work Rubric to assess them throughout the unit whether they are working as a team doing an experiment, or working as an individual on a team task.

Use the COOPERATIVE GROUP WORK RUBRIC often at first to reinforce good behavior or to discourage and redirect poor behavior.

6. Assign team roles or allow team members to select.

7. One at a time allow the Managers to come to the bucket to choose a bottle and take it back to their team space. To explain why the bottles are uncorked and the notes are sticking out, tell the class that the G.E.T.U. broke off the corks and sent the bottles to you like that so you could get to the note easily.

If you chose to assign families to teams, call each team up to the front and distribute each assigned bottle.

8. Remind teams that they must NOT take the note out of the bottle until tomorrow. Today they are determining the location where the bottle was found and where the family was last seen.

9. Using classroom atlases and their Student Guides, have students mark where their bottle was found on the map on page 4 or 5 of their Student Guide. Also mark the place where their family was last seen.

If your students are unfamiliar with longitude and latitude, hemispheres, and geography in general, take the time to teach them.

10. On the classroom World Map, have each team identify and label where their bottle was found.

11. Also direct students to put the latitude/longitude coordinates and the location where the bottle was found on page 6 of the Student Guide in the box next to "Where Bottle Was Found."

12. When students are finished, tell them to put their Student Guides in the Team Folders and collect them. Also, collect the bottles and put them in a secure place.

Phase One—Day 2

Objectives

- Introduce ocean currents
- Become familiar with the ocean currents map
- Understand that the sun is the energy source that creates ocean currents
- Remove and read "Help Letter"
- Understand why the bottles were weighted (optional)
- Create a collage/poster depicting information on OCEAN CURRENTS AND THE SUN (optional)

Materials

- Team Folder
- OCEAN CURRENTS MAP — *transparency*
- OCEAN CURRENTS OVERVIEW — *class set + transparency (optional)*
- OCEAN CURRENTS AND THE SUN — *class set + transparency (optional)*
- OCEAN CURRENTS QUESTIONS — *class set (optional)*
- Paper, crayons, markers, glue, magazines, etc. (for the poster/collage) — *class set (optional)*
- Plastic water bottle with top (empty; for demonstration) — *one (optional)*

Procedure

1. Ask students to sit with their teammates. Distribute Team Folders and bottles.

TEACHING TIP

Illuminate the transparency of the OCEAN CURRENTS MAP while students complete the OCEAN CURRENTS OVERVIEW. Enlarge this map on a wall for increased visibility.

2. Distribute OCEAN CURRENTS OVERVIEW. Ask students to put their names at the top of the page. Tell students they will need to look at the map on pages 4 and 5 to complete this activity. You may run this activity as a whole class lesson, or allow students to read the paragraph, discuss the questions, and answer them in their teams.

3. Review the answers with the students and ask them to correct their own papers (see **Teacher Reference, Answer Keys**). Summarize the important information on this sheet.
   a. The movement of ocean water is called an *ocean current*.
   b. Ocean currents move in large, rotating loops called *gyres*.
   c. Gyres in the Northern Hemisphere spin clockwise.
   d. Gyres in the Southern Hemisphere spin counterclockwise.
   e. Ocean currents that start at the poles are cool.
   f. Ocean currents that start at the Equator are warm.

4. Ask the teams to discuss this question:

   "Why did the stranded families put sand into the bottles?"

   a. The Supervisor leads the team discussion and the Recorder writes down the reason(s) why. After about 3–5 minutes, ask the teams to report. The Supervisor speaks for the team.
   b. The two most common answers are: 1) the sand contains clues and 2) the sand weighs down the bottle so that it floats down in the water rather than on top.

5. Distribute OCEAN CURRENTS AND THE SUN. Ask students to put their names at the top of the page. Ask students to read the essay as teams or as a whole class.

6. Distribute OCEAN CURRENTS QUESTIONS. Students work as a team as they individually complete this page.

7. Summarize the information in this important background essay.
   a. The sun is the source of energy that drives all ocean currents.
   b. Currents are formed by the winds or changes in density.
   c. There are two kinds of currents: surface currents and deep-water currents.
   d. Surface currents may be warm or cool.
   e. Deep-water currents are generally cool or cold.

8. **Optional**
   Ask students to create a poster, mobile, or collage that depicts the information from this essay and/or OCEAN CURRENTS OVERVIEW. They may add words to their art or give an oral talk when they present it. Allow class time or assign this for homework.

9. Direct team Readers to read the "Help Letter" to their team. Read or tell:

   "All the letters have been ruined. But remember, the G.E.T.U. has arranged for the local CSI unit to help you out. While we are waiting for results, we will be learning more about currents and doing some density experiments."

10. Ask the Recorders to organize the Team Folders. Students should put all handouts inside their Student Guide. The Recorders should make certain that everyone has put his/her name on each handout.

If you float an empty, plastic water bottle on top of the bucket, you can blow on it and push it across the bucket. Reinforce for students that if bottles float ON the water, the wind may just blow them right back onto shore.

Phase One—Day 3

Objectives

- Understand that winds drive surface ocean currents
- Understand that currents starting at the Equator are warm
- Understand that currents starting at the poles are cool

Materials

- Team Folder
- WIND AND SURFACE CURRENTS — *class set + transparency (optional)*
- CLIMATE AND OCEAN CURRENTS — *class set (optional)*
- SURFACE CURRENTS AND CLIMATE — *class set + transparency (optional)*
- COOPERATIVE GROUP WORK RUBRIC — *as needed*
- Atlases, almanacs, other reference books and/or the Internet — *as needed by the class*

Procedure

1. Ask students to sit with their teammates.

There is not enough time in this 15-day unit to investigate the weather patterns associated with winds or the Coriolis Effect.

2. Distribute WIND AND SURFACE CURRENTS. Ask students to put their names at the top of the page. Discuss this essay as a whole class or in teams. Reinforce the key concepts
   a. The sun creates the winds.
   b. The winds drive surface ocean currents.
   c. Both the wind gyres and ocean current gyres spin *clockwise* in the Northern Hemisphere and *counterclockwise* in the Southern Hemisphere.

3. **Optional**
   Distribute CLIMATE AND OCEAN CURRENTS. Ask students to put their names at the top of the page. This is a team activity. Follow the directions on the student handout.
   a. This is a good time to remind Supervisors that they are in charge of their team. Team members all share the research responsibilities to find the answers to fill in the chart.
   b. Walk around the room as students work on their research. You can use the COOPERATIVE GROUP WORK RUBRIC orally and tell teams how they are doing. This rewards good cooperative group work and draws attention to work that could improve.
   c. After 10–15 minutes, reconvene the class to go over what teams have found. Ask Supervisors to share their teams' answers to #3.

4. Distribute SURFACE CURRENTS AND CLIMATE. Ask students to put their names at the top of the page. Read as a whole class or in teams.

5. Go over the directions for the activity. Again, the Supervisor should organize/assign the work. Allow 10 minutes to complete the activity.

6 While the teams are working, walk around the room. This time evaluate student cooperative group work using the COOPERATIVE GROUP WORK RUBRIC.

7. If time allows, have teams share what they have found. If no time is available, ask the Recorders to organize the Team Folders. Students should put all handouts inside their Student Guide. The Recorders should make certain that everyone has put his/her name on each handout. Collect the folders from the Supervisors.

Take time now to help teams understand the roles and what they need to do to successfully and efficiently complete team tasks.

Phase One—Day 4

Objectives

- Understand the meaning of flotsam
- Understand that flotsam may drift from one current to another
- Understand that following flotsam proves that currents connect the oceans of the world
- Understand that ships routinely drop flotsam overboard
- Understand that some flotsam may be harmful

Materials

- Team folder
- FLOTSAM AND JETSAM — *class set + transparency*
- FLOTSAM AND JETSAM ACTIVITY — *class set*
- CSI FLOTSAM/JETSAM FACTS — *one per team*
- FLOTSAM/JETSAM ITEMS — *two items per team*
- TEAM TEST 1 — *class set (optional)*

TEACHING TIP

Laminate the Flotsam/Jetsam items for durability.

Preparation

1. Prior to class duplicate FLOTSAM/JETSAM ITEMS.

2. Laminate each item and place two items in each Team Folder.

Procedure

1. Ask students to sit with their teammates.

2. Read or tell:

read or tell

"Today we are going to find out about Flotsam and Jetsam. Flotsam refers to cargo that falls off a ship. Jetsam refers to cargo that the crew actually throws off the ship.

"Over the years you may have heard about cargo ships that have either dropped or lost their cargo for one reason or another. First, think about what types of things cargo ships carry? (*Cars, oil, etc.*) In recent years, cargo ships carry "containers." Some of these containers are the boxes on 18-wheeler trucks. At the port, shippers release the container from the truck bed and haul it on board the ship. At the next port, they unload the container onto another flat bed truck that takes it away.

"Why might a cargo ship drop or dump its cargo? *(Storms, onboard fires, collisions).* Sometimes the cargo sinks. Later, fishing boats pull up some really strange things in their drag nets. (*example…cars*) Other times, the cargo may float along drifting for months or years on ocean currents. Have any of you heard or read about any? (*Answers may vary.*) Today, we are going to read about five famous spills."

3. Distribute FLOTSAM AND JETSAM. Read the essay as a class or allow students to read silently or aloud within their teams.

4. Read or tell

"I would like you to think of your team as a cargo company. Some items or flotsam have fallen off your ship! In your Team Folder, you will find 2 items that were found on a coast in various places in the world. The Crime Scene Investigations unit, or CSI, was called in to analyze the flotsam, and I will show you what they came up with. It is your job to trace the currents that your flotsam took. Work together and be precise. I will send your findings back to the CSI tomorrow. Good Luck.

"Remember this is a team activity. Supervisors, make sure that everyone participates."

5. Distribute FLOTSAM AND JETSAM ACTIVITY and CSI FLOTSAM/JETSAM FACTS. They will also need the current maps (pages 4–5) in their Student Guides.

6. Allow about 10 minutes. Walk around the room to keep groups focussed and to answer questions. Use the COOPERATIVE GROUP WORK RUBRIC to reinforce good teamwork. You may need to adjust time frames. When you believe all teams are done, collect their items.

TEACHING TIP

Consider having students complete the flotsam activity for homework. If you do not have time to have other students solve the currents that impacted the flotsam, grade the homework and display it on your bulletin board.

7. **Optional**
   a. Instruct students to think of themselves as a cargo company. First they need to decide what their cargo is…remembering that some things will float and others will sink. They need to choose something that will float.
   b. After they decide on their cargo, they decide where it fell off their ship(latitude and longitude) and became flotsam.
   c. Then, they determine at least three currents that carried their flotsam and where the item arrived/was found.
   d. Finally, they draw their flotsam item, color, and label it. They need to attach a note stating where the flotsam fell off the ship and where a beachcomber discovered it.
   e. Later in the week, give the flotsam and notes to other students who try to determine the currents that carried the flotsam.
   f. Allow students a short time to solve their flotsam mysteries. Then allow a few more minutes for students to present their findings to the original students. Let the original students decide if they are correct or not.

The Team Tests are an opportunity for peer teaching and reinforcement of the information learned thus far. All students feel a sense of success as they work together as a team to answer all the questions correctly.

8. **Optional**
   Distribute TEAM TEST 1 and allow students to work together in their teams to complete their tests. Use **Teacher Reference, Answer Keys** for the correct answers.

9. Ask the Recorders to organize the Team Folders. Students should put all handouts inside their Student Guide. The Recorders should make certain that everyone has put his/her name on each handout. Collect the folders from the Supervisors.

Phase One—Day 5

Objectives

- Learn that temperature affects density
- Demonstrate that warm water will float on top of cold water
- Answer comprehensive questions about temperature and density
- Perform a multi-task experiment in a cooperative team

Materials

- DENSITY LAB #1: Temperature — *one per team*
- DENSITY LAB #1 SUMMARY: Temperature — *class set + transparency (optional)*
- DENSITY AND TEMPERATURE — *class set + transparency (optional)*
- LAB REPORT — *class set (optional)*
- TEAM TEST 2 — *class set (optional)*

Density Lab #1: Temperature

- Baby food jars (4–ounce; the rims of both jars must be the same size) — *two per team*
- Colored pencils or crayons — *one set per team*
- Index cards (3" x 5") — *three per team*
- Paper (white, blank) — *one per team*
- Paper towels — *two to three per team*
- Smocks/old shirts for team members handling jars — *class set*
- Tray or large bowl to catch overflow of water — *one per team*
- **Filling Station**
  Block of ice (or ice cubes) — *one*
  Container (64–oz) — *two*
  Food coloring (blue and red) — *one of each*
  Measuring cup (one-half cup) — *at least two*

Preparation

1. Try this experiment yourself before running the lab with students.

2. Set up a materials station for the Density Lab. Managers and Recorders come to this central location to gather their materials.

3. Set up the filling station
   - Place a block of ice into a large container and fill with cold water. Add enough blue food coloring to create a deep blue color and mix.
   - Fill a large container with warm/hot water out of the tap. Add enough red food coloring to create a deep red color and mix. You may need to add more to maintain a warm temperature.
   - Place the measuring cups with handles (one for warm water and one for cold water) near the containers so students can refill jars.

Have students complete a LAB REPORT for homework.

Provide smocks for the students to protect their clothing: food coloring stains clothing!

Set up the filling station right before class so that the cold water is cold and the warm, is warm.

You may need to add more warm water if the solution cools too rapidly. It is important to maintain the temperature differential between the two solutions. The color will be lighter as the red solution becomes more diluted.

Procedure

1. Have students move into their groups.

2. Distribute the DENSITY LAB #1: Temperature to each team.

3. Read or tell:

   "This experiment is a team activity. Remember your roles. It is important that you listen as your Reader reads the directions step by step. But, to help you better understand what you have to do, I am going to model how to handle the jars."

4. Demonstrate how to manipulate the jars using uncolored water. Do NOT use the colored hot and cold water because it will spoil the surprise they will experience when the cold and warm water jars are put together.

Remind students that food coloring stains!!

Students should repeat this experiment several times to appreciate what happens.

5. Direct Supervisors to start the experiment. Be certain that they are wearing smocks or old shirts.

6. Distribute a sheet of plain white paper to each team. The Recorders will use colored pencils or crayons to sketch the various results as they occur. Tell them illustrations should be drawn each time the liquids come together. The final outcome of the experiment must also be documented on the record sheet.

7. Distribute the DENSITY LAB #1 SUMMARY: Temperature. The team should discuss the questions and each member should complete his/her own Lab Summary.

8. Distribute DENSITY AND TEMPERATURE. Read as a whole class or in teams. Discuss the essay and what happened in the experiments.

9. **Optional**
   - Brainstorm why the index card remained on the jar when the jar was tipped upside down. **Answer**: The pressure is greater on the outside/underside of the card than it is on the inside of the jar, thus the card stays in place.
   - Once the experiment is done the team can switch which jar starts off with the index card. They should use warm water with the index card first a few times then try with cold water a few times. Ask them if this had an effect on the outcome.

10. **Optional**
    Distribute TEAM TEST 2 and allow students to work together in their teams to complete their tests. Use **Teacher Reference, Answer Keys** for the correct answers.

11. Ask the Recorders to organize the Team Folders. Students should put all handouts inside their Student Guide. The Recorders should make certain that everyone has written his/her name on each handout. Collect the folders from the Supervisors.

The Team Tests are an opportunity for peer teaching and reinforcement of the information learned thus far. All students feel a sense of success as they work together as a team to answer all the questions correctly.

Phase One—Day 6

Objectives

- Learn that salinity affects density
- Demonstrate that **less dense** liquids will **float** on top of more dense liquids
- Perform a multi-task experiment in a cooperative team
- Answer comprehensive questions concerning salinity and density
- Relate today's findings to the real world

Materials

- DENSITY LAB #2: Salinity — *one per team*
- DENSITY LAB #2 CHART — *one per team*
- DENSITY LAB #2 SUMMARY: Salinity — *class set + transparency (optional)*
- LAB REPORT — *class set (optional)*

TEACHING TIP

Have students complete a LAB REPORT for homework.

Density Lab #2: Salinity

- Coffee can filled with tap water — *one per team*
- Colored pencils or crayons (red, blue, green, yellow) — *one of each per team*
- Eyedropper — *one per team*
- Food coloring (four colors: red, green, yellow, blue) — *one set*
- Paper cup for discarded samples — *one per team*
- Paper cup weighted with sand, lentils, etc. in which to stand the test tube — *one per team*
- Small test tube (75–mm) — *one per team*
- Solution samples in baby food jars with lids (four colors) — *one of each*

Preparation

1. Assemble Density Lab materials for each team at designated Prep Area. Managers come to this central location to gather their materials. Materials below are listed as what is needed for each team.
   - Small test tube (75–mm) — *one*
   - Eye dropper — *one*
   - Coffee can filled with tap water — *one*
   - Paper cup for discarded samples — *one*
   - Paper cup weighted with sand, lentils, etc. to stand test tube in — *one*

TEACHING TIP

You need to fill <u>half</u> of the paper cup with sand or lentils so that the test tube can be in a <u>firm</u> slanted position. You want the test tube to be slanted so that the drops will <u>slide down the test tube slowly</u> and the test tube <u>will not move</u>.

2. Set up the filling station. Each team needs four baby food jars with lids containing four different saline solutions per team. See directions below:
   Note: You will need four (4–oz) baby food jars with lids per team and any type of salt. For the best result, measure the salt into each jar individually. Do not try to make a large jug of a given sample. It is too difficult to keep salt in solution.
   - Fill each jar with tap water.
   - Add **5 teaspoons of salt** and two drops of **yellow** food coloring to one jar.
   - Add **3 1/2 teaspoons of salt** and two drops of **red** food coloring to the next jar
   - Add **1 1/2 teaspoons of salt** and two drops of **green** food coloring to the third jar.
   - Add **NO salt** and two drops of **blue** food coloring to the last jar.

3. Read DENSITY, TEMPERATURE, AND SALINITY before beginning your class. It will give you helpful facts.

Procedure

1. Read or tell:

   "This experiment is a team activity. It involves four solutions that are four different colors. In order for each team member to fully participate, you will be assigned a different color. The directions will tell you which color. You will work as a team to complete the lab, but your Supervisor will lead the experiment. Follow the directions carefully as the Reader reads them out loud."

If a team has more than four members, ask students to allow the technician to do at least four samples.

2. Distribute DENSITY LAB #2: Salinity and DENSITY LAB #2 CHART. Direct students to DENSITY LAB #2: Salinity first to understand the Experimental Procedure and then DENSITY LAB #2 CHART to determine the sample pairs.

Remind students that the dropper must touch the side of the slanted test tube when dropping the drops. This way the drops will dribble down the test tube slowly and cause less turbulence and mixing.

3. Walk around the room giving assistance as needed. Use the Cooperative Group Work Rubric to reinforce good cooperation.

4. After completing the lab, distribute the DENSITY LAB #2 SUMMARY: Salinity. Students should discuss these questions together and answer in complete sentences.

5. **Optional**
   "Limiting The Variables"
   a. Read or tell:

      "No matter how carefully we follow directions, sometimes there are outside factors that influence or change our results. What would happen if I drop the drops from a height of two feet above the test tube?"

   b. Lead a discussion so that the students will realize that dropping the drops so high above the test tube will cause the solutions to mix and ruin the results! Ask,

      "What would happen if someone accidentally bumped the desk while you were dropping the drops into the test tube?"

   c. Again, students should deduce that this outside factor or variable will influence or even ruin the results of the experiment.
   d. Ask students to work together in their teams for a minute or two to generate a list of possible variables that would influence the results of this lab.
   e. Reconvene the class and discuss.

6. Ask the Recorders to organize the Team Folders. Students should put all handouts inside their Student Guide. The Recorders should make certain that everyone has written his/her name on each handout. Collect the folders from the Supervisors.

Phase Two—Day 7

Objectives

- Complete a formative assessment (optional)
- Understand how changes in density creates ocean currents
- Understand how upwellings of ocean currents returns nutrients to the surface of the ocean
- Learn to use DAILY DISCOVERY LOGS

Materials

- DENSITY, TEMPERATURE, AND SALINITY — *class set + transparency (optional)*
- DAILY DISCOVERY LOG — *class set*
- DAILY DISCOVERY LOG SAMPLE — *one per team*
- TEAM TEST 3 — *class set (optional)*

Procedure

1. Have students sit in teams.

2. Distribute DENSITY, TEMPERATURE, AND SALINITY. Read the top part as a whole class or have students read it in teams. Allow teams time to discuss the matrix.

Factors	High Salinity	Low Salinity
warm water	?	F
cold water	S	?

3. When students have written answers, discuss as a whole class. The question marks mean that the water may or may not be more dense than the water around it. It's a tight balance. Now read the rest of the essay to answer *What happens in water that you identified with question marks?*

4. **Optional**
   a. Students research the phenomenon known as El Niño.
   b. Students do further research on upwellings or undersea waterfalls.

5. Read or tell:

   "As you know, the local CSI has the damaged Help Letters as well as the contents of the bottles. Don't worry because they have been working very hard to decipher the notes and analyze the contents. The CSI unit will analyze soil and sand samples, plant (flora) debris, and animal material (fauna) found in the bottles or on the notes. With any luck, the stranded families will have described the landscape and the climate. They may have told about the local plants or animals. As you know, plants (flora) and animals (fauna) live in specific ecosystems. For example, an animal that thrives in a rain forest could not live in a desert. With these types of clues, you can eliminate some areas and research other areas more closely.

   "Let's look at how you will research these clues."

6. Direct teams to their Student Guide, page 3. Read and discuss **Chasing Clues**. Distribute DAILY DISCOVERY LOGS and DAILY DISCOVERY LOG SAMPLE. Go over how to use it.

*See **Setup Directions #19, Use Computer Time and Resources Effectively** on page 12. The suggestions will help you run the Internet research more efficiently.*

7. Go over your classroom procedures for using the Internet, going to the library, and maintaining the class references in an orderly fashion. Ask the Managers of each team to help reorganize the references at the end of each class period. Also, be certain that one team does not "hog" the research materials. Set time limits for use.

8. If time remains in the period, allow the teams to look at where their bottles were found and make some predictions about which currents may have brought them to that spot.

9. **Optional**
   Distribute TEAM TEST 3 and have teams work together as students complete their tests. Use **Teacher Reference, Answer Keys** for the correct answers.

The TEAM TESTS are an opportunity for peer teaching and reinforcement of the information learned thus far. All students feel a sense of success as they work together as a team to answer all the questions correctly.

10. Ask the Recorders to organize the Team Folders. Students should put all handouts inside the Student Guide. It will be kept in the Team Folder. The Recorders should make certain that everyone has written his/her name on each handout. Collect the folders from the Supervisors.

Phase Two—Day 8

Objectives

- Research CSI Clue #1 using technology and print resources
- Communicate findings to other team members
- Record data on DAILY DISCOVERY LOG

Materials

- CSI CLUES #1: Landforms — *one envelope per team*
- DAILY DISCOVERY LOG — *class set*
- WORK CITED RECORDING BLANKS — *class set of each + transparency*
- Reference materials — *many per team*
- Computer with Internet access — *several*

Preparation

1. Prior to class on Day 8 prepare all CSI Clues envelopes for each team/bottle. (See **Setup Directions #15, CSI Clues** on page 10 for more information). Today teams will receive the envelope with CSI Clues #1: Landforms.

2. Prepare a packet of the following materials for each team:
   a. DAILY DISCOVERY LOG — *one per member*
   b. WORK CITED RECORDING BLANKS — *one set of five per member*

Procedure

1. Illuminate the transparency of the WORK CITED RECORDING BLANKS. All team members must keep a record of where they collect information. Go over the format for each of the five reference types.

2. Have students sit in teams. Distribute the envelopes with CSI Clues #1 and the packet of materials to the team Managers.

3. The Supervisor reminds the team of their mission and re-reads page 1 of the Student Guide out loud to the team. The Reader reads CSI Clues #1 to the team.

4. Each student must document today's CSI Clue #1 on his/her DAILY DISCOVERY LOG.

5. The Supervisor organizes the team and directs the research of information using books, computers, atlases etc. He/she distributes the individual copies of the WORK CITED RECORDING BLANKS.

Distribute at least one set of five WORK CITED RECORDING BLANKS per student today. For subsequent days, keep a stack of extra blanks in a central location for students to take as they need them.

Consider putting a letter grade on each student's Log. This was motivating for students during the pilot testing.

6. Walk around the room giving assistance as needed. Use the COOPERATIVE GROUP WORK RUBRIC to reinforce good cooperation.

7. Students should photocopy information from books, magazines, etc. and print information from the Internet that is pertinent to the stranded family. This information and pictures will be used later as evidence for the team's *Rescue Day* presentation.

8. Reconvene the teams to meet during the **last 10 minutes** of the class to discuss their research results and findings. The Supervisor must make sure that each member completed a DAILY DISCOVERY LOG. The Recorder's DAILY DISCOVERY LOG will be assessed by the teacher and must include all the facts discovered and questions for the next day. Teams discuss all the information learned and assist the Recorder in making sure that his/her log includes all the information.

9. Ask the Recorders to organize the Team Folders. Recorders need to be certain that everyone has written their names on their WORK CITED RECORDING BLANKS. Students should put all handouts inside the Student Guide. The Recorders should make certain that everyone has written his/her name on each handout.

10. Collect folders from the Supervisors and review information using the **Teacher Reference** section in this guide. Check the Recorder's DAILY DISCOVERY LOG. If a team's facts discovered through research are correct, verify by making a check mark. If there is a problem, put a question mark and make plans to talk with the team the next day.

Phase Two—Day 9

Objectives

- Research CSI Clue #2 using technology and print resources
- Communicate findings to other team members
- Record data on DAILY DISCOVERY LOG

Materials

- CSI CLUES #2: Plant Life (flora) — *one envelope per team*
- DAILY DISCOVERY LOG — *class set*
- WORK CITED RECORDING BLANKS — *as needed*
- RESCUE DAY INVITATION — *two class sets (optional)*
- Reference materials — *many per team*
- Computer with Internet access — *several*

Preparation

1. Sort the prepared envelopes with the CSI Clues for each team. (See **Setup directions #15, CSI Clues** on page 10 for more information). Today teams will receive the envelope with CSI Clues #2: Plant Life (flora).

2. Prepare a packet of the following materials for each team:
   - DAILY DISCOVERY LOG — *one per member*

Procedure

1. Have students sit in teams.

2. Read or tell:

   "I have reviewed your Discovery Logs. Your Supervisor should check the log. If you see that I have put a check mark on the verified information, tell all your teammates to write the verified information in the proper boxes of the **Verified Team Information Chart** on pages 6–7 of the Student Guide.

   "If you see a "?," this means I have some questions about your conclusions, and you must speak with me before entering any information on the chart.

   "When your team has copied all the verified information, send your team manager to me to pick up today's CSI Clue #2."

Point out the additional WORK CITED RECORDING BLANKS near the reference materials. Remind students that they must correctly identify each source they consult.

Check the stacks each day and copy extras of those that are depleted.

DAILY DIRECTIONS
PHASE TWO—DAY 9

TEACHING TIP

It is important to correct incorrect information as soon as you discover it. A team can become lost in more ways than one.

3. While teams with checkmarks are copying in the verified information, meet with any team that you marked with a "?"

4. When the charts are complete, distribute the CSI CLUES #2 to the Manager of each team.

5. The Supervisor reminds the team of their mission.

6. The Reader reads the clues to the team. Each member summarizes CSI Clues #2 on the DAILY DISCOVERY LOG.

7. The Supervisor conducts a team meeting, organizes the team tasks, and directs the research of information using books, computers, atlases etc. He/she reminds students to maintain their WORK CITED RECORDING BLANKS.

If there is no time to copy/paste, then students should just record the URL or page numbers where the pictures were found.

8. Remind students that they can copy/paste pictures of the plants they research in a file to use later for visual aids.

9. Walk around the room giving assistance as needed. Use the COOPERATIVE GROUP WORK RUBRIC to reinforce good cooperation.

10. With 15 minutes remaining in the class, reconvene the teams. Allow **10 minutes** for team members to discuss their research results and findings. The Supervisor must make sure that each member completed a DAILY DISCOVERY LOG. The Recorder's DAILY DISCOVERY LOG will be assessed by the teacher and must include all the facts discovered and questions for the next day. Teams discuss all the information learned and assist the Recorder in making sure that his/her log includes all the information.

11. Ask the Recorders to organize the Team Folders. Students should put all handouts inside their Student Guide.

12. Collect folders from the Supervisors and review information using the **Teacher Reference** section in this guide. Check the Recorder's DAILY DISCOVERY LOG. If a team's facts discovered through research are correct, verify by making a check mark. If there is a problem, put a question mark and make plans to talk with the team the next day.

13. During the **last five minutes** of class, discuss who to invite to *Rescue Day* (Day 14). Distribute RESCUE DAY INVITATIONS as needed and have students fill out.

Phase Two—Day 10

Objectives

- Research CSI Clue #3 using technology and print resources
- Research using technology and literature
- Communicate findings to other team members
- Record data on DAILY DISCOVERY LOG

Materials

- CSI CLUES #3: Animal Life (fauna) — *one envelope per team*
- DAILY DISCOVERY LOG — *class set*
- WORK CITED RECORDING BLANKS — *as needed*
- Reference materials — *many per team*
- Computer with Internet access — *several*

Preparation

1. Sort the prepared envelopes with the CSI Clues for each team. (See **Setup directions #15, CSI Clues** on page 10 for more information). Today teams will receive the envelope with CSI Clues #3: Animal Life (fauna).

2. Prepare a packet of the following materials for each team:
   - DAILY DISCOVERY LOG — *one per member*

Procedure

1. Have students sit in their teams.

2. Direct teams to upgrade their **Verified Team Information Charts** in their Student Guides. Meet with any team that you marked with a "?"

3. When the **Verified Team Information Charts** are complete, distribute the CSI CLUES #3 to the Manager of each group.

4. The Supervisor reminds the team of their mission.

5. The Reader reads the clues to the team. Each member summarizes CSI Clues #3 on the DAILY DISCOVERY LOG.

6. The Supervisor conducts a team meeting, organizes the team tasks, and directs the research of information using books, computers, atlases etc. He/she reminds students to maintain their WORK CITED RECORDING BLANKS.

Point out the additional WORK CITED RECORDING BLANKS near the reference materials. Remind students that they must correctly identify each source they consult.

Check the stacks each day and copy extras of those that are depleted.

DAILY DIRECTIONS
PHASE TWO—DAY 10

If there is no time to copy/paste, then student should just record the URL or page numbers where the pictures were found.

7. Remind students that they can copy/paste pictures of and info about the animals they are researching in a file so that they can use them later for visual aids.

8. Walk around the room giving assistance as needed. Use the Cooperative Group Work Rubric to reinforce good cooperation.

9. During the **last 10 minutes** of the class, reconvene the teams to meet to discuss their research results and findings. The Supervisor must make sure that each member completed a DAILY DISCOVERY LOG. The Recorder's DAILY DISCOVERY LOG will be assessed by the teacher and must include all the facts discovered and questions for the next day. Teams discuss all the information learned and assist the Recorder in making sure that his/her log includes all the information.

10. Ask the Recorders to organize the Team Folders. Students should put all handouts inside their Student Guide.

11. Collect folders from the Supervisors and review information using the **Teacher Reference** section in this guide. Check the Recorder's DAILY DISCOVERY LOG. If a team's facts discovered through research are correct, verify by making a check mark. If there is a problem, put a question mark and make plans to talk with the team the next day.

Phase Two—Day 11

Objectives

- Research CSI Clue #4 using technology and print resources
- Research using technology and literature
- Communicate findings to other team members
- Record data on DAILY DISCOVERY LOG

Materials

- CSI CLUES #4: Latitude — *one envelope per team*
- DAILY DISCOVERY LOG — *class set*
- WORK CITED RECORDING BLANKS — *as needed*
- CSI NEWS FLASH — *one per team (optional)*
- Reference Materials — *many per team*
- Computer with Internet access — *several*

Preparation

1. Sort the prepared envelopes with the CSI Clues for each team. (See **Setup directions #15, CSI Clues** on page 10 for more information). Today teams will receive the envelope with CSI Clues #4: Latitude.

2. Prepare a packet of the following materials for each team:
   - DAILY DISCOVERY LOG — *one per member*

Procedure

1. Have students sit in teams.

2. Direct teams to upgrade their **Verified Team Information Charts** in their Student Guides. Meet with any team that you marked with a "?"

3. When the **Verified Team Information Charts** are complete, distribute the CSI CLUES #4 to the Manager of each group.

4. The Supervisor reminds the team of their mission.

5. The Reader reads the clues to the team. Each member summarizes CSI Clues #4 on the DAILY DISCOVERY LOG.

Duplicate an additional class set of DAILY DISCOVERY LOG if using the CSI NEWS FLASH.

Point out the additional WORK CITED RECORDING BLANKS near the reference materials. Remind students that they must correctly identify each source they consult.

Check the stacks each day and copy extras of those that are depleted.

If there is no time to copy/paste, then student should just record the URL or page numbers where the pictures were found.

Unless you have extended the research time line, today is also the last day for research.

6. The Supervisor conducts a team meeting, organizes the team tasks, and directs the research of information using books, computers, atlases etc. He/she reminds students to maintain their WORK CITED RECORDING BLANKS.

7. Remind students that they can copy/paste pictures of plants, animals, or other items they find through their research in a file so that they can use them later for visual aids.

8. Walk around the room giving assistance as needed. Use the Cooperative Group Work Rubric to reinforce good cooperation.

9. **Optional**
   Distribute CSI NEWS FLASH to those teams still needing assistance to find their families or distribute it to all teams. Remember, the goal is for each team to successfully locate its family.

10. During the **last 10 minutes** of the class, reconvene the teams to meet to discuss their research results and findings. The Supervisor must make sure that each member completed a DAILY DISCOVERY LOG. The Recorder's DAILY DISCOVERY LOG will be assessed by the teacher and must include all the facts discovered and questions for the next day. Teams discuss all the information learned and assist the Recorder in making sure that his/her log includes all the information.

11. Ask the Recorders to organize the Team Folders. Students should put all handouts inside their Student Guide.

12. Collect folders from the Supervisors and review information using the **Teacher Reference** section in this guide. Check the Recorder's DAILY DISCOVERY LOG. If a team's facts discovered through research are correct, verify by making a check mark. If there is a problem, put a question mark and make plans to talk with the team the next day.

Phase Three—Days 12–13

Objectives

- Decide where to send the rescue ship
- Prepare team presentation for G.E.T.U.
- Document supporting facts and visual aids.
- Rehearse oral presentations for *Rescue Day*

Materials

- PRESENTATION INSTRUCTIONS AND CHECKLIST — *one per team*
- Poster board — *two per team*
- Large paper bag — *one per team (optional)*

Students use the shopping bag as a place to store bulky items for the presentation.

Procedure

1. Have teams sit together. Read or tell:

   "By now you should have all the information you need to locate the missing family. Be as specific as you can. Be certain that all team members agree.

   "Now that you know where to send the ship, you must convince the G.E.T.U. Look at the directions on page 8 of your Student Guide."

2. Go over the Resue Day Presentation Directions (on page 8 of the Student Guide). Carefully review the Content and Presentation Rubrics. Distribute PRESENTATION INSTRUCTIONS AND CHECKLIST. Discuss your expectations.

3. Remind students that preparation for *Rescue Day* is a team activity. You can evaluate them daily using the COOPERATIVE GROUP WORK RUBRIC.

4. Ask Recorders to organize the Team Folders and materials at the end of each day. If necessary, have students keep oversized materials in a large paper bag.

5. With **30 minutes** remaining before the end of Day 13, remind students that they have only a half-hour to finish preparing for the presentation. They should rehearse what they are going to say. The content is a team evaluation, but each team member will be evaluated individually on his or her oral presentation.

6. If students are bringing refreshments, remind them to have them ready. Also, remind students who have invited family members to tell them when and where they should arrive.

Phase Three—Day 14
Rescue Day

Objectives

- Participate in *Rescue Day*

Materials

- AWARDS — *as needed*
- Additional seating for guests — *as needed*
- Note cards or written scripts presentation — *as needed*
- Visual aids — *as needed*
- Refreshments — *as needed (optional)*
- Video camera — *as needed (optional)*

Preparation

1. Place a welcome sign outside of classroom door. If there is a greeter, he/she can welcome guests into classroom. Post the order in which each team will present or design a program.

2. Place refreshments in an area away from the performance space.

3. Make sure students have all visual aids and note cards ready.

4. If you will be videotaping, make sure the camera is operating correctly and that the wires are positioned out of traffic areas.

Procedure

1. Make an official announcement to signal the beginning of *Rescue Day.* If there are guests, take a minute to prepare the audience by explaining what the students will do.

2. Announce each team. Have students introduce themselves before they begin.

3. Keep students on track time-wise. Pause between presentations for a minute to let the audience ask a question or two.

4. After all teams finish, lead a round of applause for all presenters.

5. Have the greeter thank guests for coming and welcome them to refreshments if they are provided. Invite guests to interview students if there is time.

6. If there is time when the audience has left, reconvene the class and distribute lined paper to each student. Students need to "process" what they learned. Ask them to write a very brief reflection piece on *S.O.S.* To help them get started, ask them to consider:
   - Is there anything new that they now understand regarding oceans and ocean currents?
   - Was there anything that surprised them?
   - Was there anything that confirmed or disproved what they initially believed on Day 1 of this unit?

7. Collect papers. Remind students to study for the POSTTEST on Day 15.

If there is no time, you can ask students to write a reflection piece after the debriefing on Day 15.

Phase Three—Day 15

Objectives

- Complete the POSTTEST
- Participate in a Debriefing

Materials

- POSTTEST — *class set*

Procedure

1. Students are <u>not</u> seated in their teams. Distribute the POSTTEST and allow 15–20 minutes for students to complete.

2. Collect tests and grade (using the **Answer Key** on page 51).

3. Use the Debriefing Questions as discussion or essay prompts. Students can respond individually, as a team, or in a group setting. (Use the **Answer Key** on page 51).

Debriefing Questions

1. If you were stranded on an island, what things would you describe and what would you place in your bottle so a rescue team could locate you?

2. The news often reports massive oil spills and ocean dumping. When they hear this, many people say, "I'm glad it didn't happen here!" What is wrong with this statement and why should people all over the world be concerned with ocean pollution?

3. "Taking a picture and only leaving a foot print," is a quote that is sometimes used by environmentalists. What do you think this means? Do you agree or disagree with it and why?

4. What would you include if you had to describe the flora and fauna in your immediate surroundings? Try to include indigenous plants (flora) and animals (fauna) if possible.

5. When a major power plant is built along the coastline, it discharges gallons of hot water by the thousands into the ocean. Based on your knowledge of density and temperature, where would you find this discharge in the water? What effect would the discharge have on the flora and fauna found in the marine environment?

This topic may require further research and could lead to a logical extension of learning of the students' local environment.

ANSWER KEYS
TEACHER REFERENCE

PRETEST

1. a
2. b
3. d
4. c
5. c
6. False
7. c
8. b
9. False
10. b
11. a and d
12. a
13. True
14. True
15. True
16. a, b, c, d
17. c
18. True
19. answers will vary
20. answers will vary

OCEAN CURRENTS

1. gyres
2. clockwise
3. counterclockwise
4. warmer
5. cooler
6. where the current originated

OCEAN CURRENTS QUESTIONS

1. The Equator
2. The Equator
3. The Poles
4. The water flows over rocks and soil that contain salts and then flows into the oceans.
5. No
6. Stage 1: evaporation
   Stage 2: water vapor
   Stage 3: condensation
   Stage 4: precipitation
   Stage 5: runoff
7. Wind and density
8. Temperature and density
9. Deep-water currents are generally cool or cold and surface currents are generally warm or cool.
10. The sun

CLIMATE AND OCEAN CURRENTS

1. **European Location**

Warmest Temperature/Coldest Temperature/Average			
Lisbon, Portugal	82°F	46°F	63°F
Madrid, Spain	91°F	32°F	57°F
Cherbourg, France	68°F	39°F	50°F
Galway, Ireland	55°F	43°F	48°F

North American Location

Warmest Temperature/Coldest Temperature/Average			
Atlantic City, United States	63°F	42°F	52°F
New York City, United States	60°F	46°F	53°F
Charlottetown, Labrador	49°F	33°F	41°F
Bonavista, Newfoundland	87°F	12°F	40°F

2. Accept any answer
3. The ocean currents affect the land temperature. A warm ocean current will make the land temperature warmer. A cold ocean current will make the land temperature colder.

SURFACE CURRENTS AND CLIMATE

Asian Location—Latitude Warmest Temperature/Coldest Temperature

Students should choose a city along the coast such as:

Osaka, Japan	34°N	82°F	32°F
Harbin, China	45°N	85°F	15°F

Warmest Temperature/Coldest Temperature

Some possible answers include:

Los Angeles, CA, United States	34°N	76°F	45°F
Portland, Oregon, United States	45°N	66°F	41°F

Currents that may have affected the climate

May include North Equatorial, Equatorial Countercurrent, and Kuro Shio (warm currents) and the Oya Shio, North Pacific, Alaska, and California (cool currents)

DENSITY LAB #1: Temperature

1. The blue went to the bottom most often. The blue liquid was cold water, which was more dense than warm water.
2. The red liquid usually floated on top. The red liquid was warm water, which is less dense than the blue cold water.
3. No, if you were to change the color of the solution that always sank to the bottom and repeat the experiment, it would still sink. The food coloring did not have enough density to change the experiment outcome. It was the density of each solution that mattered, not the color.
4. The two layers eventually mix together. Warm water may cool and begin sinking downward. Cool water may begin warming and tend to rise.
5. a. The tropical fish may survive a while because the storm may have carried warm water to the area along with the fish. The fish will remain alive as long as the water temperature stays at a temperature the fish can survive in.
   b. When the water begins to cool, the tropical fish may not be able to survive the cooler temperatures. How quickly the the water cools will affect how long the tropical fish survive.

DENSITY LAB #2: Salinity

B	B	B	Y	Y	Y	R	R	R	G	G	G
G	R	Y	B	G	R	B	G	Y	B	R	Y

DENSITY LAB #2 SUMMARY: Salinity

1. Salinity is the amount of salt dissolved in a liquid.
2. Yellow always sank to the bottom. It is the most dense because it has the most salt.
3. Blue always floated to the top. It is the least dense because it has no salt.
4. If you were to change the color of the solution that always sinks to the bottom, it would still sink. The food coloring did not have enough density to change the experiment outcome. The salinity or amount of salt in the solution determines density, not the color.

5. Yellow has the highest salinity and blue has the lowest salinity.
6. Rainwater will float. Rainwater has no salt and therefore it is less dense than ocean water, which contains salt. The less dense liquid always floats on top of the more dense liquid.
7. Water from a river would float on top of ocean water that it flows into because river water is fresh water (no salt). Ocean water is salt water and is more dense.

Team Tests (Optional)

Team Test 1

1. movement
2. gyres
3. clockwise
4. counter clockwise
5. poles
6. Equator
7. Sun
8. Wind
9. Surface and deep water
10. Surface…cold

Team Test 2

1. sun
2. temperatures
3. surface … density/ temperature
4. circles/loops
5. clockwise
6. currents
7. Trade
8. Westerlies
9. Flotsam and Jetsam
10. Currents

Team Test 3

1. surface…deep water
2. surface….deep water
3. currents
4. Westerlies
5. Equator
6. More
7. Less
8. More
9. Float…less
10. Temperature…salinity
11. Salt
12. No, the salt changes the density, not the color

POSTTEST

1. a
2. b
3. d
4. c
5. c
6. a and c
7. b
8. c
9. True
10. d
11. False
12. c
13. b
14. False
15. b
16. a and d
17. a
18. True
19. True
20. a
21. True
22. c
23. True
24. student rating of the unit

Debriefing Questions

1. Answers will vary. Students should mention landforms, climate, plants (flora), animals (fauna), natural resources, etc.
2. Ocean currents carry pollution to many areas around the world. Everybody is affected in some way by the damage created by pollution (water, air, food chain, etc.). The attitude, "I'm glad it didn't happen here" is erroneous because the earth is an ecosystem itself.
3. Ecosystems are fragile and can be disturbed by humans. Additional responses will vary.
4. Answers will vary based on indigenous plants and animals.
5. The warmer water/discharge rises to the top of the ocean because it is less dense that cold water. The discharge would heat up the cooler water thereby changing the overall temperature. This could have a negative effect on the plants and animals that live there. Some species can only survive in certain temperatures.

BOTTLE A
TEACHER REFERENCE

BOTTLE A—SMITH FAMILY—TASMANIA

Bottle was discovered at: Luderitz, Namibia, Africa

Latitude/Longitude: 25°S, 15°E

Information Regarding Bottle's Point of Origin

Landforms: rugged mountain peaks in the interior (quartzite, dolerite, basalt), igneous rock, glacial lakes; glaciers carved a series of bowl-shaped depressions called *cirques*; thick rain forests and plateaus; waterfalls

Major bodies of water: Southeast Indian Ocean, Tasman Sea, and Bass Strait

Climate: summer is hot, dry and windy, while winter (June–August) is cold, with persistent rain. The southern coast may have snow-capped mountains and hills

Hemisphere: Southern…Eastern

Flora: rain forests, eucalyptus forests, swamp gum trees—the tallest hard wood trees in the world, huon pines (*lagarostrobos franklinii*)—may live up to 3,000 years and one of the world's oldest living organisms, and fagus trees (*nothofagus gunnii*)

Fauna: Forty-spotted pardalote (*pardalotus quadragintus)*—a bird that lives in the eucalyptus forest, white-footed dunnart, spotted-tail quoll, dusky antechinus, and swamp antechinus, opossum, and echidna

Natural resources: lumber, mining, mineral processing, whaling a major industry in late 1800s

Ocean currents/ route: Antarctic Circumpolar Current to the Benguele Current

Miscellaneous information: site of over 1,000 shipwrecks

LOCATION OF SEARCH AND RESCUE MISSION
Queenstown, Tasmania, Australia
42°S, 146°E

BOTTLE B
TEACHER REFERENCE

BOTTLE B—ALVAREZ FAMILY—GALAPAGOS

Bottle was discovered at: San Miguel Island, Santa Barbara Islands, CA

Latitude/Longitude: 34°N, 120°W

Information Regarding Bottle's Point of Origin

Landforms: black lava formations, active volcano (La Cumbre), dark gray sand beaches

Major bodies of water: Pacific Ocean

Climate: June–December is cool, cloudy, and dry; December–June is warm, sunny, with afternoon showers

Hemisphere: Western

Flora: minimal in some areas due to lava; *brachycereus*, prickly pear, and candelabra cactus; passion flower, tree daisy (*scalesia*), guava trees, cotton, tree ferns, orchids

Fauna: giant tortoise (14 forms), marine iguanas, land iguanas, lava lizard, geckos, rice rat, hairy tailed bat, mockingbird, flightless cormorant, penguin (only species to live in tropical waters), blue and red footed boobies, Darwin's finch, whales, and fish

Natural resources: petroleum and hydropower

Ocean currents/route: Peru Current to the Kuro Shio Current to the California Current

Miscellaneous information: western-most island has most active volcano in the archipelago

LOCATION OF SEARCH AND RESCUE MISSION
Fernandina Island, Galapagos Islands, Ecuador, South America
0 °, 92°W

BOTTLE C
TEACHER REFERENCE

BOTTLE C—O'NEILL FAMILY—HOKKAIDO

Bottle was discovered at: Wollaston Island, Chile

Latitude/Longitude: 55°S, 67°W

Information Regarding Bottle's Point of Origin

Landforms: volcanic lakes, hot springs, peninsulas, forested mountains and hills, extinct volcanoes, marshlands

Major bodies of water: Pacific Ocean, Sea of Okhotsk, the Japan Sea

Climate: long severe winters, snow from October–April, summers have warm days but cooler nights, some typhoons

Hemisphere: Northern…Eastern

Flora: conifer, yezo spruce, stone pine forests, daimyo oaks, Sakhalin firs, tea; mandarin orange, plum, peach, and cherry trees

Fauna: Whooper swan, cranes, Steller's sea eagle, white tailed eagle, Blakiston's fish owl, red fox, sika deer, red squirrel, brown bear, fish

Natural resources: coal, iron, lead, copper, sea weed, wood, fish, squid, oysters, eels

Ocean currents/route: Antarctic Circumpolar Current to East Australian Current to the California Current to the Kuro Shio Current

Miscellaneous information: earthquakes create tsunamis; dairy farming a major industry; Ainu people (ancient race) live there; supplies 20 percent of nation's catch of fish

LOCATION OF SEARCH AND RESCUE MISSION
Hokkaido Island, Japan
43°N, 143°E

BOTTLE D
TEACHER REFERENCE

BOTTLE D—MELLO FAMILY—BRAZIL

Bottle was discovered at: Irwin, Australia

Latitude/Longitude: 28°S, 116°E

Information Regarding Bottle's Point of Origin

Landforms: river basin, sea level, abundant rain forests, many rivers ,some mountains, some plains, white sand beaches, soil erosion

Major bodies of water: Atlantic Ocean, Amazon River

Climate: tropical, hot and humid, lots of rain, long rainy season, gets 160 inches of rain per year; average temp in Jan. 80°F (27°C), average temp in July 60°F

Hemisphere: Southern…Western

Flora: parana pine, mahogany, rubber, and teak trees, *Bertholletia exceisa*, kapok, cotton, oranges, coffee, bananas, lemon, pineapple, tobacco, soybeans, pharmaceutical plants

Fauna: army ants, matamata, hairy-legged vampire bat, dwarf caiman, arapaima, tambaqui, tapir, anaconda, night monkey, ocelot, quetzel, jaguar, neon tetra fish, white piranha

Natural resources: charcoal, amethyst, asbestos, diamonds, gold

Ocean currents/route: Benguele Current to Brazil Current to Antarctic Circumpolar Current to West Australian Current

Miscellaneous information: 2,300,000 square miles of rain forest, deforestation is a major concern; world's largest exporter of coffee beans

LOCATION OF SEARCH AND RESCUE MISSION
Breves, Brazil, South America
1°S, 51°W

BOTTLE E
TEACHER REFERENCE

BOTTLE E—CHUNG FAMILY—GREENLAND

Bottle was discovered at: Catalina Island, Dominican Republic

Latitude/Longitude: 18°N, 69°W

Information Regarding Bottle's Point of Origin

Landforms: Central plateau covered in ice one–two miles thick; thousands of small islands, hundreds of long narrow sea inlets called fjords; glaciers and icebergs

Major bodies of water: Arctic Ocean, North Atlantic Ocean, Labrador Sea, Baffin Bay, Disko Bay, Greenland Sea, Denmark Strait

Climate: little rain or snow, temperatures range from –53°F, –47°C (coldest) to 12°F, –11°C (warmest), Summer has 24 hours of sunlight!

Hemisphere: Northern…Western

Flora: farming is limited due to short summers yet they do raise sheep, potatoes, and hay; no forests, some low growing trees

Fauna: sheep, seals, reindeer, musk oxen, sea Lion, blue whale, humpback whale, walrus, polar bear, cod, halibut, salmon

Natural resources: none

Ocean currents/ route: Labrador Current to Gulf Stream Current to Canary Current

Miscellaneous information: largest island in the world, nickname is "Land of the Midnight Sun;" Northern Lights, houses made of stone and earth; has largest national park in the world

LOCATION OF SEARCH AND RESCUE MISSION
Nuut, Greenland, Denmark
64°N, 51°W

BOTTLE F
TEACHER REFERENCE

BOTTLE F—DiLIBERO FAMILY—JAVA

Bottle was discovered at: Accra, Ghana, Africa

Latitude/Longitude: 6°N, 0°

Information Regarding Bottle's Point of Origin

Landforms: 2/3 land is rain forest, 13,000 islands, mountainous, 112 volcanoes, fertile soil from volcanic ash

Major bodies of water: Indian Ocean, Java Sea

Climate: tropical, hot and humid, average temperature 80°F; heavy rains most of the year, monsoons

Hemisphere: Southern…Eastern

Flora: abundant forests; cinchona, rubber, teak, bamboo, and mangrove trees; world's largest producer of rice; also bananas, cocoa, tobacco

Fauna: banded linsang, walking catfish, Javan wart snake, sun bear, naked bulldog bat, flying frog, bearded pig, robber crab, fire ants, giant clam, sardines, anchovies, tuna, scad, shrimp, elephant, rhino, tiger, tapir

Natural resources: oil, natural gas, bauxite, coal, copper, gold

Ocean Currents/Route: Agulha Current to Beguela Current to Africa Current

Miscellaneous information: , world's leader in production of quinine(drug from cinchona bark used to treat malaria); eruption of volcano on Krakatau caused a tsunami that killed 36,000 people in 1883

LOCATION OF SEARCH AND RESCUE MISSION
Surabaya, Java, Indonesia
7°S, 122°E

BOTTLE G
TEACHER REFERENCE

BOTTLE G—FARLEY FAMILY—JAMAICA

Bottle was discovered at: Hammerfest, Norway

Latitude/Longitude: 70°N, 23°E

Information Regarding Bottle's Point of Origin

Landforms: interior mountains and coastal plains, largely a limestone plateau 3,000 feet above sea level, it has deep depressions in the land called *cockpits*

Major bodies of water: Caribbean Sea, Gulf of Mexico, Atlantic Ocean

Climate: tropical, hot and humid, lots of rain all year; many hurricanes from July–November

Hemisphere: Northern…Western

Flora: banana, cacao, coconut, coffee, and citrus trees; sugar cane

Fauna: upside-down jellyfish, West Indian manatee (sea cow), longlure frogfish, king mackerel, green anole lizard, great barracuda, do-not-touch-me sponge, brain coral, ashy gecko

Natural resources: bauxite, limestone, gypsum

Ocean currents/ route: Gulf Stream Current to Norway Current

Miscellaneous information: near the Cayman Trench, along main sea lanes/trading routes; a lot of ship pollution and oil spills; world's largest producer of bauxite (needed to make aluminum)

LOCATION OF SEARCH AND RESCUE MISSION
Montego Bay, Jamaica, West Indies
18°N, 77°W

BOTTLE H
TEACHER REFERENCE

BOTTLE H—CAPUTO FAMILY—SICILY

Bottle was discovered at: Neskaupstadhur, Iceland

Latitude/Longitude: 65°N, 14°W

Information Regarding Bottle's Point of Origin

Landforms: mountains, hills, active volcano that is sometimes covered in snow (Mt. Etna largest volcano in Europe), lowlands near the coast; rocky coast north and sandy coast south; fertile soil; smaller islands in the surrounding ocean

Major bodies of water: Tyrrhenian Sea to the north, Ionian Sea to the east, Mediterranean Sea to the south

Climate: Mediterranean weather, very dry hot summers with short mild winter

Hemisphere: Northern…Eastern

Flora: stone pines; palm, juniper, beech, almond, fig, blood orange, pistachio, and olive trees, papyrus, sumac, artichokes, and wheat

Fauna: hedgehog, porcupine, frog, toads, vultures, geckos, red footed falcon (*falco vespertinus*), red fox, Bonelli's eagle, tuna, sardines, coral, and sponges

Natural resources: salt, limestone, sulfur, coal, and iron

Ocean currents/ route: Canary Current to the Gulf Stream Current to the North Atlantic Current

Miscellaneous information: produces olive oil and wines, Roman, Greek, and Phoenician influences; Sicily chosen by the gods of Mt. Olympus as the scene of their stories

LOCATION OF SEARCH AND RESCUE MISSION
Giarre, Sicily in Italy
38°N, 15°E

BOTTLE I
TEACHER REFERENCE

BOTTLE I—LAWLESS FAMILY—MADAGASCAR

Bottle was discovered at: Puerto Montt, Chile, South America

Latitude/Longitude: 42°S, 73°W

Information Regarding Bottle's Point of Origin

Landforms: narrow coastal plains, high plateaus and mountains in center; dense forests, fertile soil, river valleys

Major bodies of water: Indian Ocean, Mozambique Channel

Climate: tropical, hot and humid; warm along coast, cooler in highlands

Hemisphere: Southern…Eastern

Flora: trees have been cut for farming and cattle; orchids (over 1,000 species), baobab tree, coffee, vanilla, cloves

Fauna: aye-aye, mongoose lemur, Nile crocodile, indri, fossa, brown lemur, chameleon

Natural resources: graphite, coal, salt, bauxite

Ocean currents/ route: Antarctic Circumpolar Current to Peru (Humboldt) Current

Miscellaneous information: fourth largest island in the world; 95% of all plants (flora) cannot be found anywhere else in the world

LOCATION OF SEARCH AND RESCUE MISSION
Toamasina, Madagascar, Africa
18°S, 49°E

ID TAGS

Bottle A Smith Family Found at: 25°S, 15°E Last Seen: New Guinea	Bottle B Alvarez Family Found at: 34°N, 120 °W Last Seen: Straits of Magellan in Chile	Bottle C O'Neill Family Found at: 55°S, 67°W Last Seen: Hong Kong
Bottle D Mello Family Found at: 28°S, 116°E Last Seen: Jamaica	Bottle E Chung Family Found at: 18°N, 69°W Last Seen: Nova Scotia	Bottle F Di Libero Family Found at: 6°N, 0 ° Last Seen: Philippines
Bottle G Farley Family Found at: 70°N, 23°E Last Seen: Ireland	Bottle H Caputo Family Found at: 65°N, 14°W Last Seen: Labrador	Bottle I Lawless Family Found at: 42°S, 73°W Last Seen: Mexico

HELP LETTER

HELP!

We're stranded! Please send help!

We were sailing in our boat when a terrible storm struck. A huge wave destroyed the mast and sails. We were forced into our tiny life raft. We endured high winds and huge waves for days. Finally the storm stopped, but we drifted and drifted before catching sight of land.

Although we don't know where we are, we will tell you a little about this place. Maybe that will help you find us.

S.O.S.

Team Members

Supervisor_____

Reader_____

Recorder _____

Manager _____

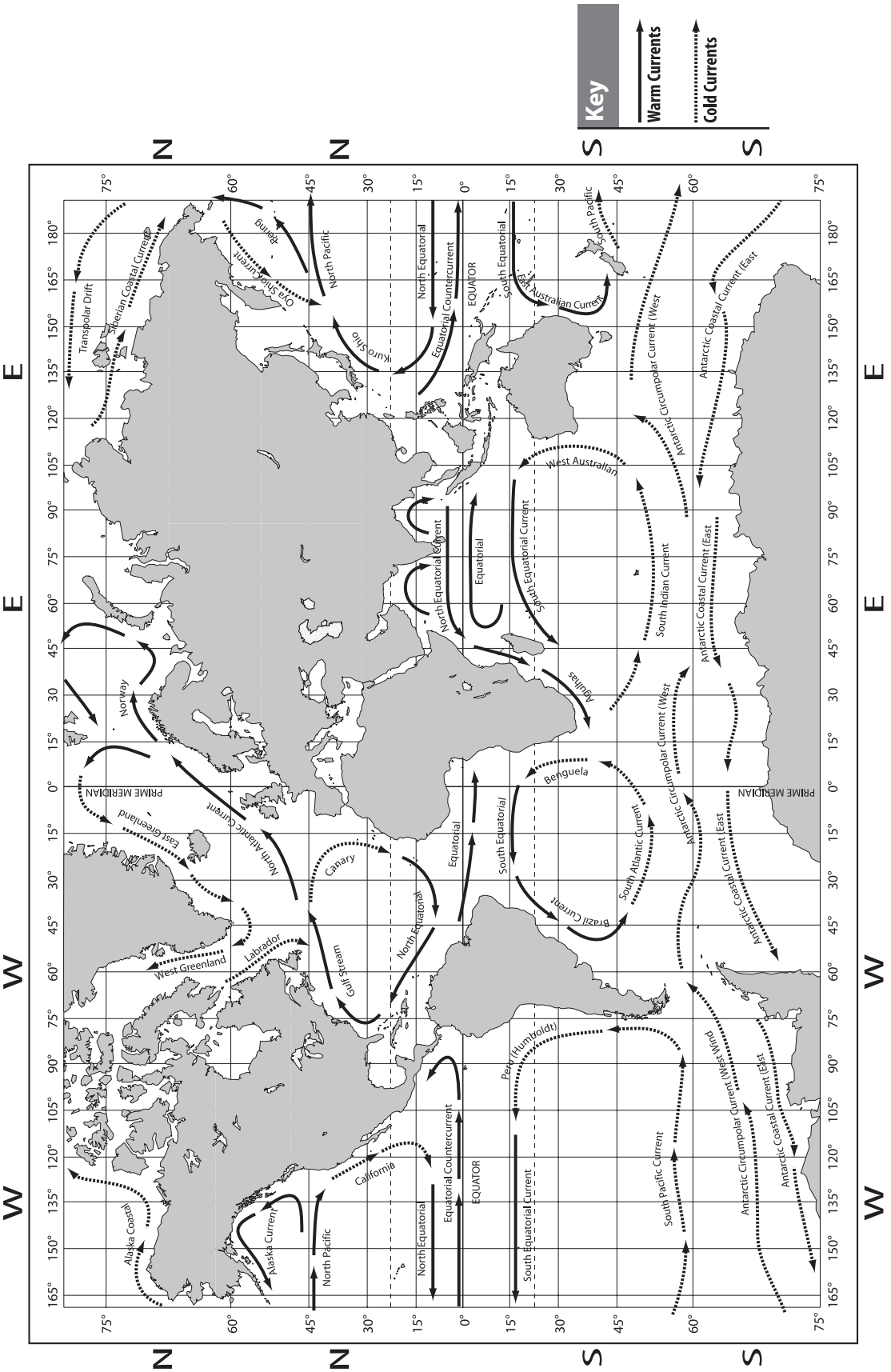
Technician _____

Lost Family _____

Bottle _____

Found at_____

OCEAN CURRENTS MAP



PRETEST (1)

Name_____ Date: _____

Directions: Circle the correct response for each of the following questions.

1. Which lines on a globe run north or south of the Equator?
   a. longitude
   b. latitude
   c. equator
   d. climate

2. Which lines show distances east or west of the Prime Meridian?
   a. longitude
   b. latitude
   c. equator
   d. climate

3. Zero degrees latitude is called the _____?
   a. Prime Meridian
   b. Tropic of Cancer
   c. North Pole
   d. Equator

4. There are _____ hemispheres on the earth.
   a. three
   b. two
   c. four
   d. six

5. The hottest climates are located between the _____ and the _____.
   a. Equator/Tropic of Cancer
   b. Tropic of Capricorn/Equator
   c. Tropic of Capricorn/Tropic of Cancer
   d. Tropic of Cancer/South Pole

6. Warm water is more dense than cold water.
   True
   False

7. What is the Earth's primary source of energy?
   a. the ocean
   b. the wind
   c. the sun
   d. electric energy

8. Ocean currents are formed from wind, temperature, and _____.
   a. waves
   b. density
   c. land forms
   d. fish

9. Ocean currents travel very short distances.
   True
   False

10. Which has the MOST density?
    a. water from an estuary
    b. ocean water
    c. rain water
    d. spring water

11. The two things that can change the density of water are _____ and _____?
    a. salt
    b. food coloring
    c. fish
    d. temperature

12. All plants (flora) and animals (fauna) survive because of _____ to a particular ecosystem.
    a. adaptation
    b. moon phases
    c. birth
    d. destruction

13. An ecosystem is a complex community in nature where plants (flora) and animals (fauna) interact with their environment.
    True
    False

14. Early navigators used the angle of the Sun above the horizon to find their latitude.
    True
    False

PRETEST (2)

15. All the water that is on the Earth now has been here since the beginning of time because of our water cycle.
    True
    False

16. What is needed for a successful rescue mission? Circle all that apply.
    a. cooperation
    b. money
    c. map skills
    d. evidence

17. The sun makes water on earth evaporate, and then it comes back down to earth as _____.
    a. pressure
    b. salt
    c. precipitation
    d. gravity

18. Although there may be changes in the amount of water on land, in the sea, and in the atmosphere at any given time, the total amount of Earth's water remains the same because of our water cycle.
    True
    False

19. If you were stranded and were going to send a message in a bottle, what things would you write on your S.O.S. note so a rescue team could locate you?

_____

_____

_____

_____

_____

_____

_____

_____

20. If you found a bottle with a message in it, what would you do?

_____

_____

_____

_____

_____

_____

_____

_____

COOPERATIVE GROUP WORK RUBIC

4 — EXEMPLARY — You *consistently* and *actively* help your group achieve its goals by communicating well with other group members, by encouraging the group to work together, and by *willingly* accepting and completing the necessary work of your daily role.

3 — EXPECTED — You *usually* help your group achieve its goals by communicating with other group members, by encouraging your group to work together, and by accepting and completing the necessary work of your daily role.

(If your evaluation is less than EXPECTED, try to use your cooperating skills more consistently.)

2 — You *sometimes* help your group achieve its goals.

1 — You *do very little* to help your group achieve its goals.

Cooperative Group Work Rubic

Name: ______________________________

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OCEAN CURRENTS OVERVIEW

Name_____ Date: _____

Our oceans are in constant motion. The movement of ocean water is called an ocean *current*. Ocean currents move very large amounts of water very great distances! The ocean currents flow or move in large rotating loops called *gyres*. The spin of the earth causes the gyres to spin in different directions in the Northern and Southern hemispheres. They may travel in a clockwise or a counter-clockwise direction. They may be either warm or cold. As they move from one place to another, warm currents eventually cool, and cold currents eventually warm. Floating objects may move from one current to another.

Directions:

Answer each question using the paragraph above and the **Ocean Currents Map** on pages 4–5 in your Student Guide:

1. Ocean currents flow in rotating loops called _____
2. Look at the larger ocean currents in the Northern Hemisphere. Do they travel clockwise or counterclockwise? _____
3. Look at the larger ocean currents in the Southern Hemisphere. Do they travel in a clockwise or a counterclockwise direction? _____
4. Are ocean currents that originate near the Equator generally warmer or cooler?

   _____
5. Are ocean currents that originate near the North or South Poles generally warmer or cooler? _____
6. Complete the following sentence:

   Generally the temperature of a current depends on _____

   _____

   _____

   _____

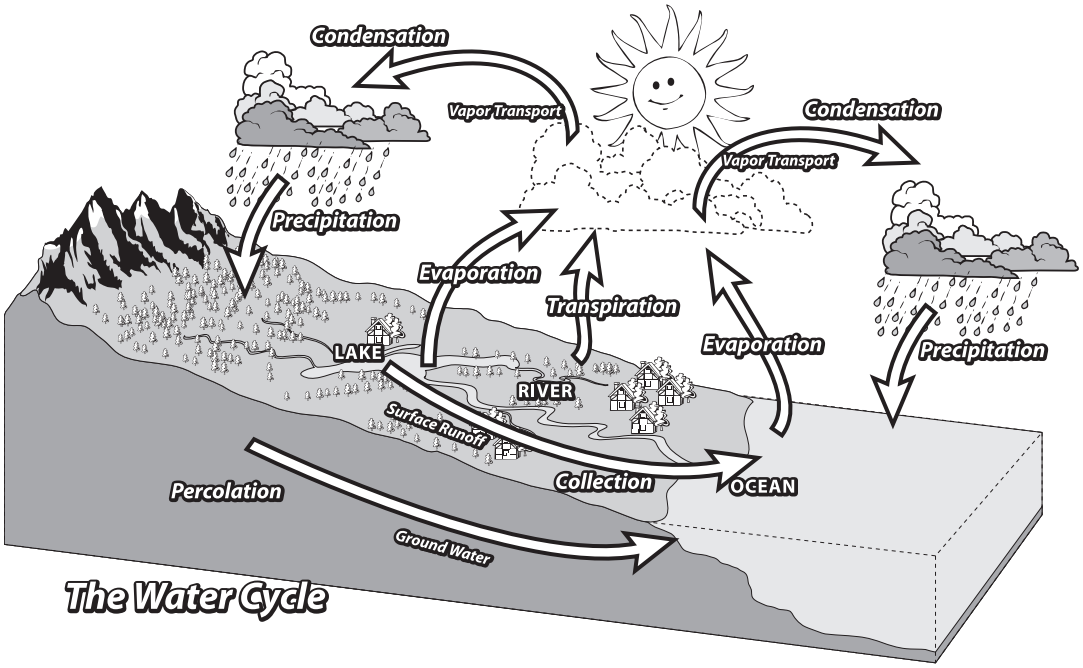
   _____

OCEAN CURRENTS AND THE SUN

Name_____ Date: _____

There are two kinds of ocean currents—s*urface* currents and *deep-water* currents. The energy to move all ocean currents ultimately comes from the *sun*. The heat of the sun warms the earth and creates global winds. Surface currents are primarily driven by the winds. These wind-driven surface currents move much faster than the deep-water currents. Surface currents may be warm or cool. Deep-water currents are generally cool or cold. As the currents move in their gyres, warmer currents eventually cool, and cooler currents eventually warm up.

Both surface and deep-water currents are driven by density. (Later in this unit you will complete two experiments that explore density, temperature, and salinity in seawater.) The sun also affects the changing density of ocean waters. You know that in some places the sun warms the ocean and raises its temperature. But you may not realize that it is also the sun that causes the ocean to be salty.



The sun affects the amount of salt in our ocean currents through the Water Cycle. You probably know that the sun's energy warms and evaporates water. When water evaporates, water molecules change into water vapor. This lighter water vapor rises in the air. Eventually, the molecules cool and condense forming water droplets around specks of dust in the atmosphere. Untold numbers of these droplets form clouds. These droplets combine and become heavy enough to create precipitation (rain, sleet, snow, hail). The precipitation falls back to earth returning the moisture that originally evaporated.

Here is how the water cycle puts salt into ocean water. When the water returns to the earth in the form of precipitation (rainwater, sleet, snow, etc.), it flows over rocks and soil that contain salt and other minerals. This runoff water then flows into gulfs and bays carrying tiny molecules of salt to the ocean. When the sun starts the cycle again, it heats the ocean, but only the water evaporates. The salt is left behind. Over billions of years, the salt has accumulated in the oceans.

Once you understand the water cycle, you can understand why the saltiest seas are the Red Sea and the Persian Gulf. They are near the Equator, and there is a high evaporation rate. You can also see why the least salty seas are near the polar regions. Here, the polar ice (fresh water) melts and mixes with the rain to add large amounts of fresh water to the ocean.

OCEAN CURRENTS QUESTIONS

Name_____ Date: _____

Directions:
Read **Ocean Currents and the Sun** as a team and then answer the questions below. Your answers do not need to be in complete sentences.

1. Where on the Earth do we find the warmest temperatures? _____

   _____

2. Where on the Earth do we find the saltiest oceans? _____

   _____

3. Where are the oceans less salty? _____

   _____

4. How did salt get in the oceans? _____

   _____

   _____

5. Does salt evaporate? _____
6. What are the five stages of the water cycle?

   Stage 1. _____

   Stage 2. _____

   Stage 3. _____

   Stage 4. _____

   Stage 5. _____
7. What causes surface currents to move?_____

   _____
8. What causes deep-water currents to move? _____

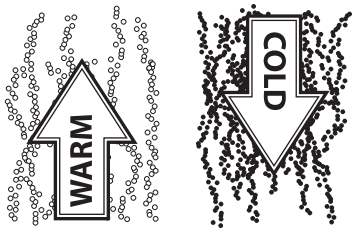
   _____
9. Which current is colder?_____

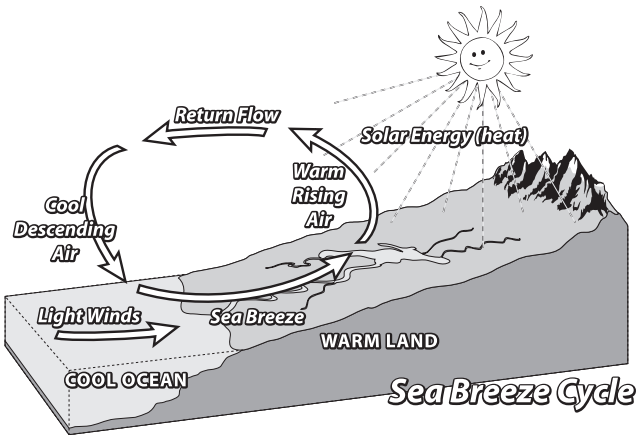
   Which current is warmer?_____
10. What is the source of all energy on earth? _____

WIND AND SURFACE CURRENTS

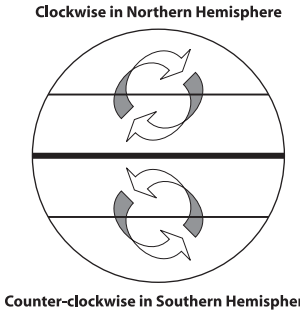
Name_____ Date: _____

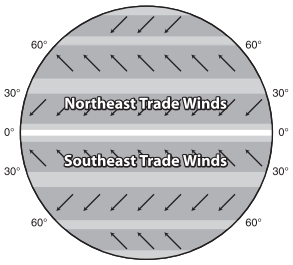
The sun creates the winds. A combination of warming and cooling air plus the spin of the earth creates consistent patterns that we call wind currents.





Because the Earth spins, the winds do not run directly north or south. They spiral clockwise in the Northern Hemisphere and counterclockwise in the Southern Hemisphere.





The energy in wind currents can be transferred to ocean currents. We call the ocean currents driven by wind, *surface currents*. Because the wind currents follow established patterns, ocean currents created by the winds have predictable patterns. The winds at the Equator are called *Northeast Trade Winds* and *Southeast Trade Winds*. The winds at the mid-latitudes (above or below the tropics) are called *Westerlies*. The winds at the high latitudes are called *Polar Easterlies*. The primary winds that drive the surface currents are the *Trade Winds* and the *Westerlies*.

Compare the wind currents in the picture above to the ocean currents on pages 4 and 5 of your Student Guide. Although surface currents travel in a general direction, they can wander. Sometimes parts of a surface current can break off into smaller currents called eddies that travel in directions different from the main current.

Surface currents, as their name implies, run in the upper levels of the ocean. The sun warms the water molecules on the surface. More than any other place on earth, the sun warms the ocean water most at the Equator. Therefore, currents (like winds) that start at the Equator and spiral either northward or southward toward the Poles are warm. Currents that start at the Poles and spiral towards the Equator are generally cool.

The spin of the earth does not allow the ocean currents to run directly north or south. They spiral clockwise in the Northern Hemisphere and counterclockwise in the Southern Hemisphere.

CLIMATE AND OCEAN CURRENTS

Name_____ Date: _____

You would expect that the closer a location is to the North Pole, then the colder it is. But that is not always the case. Complete the chart below and discuss the results.

Directions:

1. Use the Internet or reference books to find the warmest temperature and the coldest temperature for each of the locations listed below. Fill in the charts and compare the European locations to those in North America.

European Location	Latitude	Warmest Temperature	Coldest Temperature	Average Temperature
Lisbon, Portugal	39° N			
Madrid, Spain	41° N			
Cherbourg, France	49° N			
Galway, Ireland	53° N			

North American Location	Latitude	Warmest Temperature	Coldest Temperature	Average Temperature
Atlantic City, New Jersey	39° N			
New York City, New York	41° N			
Charlottetown, Labrador	49° N			
Bonavista, Newfoundland	53° N			

2. Discuss your results. Are they the same? _____

_____

_____

3. Look at your **Ocean Currents Map** on pages 4–5 of your Student Guide. What might affect the temperatures of the different locations?

_____

_____

_____

_____

SURFACE CURRENTS AND CLIMATE

Name_____ Date: _____

As you discovered, surface currents affect climate. When you compared temperatures in locations on either side of the Atlantic Ocean, you were observing the effects of the most famous surface current—the *Gulf Stream*. The Northern Hemisphere Westerly winds drive this huge current. The Gulf Stream has a great effect on climate in both the Eastern United States and in Europe. On average, the Gulf Stream is 150 miles wide and 3/4 mile deep. This immense amount of warm water "moderates" local temperatures. "Moderates" means that the winters are not as cold as expected for a certain latitude.

On your **Ocean Currents Map** (pages 4–5 of your Student Guide), follow the Gulf Stream from where it starts off the coast of Florida. See that it moves up the Eastern coast of the United States to New England. In a clockwise gyre, it heads across the Atlantic toward Europe where its warm water keeps Iceland and the British Isles much warmer than places in similar latitudes. Off the coast of northern New England and eastern Canada, the Labrador Current (a smaller cold current from the Arctic) pushes between the Gulf Stream and the coast. This eastern area of North America has cooler springs and colder winters because it does not get the benefit of the warm Gulf Stream waters.

Is there an equivalent ocean current in the Pacific that affects climate on the Eastern shores of Asia and the Western Shores of North America? You can find out.

Directions:

Find two locations on both sides of the Pacific Ocean that are relatively at the same latitude. Use the Internet or references to find the warmest temperature and the coldest temperature for each of the locations. Fill in the chart and compare the Asian locations to those on the West Coast of North America.

Asian Location	Latitude	Warmest Temperature	Coldest Temperature

North American Location	Latitude	Warmest Temperature	Coldest Temperature

What surface current or currents may affect the climate? _____

_____

_____

_____

FLOTSAM AND JETSAM (1)

Name_____ Date: _____

According to the *American Heritage Dictionary*, "The common phrase *flotsam and jetsam* is now used loosely to describe any objects found floating or washed ashore." Ocean currents carry flotsam (like your bottles) all around the world.

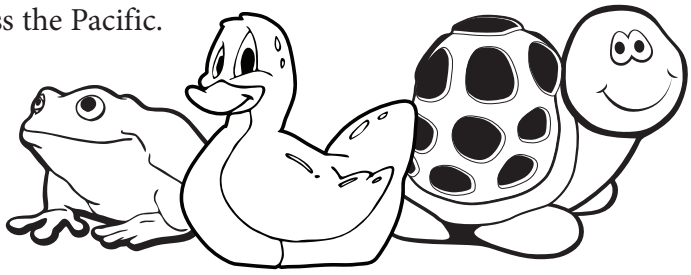
According to an article on the National Geographic website 3/1/04, every year 10,000 containers fall off freight ships into the ocean. These containers are not small, but are the box part of an 18-wheeler tractor-trailer. Shippers not only fill the ship's hold with containers, but also stack them on the decks. When the ships run into heavy seas or rogue waves, their cargo may spill over the side. Some of it sinks straight to the bottom. However, some containers split open. Their contents (flotsam) begin an ocean journey that may eventually circumnavigate the globe.

The Nike Spill

In May of 1990, a storm hit the *Hansa Carrier* off the coast of the Aleutian Islands of Alaska. It spilled 21 containers containing 80,000 Nike sneakers and work boots. Over the years, the flotsam of shoes came ashore in Vancouver (Canada), Hawaii, Taiwan, China, and Japan. More shoe flotsam eventually found their way back to the West coast of California floating in the North Pacific gyre. Oceanographers discovered something special when they studied the Nike spill. They realized that more left shoes ended up in one place, and more rights in another. Evidently the shape of the sole affected the way it drifted in the current.

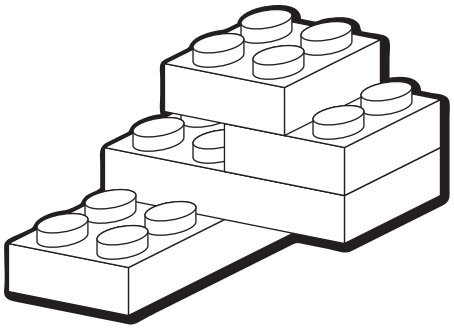
The Tub Toy Spill

In 1992, 29,000 plastic turtles, ducks, beavers, and frogs spilled into the North Pacific. They traveled on currents first eastward toward the coast of North America and then northward toward Alaska. Many continued the trip back across the Pacific. However, some toy flotsam was captured in the Arctic ice. After a trip around the North Pole, some of the toys have now entered the currents on the east side of North America and are drifting southward toward New England.



FLOTSAM AND JETSAM (2)

The Lego Spill



On February 13, 1997, a rogue wave hit the *Tokio Express* 20 miles off Lands End, England. Sixty-two containers toppled overboard. One contained almost five million Lego™ pieces. Much of the Lego flotsam was found along the coast of England. However, many pieces continued their journey in the Atlantic gyre. It took about 14 months for them to reach the coast of Florida and the Carolinas. Oceanographers expect that by 2012, the Legos will drift to the Arctic Ocean. From there they will eventually find their way to Alaska and the coast of California.

The Hockey Glove Spill

Also in 1997, the *Hyundai Seattle* sailed into a fierce storm in the Pacific off Adak, Alaska. When its engine room caught fire, the crew abandoned ship. Although the ship did not sink, much of its cargo of hockey gloves, chest protectors, and shin guards spilled over the side. This flotsam drifted eastward toward Washington state and along the coast of California. It then traveled westward to the Hawaiian Islands. Oceanographers had predicted where the cargo would drift, but were surprised that one glove arrived earlier than expected. It turned out that the glove floated with the forefinger floating above the surface. This provided a little sail that pushed it along.

Dandy and Dangerous Spills

The *Pol American* lost its cargo 11 miles off the Cape Cod National Seashore on October 18, 2000. Part of the cargo list included "confections." No one was surprised when flotsam washed ashore a few days later on Nantucket Island. The islanders found their shoreline littered with pieces of candy. Much of it was still wrapped and safe to eat! Cargo spills are usually not a direct danger to humans. However, on March 31,1997, the *Santa Clara I* spilled 21 containers into the waters between New Jersey and Long Island, New York. This could have been a horrific disaster! Four of the containers were filled with enough arsenic trioxide to poison half the population of the United States. The government spent $4 million to recover the containers. Fortunately, none had opened!

FLOTSAM AND JETSAM ACTIVITY

Name_____ Date: _____

Directions:
Read **Flotsam and Jetsam** and **Flotsam and Jetsam Facts** as a team and then answer the questions below. Your answers do not need to be in complete sentences.

1. My team found a _____ in our Team Folder.
2. This item fell off a freight ship near _____
3. It floated as far as _____
4. There are several currents that carried this item. They are (in order):
    1. _____
    2. _____
    3. _____
    4. _____
    5. _____
    6. _____
    7. _____
5. My team also found a _____ in our Team Folder.
6. This item fell off a freight ship near _____
7. It floated as far as _____
8. There are several currents that carried this item. They are (in order):
    1. _____
    2. _____
    3. _____
    4. _____
    5. _____
    6. _____
    7. _____

CSI FLOTSAM/JETSAM FACTS

Flotsam and Jetsam Facts

The following information was omitted from your **Flotsam and Jetsam** page.
Our sources discovered:

1. A hockey glove was found on the beach of a fishing village in South Korea. It had the word "Bears" sewn on to it in red thread.
2. The Legos™ were found on the shore in Myrtle Beach and two young boys took them home.
3. Three containers filled with packages of candy that fell from the ship 11 miles off of Cape Cod were found on Devon Island in Canada…frozen solid!!
4. Two additional spills were identified.
    a. Containers of toxic chemicals fell off a freight ship off the coast of Madagascar, east of Africa. These containers were found on the island of Sumatra in Indonesia. A group of natives caught them in their squid nets.
    b. A family of plastic turtles were put on a ship in China and were later identified as missing. Two plastic turtles were found in northern Russia with their heads sticking up out of the Arctic Ice.
5. Three containers that fell from the ship 11 miles off of Cape Cod were found on Devon Island in Canada…frozen solid!!

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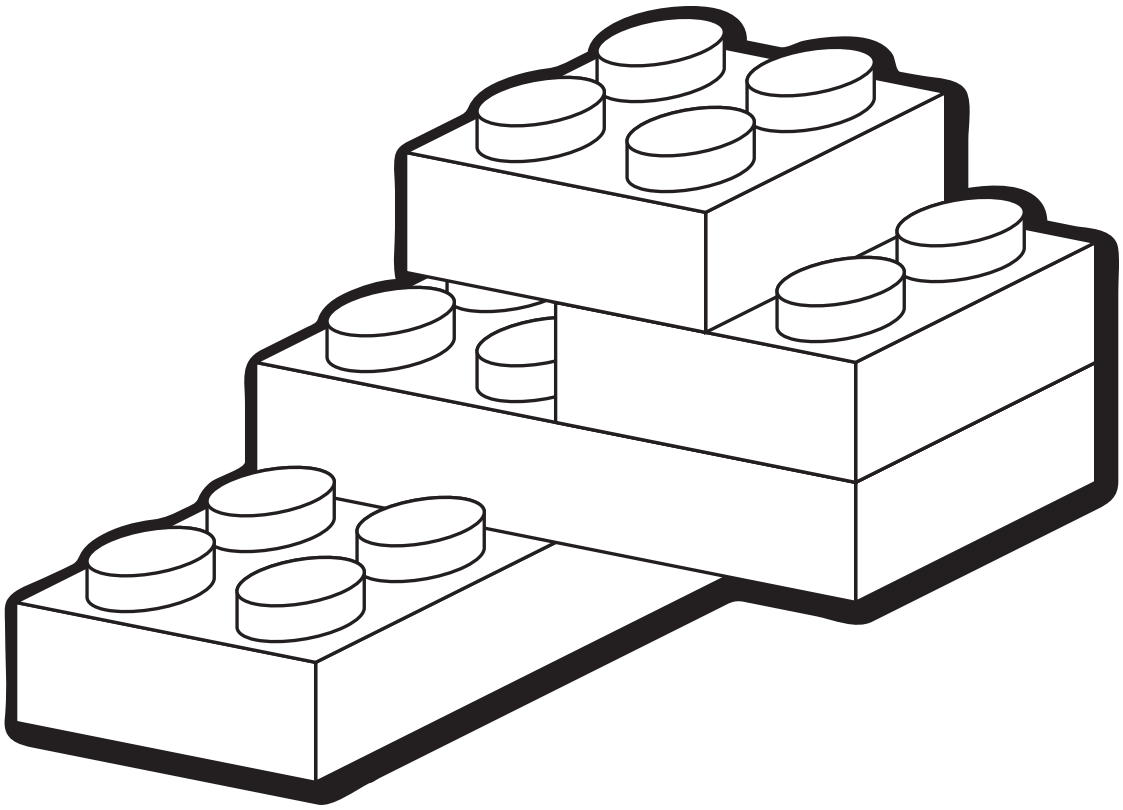
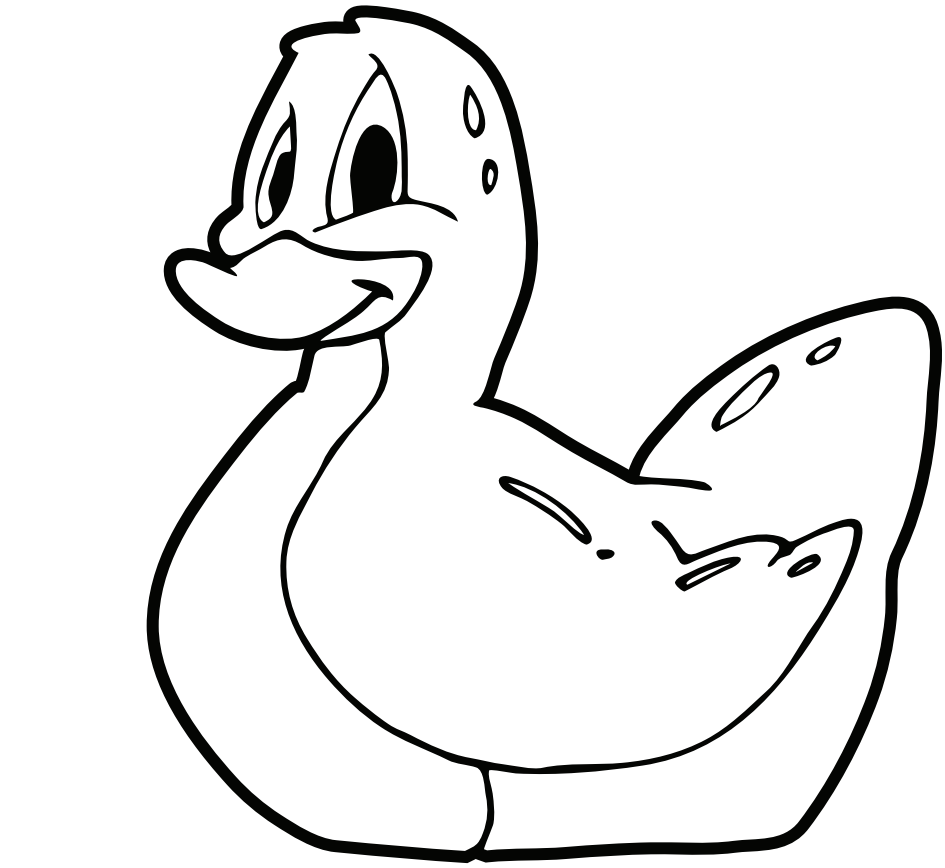
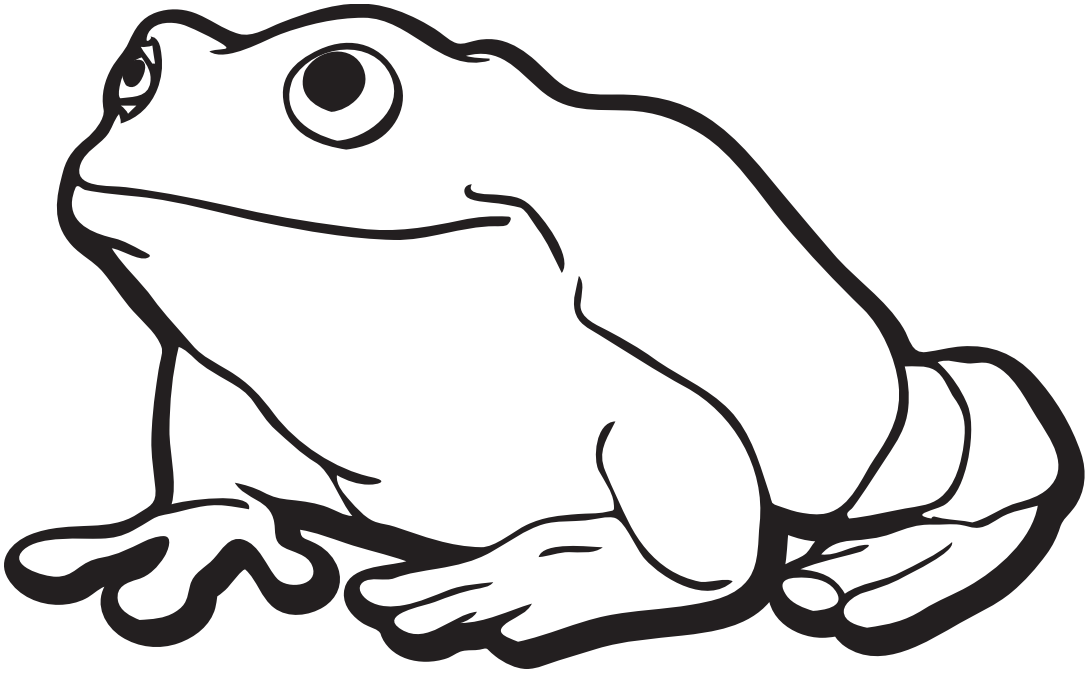
FLOTSAM/JETSAM ITEMS (1)

FLOTSAM AND JETSAM ITEMS (2)

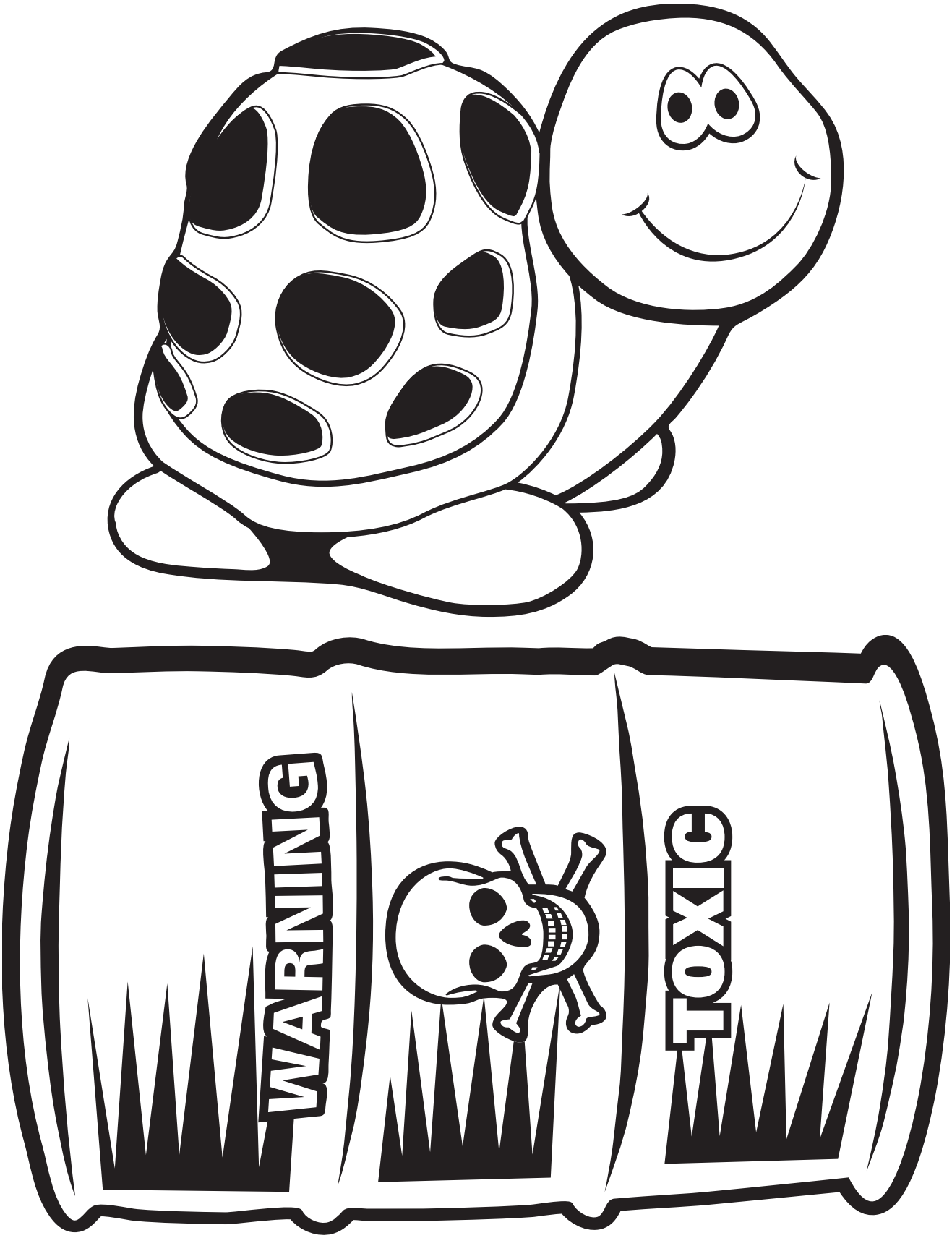


FLOTSAM AND JETSAM ITEMS (3)





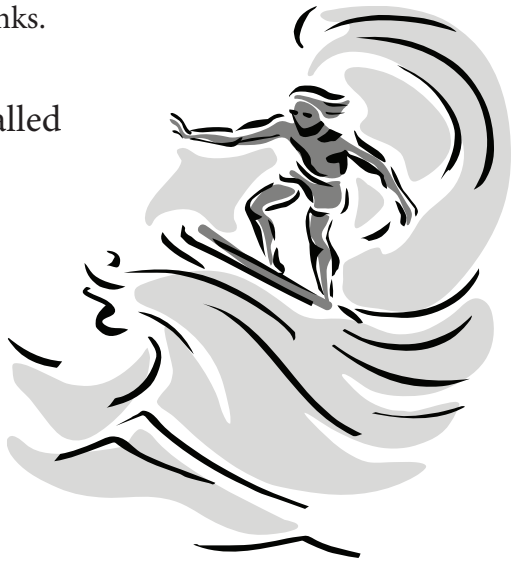
FLOTSAM AND JETSAM ITEMS (4)



TEAM TEST 1

Name_____ Date: _____

Directions:
Read the following questions with your team and fill in the blanks.



1. The _____ of ocean water is called an ocean current.
2. Ocean currents move in large rotating circles called _____.
3. Gyres in the Northern Hemisphere spin in a _____ direction.
4. Gyres in the Southern Hemisphere spin in a _____ direction.
5. Ocean currents that start at the _____ are cool.
6. Ocean currents that start at the _____ are warm.
7. The _____ is the source of all energy on earth.
8. Ocean currents form because of _____ and/or changes in density.
9. There are two kinds of currents, _____ and _____.
10. _____ currents can be warm or cool, but deep-water currents are always _____.

TEAM TEST 2

Name_____ Date: _____

Directions:
Read the following questions with your team and fill in the blanks.

1. The _____ is the source of energy that creates winds.
2. It does this by making the earth different _____.
3. The winds drive _____ currents and changes in _____ drive deep-water currents.
4. The winds and the ocean currents spin in _____ or gyres.
5. They spin _____ in the Northern Hemisphere.
6. The climate of a region can become warmer or colder depending on the _____ that flow by it.
7. The winds that are near the Equator are called _____ Winds.
8. The winds that blow across the United States are called _____.
9. Today, anything that falls off a boat and floats is generally called _____.
10. Flotsam from freight ships floats away from the place it fell into the sea because it is carried by _____.

TEAM TEST 3

Name_____ Date: _____

Directions:
Read the following questions with your team and fill in the blanks.

1. There are two types of currents in the ocean, _____ currents and _____ currents.
2. _____ currents are formed by the wind and _____ currents form due to changes in density.
3. The climate of a region is affected by the _____ that flow by it.
4. The winds that blow over the United States are called _____.
5. Trade winds blow along the _____. Both of these winds move surface currents.
6. When the molecules of a substance are cold and packed closely together, we say it is **MORE** or **LESS** dense. *(circle one)*
7. When molecules are heated up and move quickly, we say a substance is **MORE** or **LESS** dense. *(circle one)*
8. The _____ dense liquid will sink to the bottom of a test tube.
9. When it rains, the rainwater or freshwater will _____ on top of the ocean because freshwater is _____ dense than salt water.
10. Two things that can change the density of a substance are _____ and _____.
11. Sodium chloride (or NaCl) is the chemical name for _____.
12. If I were to change the color of the liquid that sank to the bottom of the test tube (it was blue) could I get it to float on top of the other liquids? Why or why not?

_____

_____

_____

DENSITY LAB #1: TEMPERATURE (1)

Introduction:

Your teacher has prepared two colored water samples. One is ice water and one is warm water from the tap. In this experiment you will discover if and how temperature affects the density of water.

Materials

- Baby food jars (4–ounce; the rims of both jars must be the same size) — *two*
- Colored pencils or crayons — *one set*
- Index cards (3" x 5") — *three*
- Paper (white, blank) — *one sheet*
- Paper towels — *two to three*
- Solution samples of different colors (one hot, one cold) — *one of each*
- Smocks/old shirts for team members handling jars (food coloring stains clothes)
- Tray or large bowl to catch overflow of water — *one*

Preparation

1. The Reader reads the **Experimental Procedure** to the team all the way through once showing the pictures as he/she reads.
2. The Manager and the Supervisor go to the Prep Area to collect all the materials except the water samples.
3. The Manager and Supervisor take two jars to the Filling Station to fill one jar with warm water and a second jar with cold water. They should return to the teamwork area—careful not to spill the water. Place both jars on the table.
4. The Reader rereads the directions step-by–step as the experiment is done.
5. The Supervisor conducts the experiment with the assistance of the Manager. The Recorder watches and notes what happens during the experiment.

Experimental Procedure

<u>Always work over the bowl or tray to catch any dripping water.</u>

1. Hold the cold water jar in your left hand and place an index card over the top of the jar, covering the opening. (**See diagram 1**)
2. Place the palm of your right hand firmly on top of the index card. Do not curl your fingers or cup your hand. Keep the index card as flat as possible against the jar opening.
3. Hold the card firmly on the jar as you invert your hand and the jar. Flip the jar over so that it is sitting in your right palm with your hand holding the index card. Hold it firmly. (**See diagram 2**)

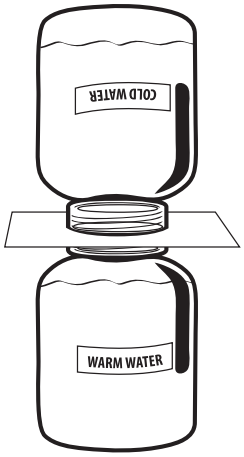
1.

2.

DENSITY LAB #1: TEMPERATURE (2)

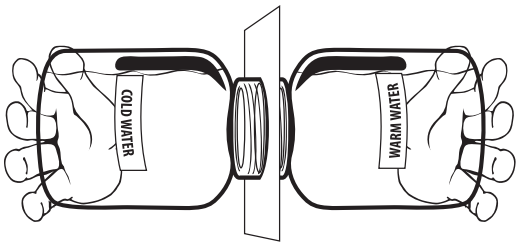
4. Ask the Manager to be **ready** to move the warm water jar under the cold water jar.
5. As the Supervisor slowly removes his/her right hand from under the index card, the Manager quickly places the warm water jar under the index card and holds it there. **Note**: Although the jar is upside down, the index card should remain on the jar long enough for the Manager to place the warm water jar where the Supervisor's hand had been. (**See diagram 3**)

3.



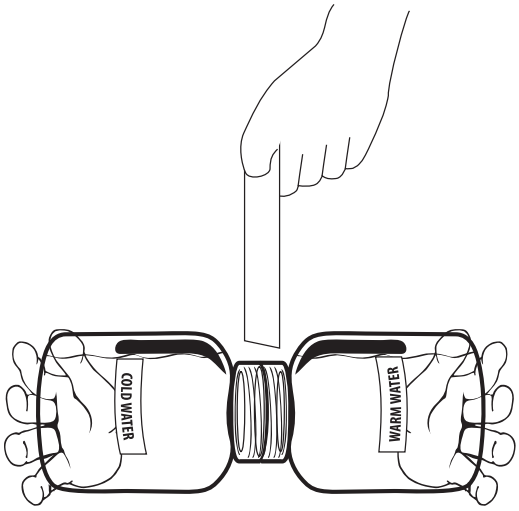
6. If the index card falls off and the water comes pouring out before the Manager's hand can position the second jar, you will have to start again. Refill the jar, get a dry index card and start over. (This experiment may take a few tries. Always start with a good, dry, and flat index card.)
7. If you were able to position the jars successfully, the Supervisor holds the cold water jar and the warm water jar together againset the index card, pressing firmly.
8. The Supervisor turns the jars sideways. Make sure the rims line up as much as possible. (**See diagram 4**)

4.



9. The Manager removes the index card slowly while the Supervisor keeps the rims lined up. As the card is removed the jars may move. It is very important that the Supervisor firmly holds the jars and lines up the rims with every move. (**See diagram 5**)
10. If water begins running out of the jars, line up rims quickly.

5.



11. Once the index card is out and the jars are rim-to-rim, observe what happens and draw it.

12. Recorders use colored pencils or crayons to sketch the results as they occur.
13. When you are finished observing, carefully lower jars into the catch basin and dump the water.
14. If there is time conduct this experiment at least one more time.
15. Clean the work area.
16. Conduct a discussion with your team to talk about your findings/theories as to what happened.

DENSITY LAB #1 SUMMARY: TEMPERATURE

Name_____ Date: _____

Directions:
Discuss these questions as a team. Answer each question neatly in one or two sentences. Use part of the question in the answer. Each team member must hand in his/her own paper.

1. In this experiment, which colored solution sank to the bottom? _____

   Was it warm or cold? Why did it sink? _____

   _____

   _____

2. In this experiment, which colored solution floated on top? _____

   Was it warm or cold? Why did it float? _____

   _____

   _____

3. If you were to change the color of the solution that always sank to the bottom and repeat the experiment, would it then float? Why or why not?

   _____

   _____

   _____

4. Describe what happens to the two layers of water after a while.

   _____

   _____

   _____

5. Sometimes tropical fish are carried by storms to colder climates.

   a. Why are they able to survive for a while? Explain.

   _____

   _____

   _____

   b. Why don't they survive for longer periods of time? Explain.

   _____

   _____

   _____

DENSITY AND TEMPERATURE

Density is defined as the *mass per unit volume*. What does this mean? It means that density is a ratio between the size of the container and how much the container weighs. Consider this example:

- What if you filled two containers of equal volume with small wooden blocks? Suppose you packed the blocks loosely in the first container, but packed them compactly in the second container. There would be more blocks in the second container. Therefore, it would have a greater mass in the same volume. The greater a substance's mass per unit volume, the more dense it is.

This is true at the molecular level of substances. If the molecules are far apart, the substance is **less dense**, and if the molecules are "packed together" or very close, the substance is **more dense**.

Here are two statements to remember:

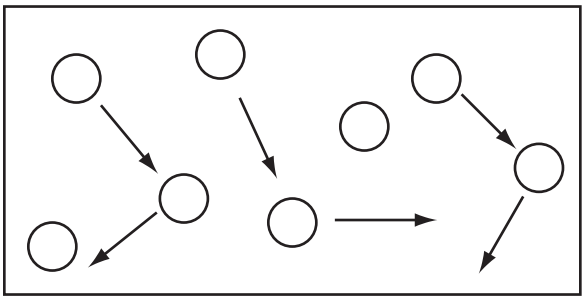
1. **Less dense substances always float on top of more dense substances.**
2. **More dense substances always sink below less dense substances.**

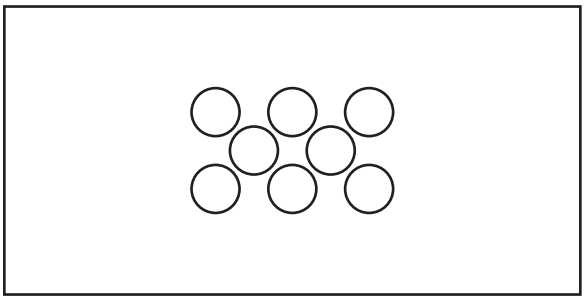
- Consider this: Wooden balls float on water because water is more dense than the wooden balls. However, steel balls sink in water because the steel balls are more dense than the water.

- Think about this: What happens when you pour oil into water? If the oil floats on top, what does that mean?

  The _____ must be less dense than the _____.

How does temperature affect density? As a substance is **heated**, its molecules move faster and faster. As they move, the molecules collide into one another and bounce each other farther apart. As the molecules bounce farther apart, the substance's volume increases. It has less mass per unit volume, and therefore, it is **less dense**. The opposite is also true. As a substance cools, its molecules slow down, collide less frequently, and take up less space. When a substance **cools**, the molecules are closer together and the substance is **more dense**.





The two boxes contain the **same mass** (8 molecules). The first box shows a substance that has been heated. The molecules are bumping into each other and taking up more space (greater volume). The first box is less dense. The second box shows a cold substance. The molecules take up less space (packed together), so the substance is more dense.

LAB REPORT

Name_____ Date: _____

Directions:

Using this outline of the steps of the Scientific Method, write up your lab experience.

1. **Problem/Question:** What do you wish to find out? Why is the lab being done? Identify and state the problem you want to solve.

   _____

   _____

2. **Hypothesis:** What do you think the answer is? Write the hypothesis as a positive statement. (Often a hypothesis will include the words "if" : "then" to describe the expected action and result.)

   _____

   _____

3. **Materials:** List the materials you need so another can duplicate your experiment.

   _____

   _____

   _____

4. **Experiment:** Design a procedure (experiment) to test your hypothesis. The Density Labs have the procedure already written up. Rewrite the procedure on your paper.

   _____

   _____

   _____

   _____

   _____

5. **Data:** Conduct the experiment and keep accurate records of your results. Repeat the experiment several times. Record the information you collect (data) on your paper. (You may also graph data.)

   _____

   _____

   _____

   _____

6. **Conclusion:** Summarize what you have discovered (what you conclude) based on the data you collected in this experiment. Your results may show that your hypothesis was correct or incorrect.

   _____

   _____

DENSITY LAB #2: SALINITY

Introduction:

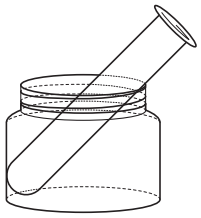
You now know that temperature affects density. You also know that less dense liquids float on top of more dense liquids. Today your teacher prepared four colored water samples by dissolving different amounts of salt in the water. Therefore, each sample has a different *salinity*. In this experiment you discover if and how salinity affects the density of water.

Materials

- Container filled with tap water — *one*
- Colored pencils or crayons (red, blue, green, yellow) — *one of each*
- Eyedropper — *one*
- Paper cup for discarded samples — *one*
- Paper cup weighted with sand, lentils, etc. in which to stand the test tube — *one*
- Small test tube (75–mm) — *one*
- Solution samples in baby food jars with lids (four colors) — *one of each*

Preparation

1. The Reader reads the **Experimental Procedure** to the team all the way through once showing any pictures as he/she reads.
2. The Manager and the Recorder go to the Prep Area to collect the materials.
3. Each team member will count drops from one color sample into the test tube. Assign the color red to the Reader, green to the Recorder, yellow to the Manager, and blue to the Supervisor.



Experimental Procedure

Follow the same procedure for each pair of samples.

1. Stand the test tube in the weighted cup and let it rest (slanted) on the rim.
2. Seal the jar and shake the sample for 10 seconds before using the dropper.
3. Draw up the first sample into the dropper. Carefully count 50 drops as you drop them into the test tube. The dropper must touch the inside of the test tube so that the drops move slowly down the side of the tube.
4. **Always rinse the dropper** in the container of tap water after each use.
5. Draw up the second sample into the dropper. Carefully count 50 drops into the test tube. The dropper must touch the inside of the test tube so that the drops move slowly down the side.
6. Observe and record results. If one sample sank below the other, this sample is more dense than the one that floated on top. Record what you observed on the **Density Lab #2 Chart**.
7. Discard the samples into the discard paper cup and rinse the dropper and test tube thoroughly in the container of tap water.
8. Repeat for another pair of samples.

DENSITY LAB #2 CHART

Directions

1. For each pair of samples, you must add the drops in the correct order. The chart below tells you which color to put in first. Always put the color listed **below the line** in first. For example, in the first pair (B over G,), you would put Green in first.
2. After adding the second colored sample, observe. If the second color floated on the first color you added, then the first color is more dense. If the second color sank below the first color, the second color is more dense. In any case, the **more dense** color will end up on the bottom.
3. The Recorder circles the letter that is **more dense** for each pair (for example in the first pair, if B is more dense than the Recorder circles B):

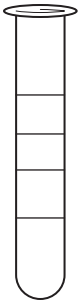
TABLE:

B	B	B	Y	Y	Y	R	R	R	G	G	G
G	R	Y	B	G	R	B	G	Y	B	R	Y

4. From your results above, summarize your findings. For each combination, circle the colored solution that is more dense.

B or G **G or Y** **Y or R** **B or R** **G or R** **B or Y**

5. You will create a four-layer sample in your test tube. Using the colored pencils, predict the colors:



6. Using the data you noted in #4 and the hypothesis you developed in #5, build a four-layer sample in your test tube. Use the same **Experimental Procedure** as earlier, being careful to drop the colored samples slowly down the side of the test tube. When it is ready, raise your hand to notify the teacher. Using your colored pencils, draw what you see.

Does it match your prediction? _____

DENSITY LAB #2 SUMMARY: SALINITY

Name_____ Date: _____

Directions:

Discuss these questions as a team. Answer each question neatly in one or two sentences. Use part of the question in the answer. Each team member must hand in his/her own paper.

1. Define salinity.

   _____

   _____

   _____

2. Which colored solution always sank to the bottom of the test tube? _____

   Why does it sink? _____

   _____

3. Which colored solution always floated on top of all the other solutions? _____

   Why does it float? _____

   _____

4. If you were to change the color of the solution that always sank to the bottom and repeat the experiment, would it then float?

   Why or why not? _____

   _____

   _____

5. Salt makes water more dense. Which color had the highest salinity? _____

   In this experiment, which color had the lowest salinity? _____

6. Based on the experiment, would you predict that rainwater would float or sink in ocean water?

   Explain your answer. _____

   _____

   _____

7. Based on the experiment, would you predict that the water from a river would float on or sink when it flowed into the ocean?

   Explain your answer. _____

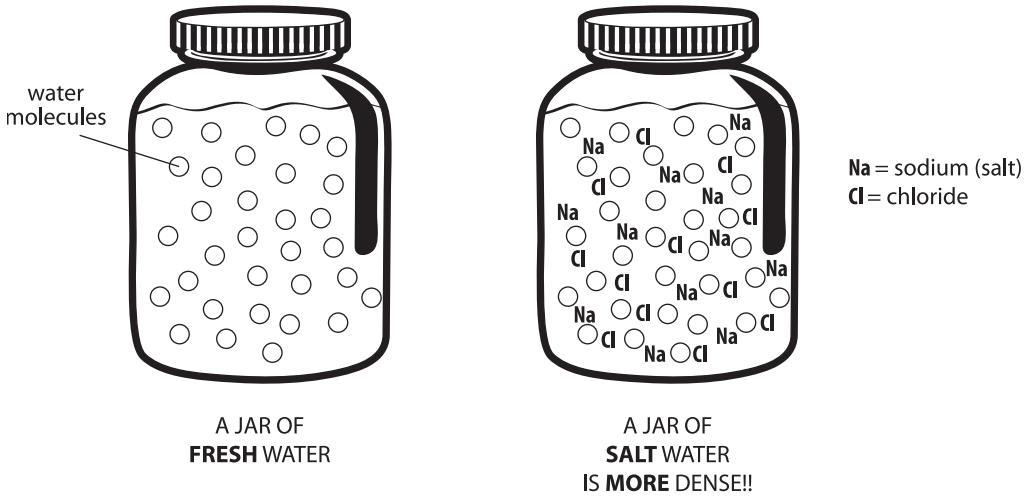
   _____

DENSITY, TEMPERATURE, AND SALINITY (1)

Name_____ Date: _____

Density and Temperature
You already know that density is defined as *mass per unit volume*. You also know that as a substance is warmed its molecules collide, taking up more space. Because the molecules are moving so much, fewer of them fit into a given space. **Density Lab #1** proved that warm water is less dense than cold water.

Density and Salinity
Density Lab #2 proved that there is another factor that affects the density of water—**salinity**. Salinity is the amount of salt dissolved in a liquid. When salt (NaCl) dissolves in water, the salt molecules break up into sodium (Na) and Chloride (Cl). Their atoms drift among the water molecules filling in the spaces. (Picture the way grains of sand would fill in the space around pebbles in a glass.) Take a look at this diagram.



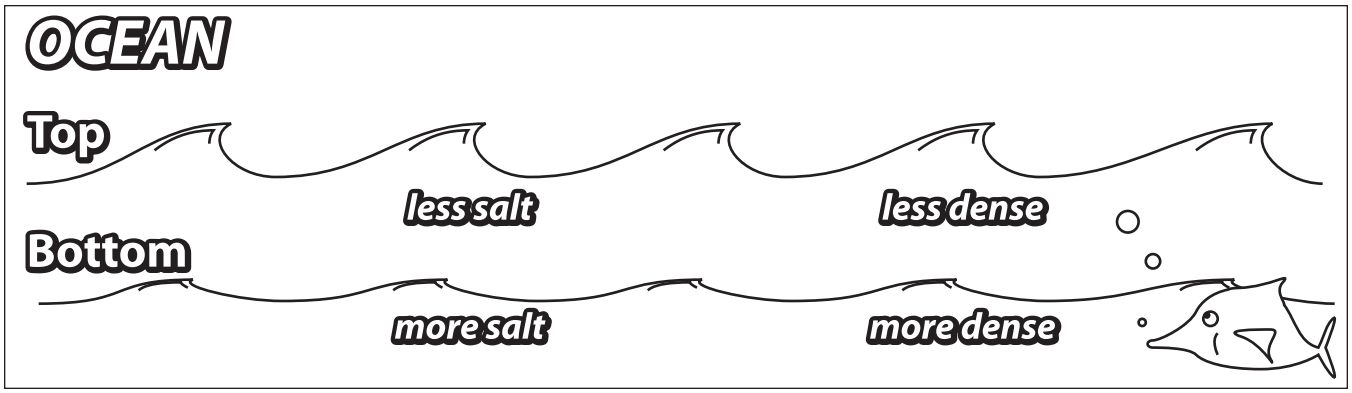
The jar of salt water is more dense. When salt dissolves, the compound separates into its elements Na (sodium) and Cl (chloride) The jar of salt water is similar to the water in the ocean.

Adding the salt to water did not change the volume very much, but the weight of the salt increased the mass of the water. Therefore, there was more mass in a similar volume. Your experiment proved that salt water is more dense than fresh water. And it also proved, the saltier the water, the more dense the water.

Density and Ocean Currents
In your experiments you saw how one pool of water moved onto or under another pool of water because of its different density. In your experiments, you actually created density currents. Density currents in the ocean are also known as *thermohaline* circulation. They are caused by differences in density of ocean water due to changes in salinity and temperature.

From what you have explored, you know for certain that…
- Less dense ocean water always floats above more dense ocean water.
- More dense ocean water will always sink below less dense ocean water.

DENSITY, TEMPERATURE, AND SALINITY (2)



Look at the following matrix. In two cases you can be certain what the water will do, but in two other cases, you can't be as sure. Complete the matrix with F for floats and S for sinks and ? for not sure.

Factors	High Salinity	Low Salinity
warm water		
cold water		

What happens in water that you identified with the question marks?
Unlike water in a bathtub, ocean waters do not randomly mix. They exist as layers, pools, and currents. These layers, pools, and currents are separated by small differences in density. A slight change in the temperature or salinity may tip the balance. When a bottom layer becomes less dense, it will rise. This is called an upwelling. When a surface layer becomes more dense, it will sink to the bottom of the sea forming an undersea waterfall.

Fish, diatoms, algae, and other ocean life use up nutrients in the surface water. When they die and sink to the bottom, they take these nutrients to the bottom. Upwellings bring nutrients back from the bottom of the ocean to the surface to feed the food chain. At the location of upwellings, there are usually exceptional fishing grounds. Three famous upwellings are at the Grand Banks of Newfoundland, the Canary Islands off Europe, and the Pacific Ocean off the northwest coast of South America.

DAILY DISCOVERY LOG

DAY _____

Bottle Letter _____ Date: _____

Supervisor _____ Recorder: _____

What did CSI tell you today? From the information they gave you, think about what questions you have and what you will research?

Summarize Clues	Questions or Research Leads

What facts did your team discover? _____

_____

_____

_____

_____

DAILY DISCOVERY LOG SAMPLE

DAY 8

Bottle Letter M Date: Sample

Supervisor Danny Recorder: Jon Michael

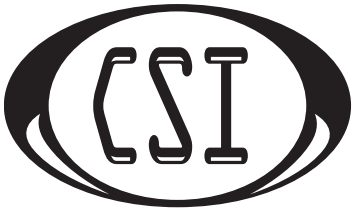
What did CSI tell you today? From the information they gave you, think about what questions you have and what you will research?

Summarize Clues	Questions or Research Leads
hot, humid climate bananas cacao trees	Where do banana and cacao trees grow?
kaolin and limestone	What are these natural resources used for?

What facts did your team discover?

The family can't be in the Arctic or Antarctic Circle areas.
Not in Northern Europe or Canada either. Too hot.

CSI INSIGNIA



Crime Scene Investigations
Unit

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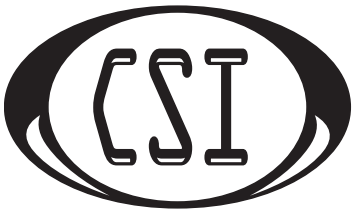

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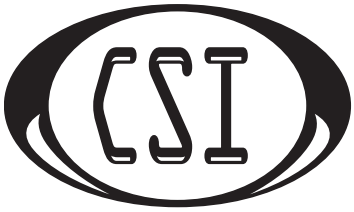

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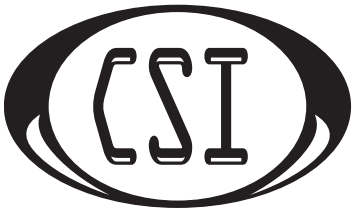

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BOTTLE A CSI REPORT
Clues #1: Landforms

1. **Bottle analysis**
   We found interesting granules in the bottle that we identified as quartzite, dolerite, and basalt.
2. **Recovered text**
   Our CSI laboratory analysis was able to decipher the washed-away writing on the message enclosed in the bottle. The pressure used when writing the note left some letter indentations that gave us some clues to the sections missing. Here is what we deciphered:

   "It's quite beautiful here. There are mountains with waterfalls and a beautiful rain forest. I drew a picture below."

   Analysis: We could only partially recover the drawing. We can see the waterfalls and a series of bowled shaped depressions we think are *cirques.*

We will continue our analysis and will forward more information as we complete tests.

Good luck,
Crime Scene Investigations Unit

BOTTLE A CSI REPORT
Clues #2: Plant Life (flora) and Climate

1. **Bottle analysis**
   The small pieces of bark removed from the bottle were from two interesting species of trees. The huon pine (*lagarostrobos franklinii*) is one of the world's oldest species of trees and the swamp gum is one of the tallest hardwood trees found in the world.
2. **Recovered text**

   "There are all kinds of plants here. There are some very tall trees, and you can smell the eucalyptus that grows everywhere."

   "The weather here is summer-like now—hot, dry, and windy. Six months ago it was cold and rainy."
3. **Letter analysis**
   A light stain on the paper turned out to be saliva from some type of rain forest animal, but we have not been able to determine exactly what it is as of now. Our analysis continues daily. More information will be forthcoming.

Our analysis continues daily. More information will be forthcoming.

Good luck,
Crime Scene Investigations Unit

BOTTLE A CSI REPORT
Clues #3: Animal Life (fauna)

1. **Bottle analysis**
   The small leathery pieces found in the bottle are from an egg. We believe the egg came from an egg-laying mammal called an echidna, an interesting creature. There was a small feather, too. This appears to be from a small bird. Through DNA analysis we determined it came from the forty-spotted pardalote (*pardalotus quadragintus*). This species is threatened with extinction. There was a small piece of feces that we analyzed. It came from the white-footed dunnart.
2. **Recovered text**
   "There are some strange-looking animals around here. There's a small one with tiny eyes and a long snout. It has big, digging claws. It seems to like to eat ants."
   "There are also some beautiful birds here, too. Some have black wings and greenish bodies."

We will have the final analysis done by tomorrow.

Good luck,
Crime Scene Investigations Unit

BOTTLE A CSI REPORT
Clues #4: Latitude

1. **Recovered text**
   "Using a crude sundial we were able to figure our approximate latitude. It is 42°."
   "Please find us soon! We look up at the Southern Cross each night and hope that it will guide your rescue ships to us."
   The Smith Family

We hope that we have helped you in your search for this missing family. If there is further evidence you would like us to analyze, please send it to us.

Good luck,
Crime Scene Investigations Unit

CSI CLUES
BOTTLE B (1)

BOTTLE B CSI REPORT
Clues #1: Landforms

1. **Bottle analysis**
   Small specks of dark gray sand from a beach was found in the bottle. We also found pieces of black lava. These pieces do not appear to be very old. This means that the lava may be from an active volcano.
2. **Recovered text**
   Our CSI laboratory analysis was able to decipher the washed-away writing on the message enclosed in the bottle. The pressure used when writing the note left some letter indentations that gave us some clues to the missing sections. Here is what we deciphered so far:

   "*The beaches here are dark gray, not like at home. We can see mountains in the distance. One is a volcano! We can see the smoke.*"

We will continue our analysis and will froward more information as we complete tests.

Good luck,
Crime Scene Investigations Unit

BOTTLE B CSI REPORT
Clues #2: Plant Life (flora) and Climate

1. **Bottle analysis**
   We found pollen from the tree daisy (*scalesia*) in the bottle. There were also some spines from several cacti. The brachycereus, prickly pear, and candelabra cacti. Also in the bottle were some orchid petals.
2. **Recovered text**

   "*We have fruit to eat. And there are beautiful flowers here. I think some are orchids.*"

   "*It has been cool and dry lately, but six months ago it was warm with afternoon showers.*"
3. **Letter analysis**
   Our team also noted there was a subtle stain on the note that turned out to be guava juice.

Our analysis continues daily. More information will be forthcoming.

Good luck,
Crime Scene Investigations Unit

BOTTLE B CSI REPORT
Clues #3: Animal Life (fauna)

1. **Bottle analysis**
   There was a piece of claw from either a marine iguana or a land iguana in the bottle. Two small feathers were found, too. After DNA sampling, we determined that the feathers were from a tropical water penguin and a Darwin's finch.
2. **Recovered text**
   "There are some very interesting animals here. We have seen huge tortoises and some large fishing birds. Their bodies are sometimes white and sometimes brown, but their feet are bright red! I drew a picture below."
   After intense investigation, we were able to bring back the faded illustration of what appears to be a red footed booby.
3. **Letter analysis**
   Our CSI laboratory analysis has also determined that a stain on the note turned out to be bat droppings from a mammal called the hairy-tailed bat.

We will have the final analysis done by tomorrow.

Good luck,
Crime Scene Investigations Unit

BOTTLE B CSI REPORT
Clues #4: Latitude

1. **Recovered text**
   "Using a crude sundial we were able to figure our approximate latitude. We must be nearly on the Equator!"
   "Please find us soon!"
   The Alvarez Family

We hope that we have helped you in your search for this missing family. If there is further evidence you would like us to analyze, please send it to us.

Good luck,
Crime Scene Investigations Unit

CSI CLUES
BOTTLE C (1)

BOTTLE C CSI REPORT
Clues #1: Landforms

1. **Bottle analysis**
   There were small granules of minerals from a volcano in the bottle. Analysis shows that they were formed years ago and that this site is probably near an extinct volcano. There were also interesting traces of coal, iron, lead, and copper in the sample.
2. **Recovered text**
   Our CSI laboratory analysis was able to decipher the washed-away writing on the message enclosed in the bottle. The pressure used when writing the note left some letter indentations that gave us some clues to the sections missing. Here is what we deciphered so far:

   "There are hot springs here. There are also marshes filled with brackish water, too salty to drink."

We will continue our analysis and will froward more information as we complete tests.

Good luck,
Crime Scene Investigations Unit

BOTTLE C CSI REPORT
Clues #2: Plant Life (flora) and Climate

1. **Bottle analysis**
   Particles in the bottle included leaf fragments from the daimyo oak. There were also traces of sap from the stone pine and yezo spruce.
2. **Recovered text**

   "Fortunately now we have plenty to eat. There are plum, peach, mandarin orange, and cherry trees growing nearby."

   "We have experienced all kinds of weather since we arrived. The winter was cold with lots of snow. It's warm now, but the nights are cool. We are worried that we will have another storm. Last month we had to seek shelter from a major storm with winds over 100 mph.

Our analysis continues daily. More information will be forthcoming.

Good luck,
Crime Scene Investigations Unit

BOTTLE C CSI REPORT
Clues #3: Animal Life (fauna)

1. **Bottle analysis**
   There were feathers in the bottle that we identified as belonging to a white tailed eagle or Steller's sea eagle. There were also traces of bird feces from either some type of crane or a whooper swan. Small traces of animal fur were stuck to the inside of the bottle. We analyzed these pieces and results showed that they are from a sika deer.
2. **Recovered text**
   "We are using squid ink to write this letter. There are a lot of different birds here. There are large white birds that swooped down to catch fish. There are others that look like cranes that fish in the marsh."
   "We are also eating fish and some shellfish. There are plenty of oysters."
3. **Letter analysis**
   Stuck to the note was a small piece of claw. The sample is small, but we think it may be from an owl called the Blakiston's fish owl.

We will have the final analysis done by tomorrow.

Good luck,
Crime Scene Investigations Unit

BOTTLE C CSI REPORT
Clues #4: Latitude

1. **Recovered text**
   There was a lot of damage to the bottom of the note. However, using several techniques we were able to recover the following text.
   "Using a crude sundial we were able to figure our approximate latitude. It is 43°"
   "Please find us soon! We look up at the North Star each night and hope that it will guide your rescue ships to us."
   The O'Neill Family

We hope that we have helped you in your search for this missing family. If there is further evidence you would like us to analyze, please send it to us.

Good luck,
Crime Scene Investigations Unit

CSI CLUES
BOTTLE D (1)

BOTTLE D CSI REPORT
Clues #1: Landforms

1. **Bottle analysis**
   The sand in the bottle contained some very interesting minerals. There were amethyst, asbestos, and two small diamonds. Traces of fertile soil were stuck to the inside of the bottle. We believe that this soil sample came from a large river basin.
2. **Recovered text**
   Our CSI laboratory analysis was able to decipher the washed-away writing on the message enclosed in the bottle. The pressure used when writing the note left some letter indentations that gave us some clues to the sections missing. Here is what we deciphered:
   "We are on a coast with white, sandy beaches. In the distance we can see mountains. There seems to be many rivers that run down to the sea."

We will continue our analysis and will froward more information as we complete tests.

Good luck,
Crime Scene Investigations Unit

BOTTLE D CSI REPORT
Clues #2: Plant Life (flora) and Climate

1. **Bottle analysis**
   In the bottle there were fragments of several plants (flora) including the rare kapok tree, the parana pine, and the outside coating of a coffee bean. There were also wood fibers from at least three different trees: rubber, teak, and mahogany.
2. **Recovered text**
   "We have been eating lots of fruit including oranges, lemons, and bananas."
   "We have found some bushes that look like cotton plants. We may need to learn how to weave cloth if we aren't rescued soon."
   "It is hot and humid. It rains all the time."
3. **Letter analysis**
   Also on the note we found traces of sap from a rare plant called *Betholletia Exceisa*.

Our analysis continues daily. More information will be forthcoming.

Good luck,
Crime Scene Investigations Unit

BOTTLE D CSI REPORT
Clues #3: Animal Life (fauna)

1. **Bottle analysis**
   There was a feather in the bottle that belonged to a quetzel. There was also animal fur from several animals including the night monkey and tapir. There was a stain on the note and after we analyzed it, we found out that it was urine from a reptile called a matamata.
2. **Recovered text**
   "We have seen all kinds of strange wildlife here. There are these tiny bats that walk on all fours and hop on the ground. We've seen them attack birds. They bite their legs and suck the blood!"
   "It's dangerous here, too. We saw probably the biggest snake in the world. We have also seen long columns of ants that attack and devour small animals. And we never swim in the river! Piranhas!"

We will have the final analysis done by tomorrow.

Good luck,
Crime Scene Investigations Unit

BOTTLE D CSI REPORT
Clues #4: Latitude

1. **Recovered text**
   There was a lot of damage to the bottom of the note. However, using several techniques we were able to recover the following text.
   "Using a crude sundial we were able to figure our approximate latitude. We must be nearly on the Equator!"
   "Please find us soon!
   The Mello Family

We hope that we have helped you in your search for this missing family. If there is further evidence you would like us to analyze, please send it to us.

Good luck,
Crime Scene Investigations Unit

CSI CLUES
BOTTLE E (1)

BOTTLE E CSI REPORT
Clues #1: Landforms

1. **Bottle analysis**
   The soil sample in the bottle shows a lot of damage from glaciers. There are also some rock samples from very ancient rocks, probably some of the oldest on earth.
2. **Recovered text**
   Our CSI laboratory analysis was able to decipher the washed-away writing on the message enclosed in the bottle. The pressure used when writing the note left some letter indentations that gave us some clues to the sections missing. Here is what we deciphered:

   "It's cold here! We regularly see icebergs floating by."

   "There is an incredible number of small islands around us, I hope you will be able to find us."

We will continue our analysis and will froward more information as we complete tests.

Good luck,
Crime Scene Investigations Unit

BOTTLE E CSI REPORT
Clues #2: Plant Life (flora) and Climate

1. **Bottle analysis**
   There was little plant material in the soil. We did find some hay. There was a wooly fiber stuck to the sample of hay and we found out that it was from a lamb.
2. **Recovered text**

   "We are having a terrible time growing anything to eat except for some potatoes. There aren't any forests around here either."

   "The warmest it got here was about 50° and that was only for a couple of weeks. Last summer the sun was out for 24 hours, but nothing had time to grow."

Our analysis continues daily. More information will be forthcoming.

Good luck,
Crime Scene Investigations Unit

BOTTLE E CSI REPORT
Clues #3: Animal Life (fauna)

1. **Bottle analysis**
   There was some evidence of animals in the bottle sample. There were fish scales from a salmon. There were also small traces of manure from a musk ox.
2. **Recovered text**
   "There are so many amazing animals here. Some are fun to watch like the walruses and seals. We even saw a couple of whales swimming close off the beach. I think one was a humpback. The second one we saw was huge—maybe 80 feet long!"
   "Some animals worry us, though, like the huge polar bear that wandered into our camp last night."

We will have the final analysis done by tomorrow.

Good luck,
Crime Scene Investigations Unit

BOTTLE E CSI REPORT
Clues #4: Latitude

1. **Recovered text**
   There was a lot of damage to the bottom of the note. However, using several techniques we were able to recover the following text.
   "*Using a crude sundial we were able to figure our approximate latitude. It is* 64°."
   "Please find us soon! We look up at the North Star each night and hope that it will guide your rescue ships to us."
   The Chung Family

We hope that we have helped you in your search for this missing family. If there is further evidence you would like us to analyze, please send it to us.

Good luck,
Crime Scene Investigations Unit

CSI CLUES
BOTTLE F (1)

BOTTLE F CSI REPORT
Clues #1: Landforms

1. **Bottle analysis**
   The bottle sample contained traces of volcanic ash and igneous rock. There were also tiny particles from three minerals—bauxite, coal, and copper.
2. **Recovered text**
   Our CSI laboratory analysis was able to decipher the washed-away writing on the message enclosed in the bottle. The pressure used when writing the note left some letter indentations that gave us some clues to the sections missing. Here is what we deciphered:

   "There are volcanos here. In fact, I think this island was once a volcano. Although there are mountains, the soil seems very fertile."

   "We can see ships sailing off in the distance, but they never see our signal fires!"

We will continue our analysis and will froward more information as we complete tests.

Good luck,
Crime Scene Investigations Unit

BOTTLE F CSI REPORT
Clues #2: Plant Life (flora) and Climate

1. **Bottle analysis**
   The bottle contained grains of rice. There were traces of bark from mangrove and teak trees. There were also minute traces of quinine.
2. **Recovered text**

   "There are lots of trees here. I can identify the banana trees, and I think there may be rubber trees, too. The sap is white and sticky. We think that we may have coffee plants here, too. As soon as we can figure out how to roast the beans without burning them, we can make coffee!"

   "The weather is very hot and humid. We have experienced heavy rains for several months."

Our analysis continues daily. More information will be forthcoming.

Good luck,
Crime Scene Investigations Unit

BOTTLE F CSI REPORT
Clues #3: Animal Life (fauna)

1. **Bottle analysis**
   There were several pieces of evidence of animal life in the bottle. We found fragments of fire ants and fur from a sun bear. There were tiny bones that we think came from a naked bulldog bat. There was a fragment of a claw embedded in the note. We analyzed this sample and found out that it came from a crustacean called the robber crab.
2. **Recovered text**
   "There are all sorts of animals here. Some are dangerous like the tigers, rhinos, and snakes. Some are just weird. We've seen flying frogs and some catfish that actually walk! They come right out of the water searching for food!"

Will have the final analysis done by tomorrow.

Good luck,
Crime Scene Investigations Unit

BOTTLE F CSI REPORT
Clues #4: Latitude

1. **Recovered text**
   There was a lot of damage to the bottom of the note. However, using several techniques we were able to recover the following text.
   "Using a crude sundial we were able to figure our approximate latitude. It is 7°. We must be nearly on the Equator!"
   "Please find us soon!"
   The DiLibero Family

We hope that we have helped you in your search for this missing family. If there is further evidence you would like us to analyze, please send it to us.

Good luck,
Crime Scene Investigations Unit

CSI CLUES
BOTTLE G (1)

BOTTLE G CSI REPORT
Clues #1: Landforms

1. **Bottle analysis**
   The bottle contained sand with traces of limestone and bauxite. There were also traces of gypsum and high-grade calcium carbonate.
2. **Recovered text**
   Our CSI laboratory analysis was able to decipher the washed-away writing on the message enclosed in the bottle. The pressure used when writing the note left some letter indentations that gave us some clues to the sections missing. Here is what we deciphered:

   "This island is beautiful. We can see a bigger island to the southeast and it's covered with magnificent mountains."

   Note: There was an oil smudge on the letter such as the type found on the hulls of large seagoing vessels.

We will continue our analysis and will froward more information as we complete tests.

Good luck,
Crime Scene Investigations Unit

BOTTLE G CSI REPORT
Clues #2: Plant Life (flora) and Climate

1. **Bottle analysis**
   There were parts of plants (flora) in the sample. We found leaf fragments from coffee bushes and the leathery skin of a cacao fruit. There was also a piece of sugar cane stalk.
2. **Recovered text**

   "We have been eating lots of fruit, especially bananas and citrus fruits."

   "The weather here is usually hot and humid. It has lots of rain. Between July and November we had two nasty storms with winds over 100 miles per hour! These hurricanes were awful!"

Our analysis continues daily. More information will be forthcoming.

Good luck,
Crime Scene Investigations Unit

BOTTLE G CSI REPORT
Clues #3: Animal Life (fauna)

1. **Bottle analysis**
   There were fish scales from at least three different fish, a great barracuda, a king mackerel, and a longlure frogfish. There were dried pieces of a touch-me-not sponge, an endangered species. There were also bone fragments that we determined came from an ashy gecko.
2. **Recovered text**
   "This place has lots of animals. In fact, many look like pets from the pet store. I saw a green anole lizard. Just off shore, we've seen manatees swimming. Also off shore, but at a great distance, we can see ships pass us by. It's so frustrating that they can't see our signal fires."

We will have the final analysis done by tomorrow.

Good luck,
Crime Scene Investigations Unit

BOTTLE G CSI REPORT
Clues #4: Latitude

1. **Recovered text**
   There was a lot of damage to the bottom of the note. However, using several techniques we were able to recover the following text.
   "*Using a crude sundial we were able to figure our approximate latitude. It is* 18°."
   "Please find us soon! We look up at the North Star each night and hope that it will guide your rescue ships to us."
   The Farley Family

We hope that we have helped you in your search for this missing family. If there is further evidence you would like us to analyze, please send it to us.

Good luck,
Crime Scene Investigations Unit

BOTTLE H CSI REPORT
Clues #1: Landforms

1. **Bottle analysis**
   The sample in the bottle contained granules of limestone, coal, and iron. There were also traces of lava that were not that old. This probably means there may be an active volcano nearby.
2. **Recovered text**
   Our CSI laboratory analysis was able to decipher the washed-away writing on the message enclosed in the bottle. The pressure used when writing the note left some letter indentations that gave us some clues to the sections missing. Here is what we deciphered:

   "*There were are hills and mountains near us. I can see that at least one is an active volcano. The air smells of rotten eggs or a burning match.*"

   We believe that the smell may be sulfur. Also, the ink was made from sumac and salt. There may be salt deposits nearby.

We will continue our analysis and will froward more information as we complete tests.

Good luck,
Crime Scene Investigations Unit

BOTTLE H CSI REPORT
Clues #2: Plant Life (flora) and Climate

1. **Bottle analysis**
   There was plant material in the bottle that we identified as Mediterranean sedge *(Cyperus papyrus)*. Ancient people used to make papyrus from it. There were also sap samples from a stone pine and a juniper tree. There were leaf fragments from palm and beech trees.
2. **Recovered text**

   "*We have plenty to eat. We have artichokes, blood oranges, pistachios, figs, and almonds. There are also ancient olive trees, but we don't know how to make the olives edible.*"

   "*We have had a short, mild winter. During the summer months it is very dry and hot.*"

Our analysis continues daily. More information will be forthcoming.

Good luck,
Crime Scene Investigations Unit

BOTTLE H CSI REPORT
Clues #3: Animal Life (fauna)

1. **Bottle analysis**
   The bottle contained small, broken pieces of hedgehog quills. Our analysis of the soil samples showed many frogs and toads are in the area. We found one small bone fragment from a gecko lizard. There was a distinctive mark on the fragment that we believe came from a red footed falcon (*falco vespertinus*). There was also a small piece of fur from a red fox.
2. **Recovered text**
   "We use nets to fish every day from the shore. We capture sardines. Off shore, but at a great distance, we can see ships pass us by. It's so frustrating that they can't see our signal fires."

We will have the final analysis done by tomorrow.

Good luck,
Crime Scene Investigations Unit

BOTTLE H CSI REPORT
Clues #4: Latitude

1. **Recovered text**
   There was a lot of damage to the bottom of the note. However, using several techniques we were able to recover the following text.
   "*Using a crude sundial we were able to figure our approximate latitude. It is* 38°."
   "Please find us soon! We look up at the North Star each night and hope that it will guide your rescue ships to us."
   The O'Neill Family

We hope that we have helped you in your search for this missing family. If there is further evidence you would like us to analyze, please send it to us.

Good luck,
Crime Scene Investigations Unit

BOTTLE I CSI REPORT
Clues #1: Landforms

1. **Bottle analysis**
   The sample in the bottle shows traces of salt, bauxite, graphite, and coal dust. There was also a trace of ilmenite, a titanium ore.
2. **Recovered text**
   Our CSI laboratory analysis was able to decipher the washed-away writing on the message enclosed in the bottle. The pressure used when writing the note left some letter indentations that gave us some clues to the sections missing. Here is what we deciphered:

   "There are mountains here. The soil seems quite fertile. There are also rivers that flow into the sea."

We will continue our analysis and will forward more information as we complete tests.

Good luck,
Crime Scene Investigations Unit

BOTTLE I CSI REPORT
Clues #2: Plant Life (flora) and Climate

1. **Bottle analysis**
   There was evidence of several distinct plants (flora) in the bottle. There was a piece of clove and a fragment of a vanilla plant. There were some bark samples that we identified as coming from the baobab tree. There were also minute pieces of a coffee bean.
2. **Recovered text**

   "The forest is quite dense, but beautiful. There are thousands of different orchids growing on the trees."

   "It's very hot and very humid here. The moisture seems to hang in the air."

Our analysis continues daily. More information will be forthcoming.

Good luck,
Crime Scene Investigations Unit

BOTTLE I CSI REPORT
Clues #3: Animal Life (fauna)

1. **Bottle analysis**
   The bottle contained fur we identified as coming from three different kinds of lemurs. One is the brown lemur, the second is the mongoose lemur, and the last is the aye-aye, an endangered
2. **Recovered text**
   "There are strange animals here. One comes out only at night, but it has one long finger on each hand. It uses it to poke into rotted word looking for insects. It uses its long fingers to open coconuts, too."
   "At night, we also occasionally see large grayish cats. They're about five feet long including their tails."
   "We stay out of the rivers here because of the crocodiles."
3. **Letter analysis**
   On the note we found evidence of urine from an Indri Monkey.

We will have the final analysis done by tomorrow.

Good luck,
Crime Scene Investigations Unit

BOTTLE I CSI REPORT
Clues #4: Latitude

1. **Recovered text**
   There was a lot of damage to the bottom of the note. However, using several techniques we were able to recover the following text.
   "Using a crude sundial we were able to figure our approximate latitude. It is 18°."
   "Please find us soon! We look up at the Southern Cross each night and hope that it will guide your rescue ships to us."
   The Lawless Family

We hope that we have helped you in your search for this missing family. If there is further evidence you would like us to analyze, please send it to us.

Good luck,
Crime Scene Investigations Unit

CSI NEWS FLASH (1)

CSI News Flash!!
Bottle A

We've discovered some species that are unique to your area.

An animal called the "devil" lives there. Also, there was some fur from a spotted potoroo found in the bottle, and lastly, the family sighted a false killer whale off the coast of the island.

We hope this new information helps you, and we look forward to hearing from you.

CSI News Flash!!
Bottle B

We've discovered some species that are unique to your area.

We found a scale from a giant tortoise in the bottle. Also, there was a feather of a hawk in the bottle. We have calculated that this type of hawk weighs 1.5 to 3.5 pounds. The urine from a male sea lion was on the letter too. This mammal belongs to the eared seal family.

We hope this new information helps you, and we look forward to hearing from you.

CSI News Flash!!
Bottle C

We've discovered some species that are unique to your area.

We found a pine needle in the bottle and it was analyzed. It came from a tree called the Sakhalin fir tree. We also found a pottery fragment that dated back to an ancient race, the Ainu people.

We hope this new information helps you, and we look forward to hearing from you.

CSI NEWS FLASH (2)

CSI News Flash!!
Bottle D

We've discovered some species that are unique to your area.

A sample of fur was stuck to the inside of the bottle. It was analyzed and found to belong to the hairy-legged vampire bat. There was a tooth fragment stuck to the note. It belonged to the dwarf caiman. A skin sample from an anaconda was found in the bottle.

We hope this new information helps you, and we look forward to hearing from you.

CSI News Flash!!
Bottle E

We've discovered some species that are unique to your area.

A chip from the antler of a male reindeer was found in the bottle. We were able to decipher more of the note, and the family claimed that the northern sky was filled with colorful images. We can only surmise that they were viewing the Northern Lights (Aurora Borealis).

We hope this new information helps you, and we look forward to hearing from you.

CSI News Flash!!
Bottle F

We've discovered some species that are unique to your area.

There was a toenail of a tiger frog as well as a scale from the Javan wart snake on the note. Lastly, the bottle had a bone fragment in it from a stone fish , and we also recovered a tooth from the spotted snake eel.

We hope this new information helps you, and we look forward to hearing from you.

CSI NEWS FLASH (3)

CSI News Flash!!
Bottle G

We've discovered some species that are unique to your area.

The bottle contained a scale from a red snapper and a front claw of a stone crab. We also detected a secretion on the note. It was analyzed and found to belong to a jigger.

We hope this new information helps you, and we look forward to hearing from you.

CSI News Flash!!
Bottle H

We've discovered some species that are unique to your area.

This bottle contained a cell from the apollo butterfly. We detected a urine stain on the note, and it was from a female aesculapian. Also, a piece of shell from a blue limpet was in the bottom of the bottle. The inside of the bottle was covered in a strange film; it was olive oil.

We hope this new information helps you, and we look forward to hearing from you.

CSI News Flash!!
Bottle I

We've discovered some species that are unique to your area.

An eyelash was stuck to the note. It was analyzed and belonged to a carnivorous mammal called a fossa, also spelled foussa. Also, the numerous brown stains on the note were made from cattle manure.

We hope this new information helps you, and we look forward to hearing from you.

WORK CITED RECORDING BLANKS (1)

BOOK

Fill in the blanks as you do your research.

AUTHOR ____ (period).
last name (comma), first name

TITLE ____ (period).
underlined or in italics

PLACE OF PUBLICATION__________________ (colon): PUBLISHER ____________ (comma),

DATE ______________________ (period). PAGES ______________ (period).

Sample:
Scarle, Thomas. Ancient Sumer: Amazing Achievements. River City, IA: River City Press, 1989. Pages 57, 58, 188, 189.

BOOK

Fill in the blanks as you do your research.

AUTHOR ____ (period).
last name (comma), first name

TITLE ____ (period).
underlined or in italics

PLACE OF PUBLICATION__________________ (colon): PUBLISHER ____________ (comma),

DATE ______________________ (period). PAGES ______________ (period).

Sample:
Scarle, Thomas. Ancient Sumer: Amazing Achievements. River City, IA: River City Press, 1989. Pages 57, 58, 188, 189.

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PLACE OF PUBLICATION__________________ (colon): PUBLISHER ____________ (comma),

DATE ______________________ (period). PAGES ______________ (period).

Sample:
Scarle, Thomas. Ancient Sumer: Amazing Achievements. River City, IA: River City Press, 1989. Pages 57, 58, 188, 189.

REFERENCE BOOK/ENCYCLOPEDIA

Fill in the blanks as you do your research.

AUTHOR (if any is given) _____ (period).
last name (comma), first name

TITLE OF ARTICLE (in quotes) " _____ (period)."

NAME OF REFERENCE BOOK _____ (period).
underlined or in italics

DATE OF EDITION_____ (period). PAGES _____ (period).

Sample:
Thompson, George. "Ancient Mesopotamia." The World Encyclopedia. 4th edition, 1993. Pages 436–438.

REFERENCE BOOK/ENCYCLOPEDIA

Fill in the blanks as you do your research.

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NAME OF REFERENCE BOOK _____ (period).
underlined or in italics

DATE OF EDITION_____ (period). PAGES _____ (period).

Sample:
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WORK CITED RECORDING BLANKS (3)

MAGAZINE/PERIODICAL

Fill in the blanks as you do your research.

AUTHOR ____ (period).
last name (comma), first name

TITLE OF ARTICLE (in quotes) " ________________________________ (period)."

NAME OF PERIODICAL ____

VOLUME NUMBER (if any) ____________________ DATE ______________(colon):

PAGES ____________________ (period).

Sample:
Shaw, Sam. "Gold Mining—The Wet Way." <u>Miner's Digest</u> Vol. 52 Sept. 1968: pages 31–42.

MAGAZINE/PERIODICAL

Fill in the blanks as you do your research.

AUTHOR ____ (period).
last name (comma), first name

TITLE OF ARTICLE (in quotes) " ________________________________ (period)."

NAME OF PERIODICAL ____

VOLUME NUMBER (if any) ____________________ DATE ______________(colon):

PAGES ____________________ (period).

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MAGAZINE/PERIODICAL

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TITLE OF ARTICLE (in quotes) " ________________________________ (period)."

NAME OF PERIODICAL ____

VOLUME NUMBER (if any) ____________________ DATE ______________(colon):

PAGES ____________________ (period).

Sample:
Shaw, Sam. "Gold Mining—The Wet Way." <u>Miner's Digest</u> Vol. 52 Sept. 1968: pages 31–42.

WORK CITED RECORDING BLANKS (4)

INTERNET/WEBSITE

Fill in the blanks as you do your research.

AUTHOR (if any is given) ______________________________ (period).
last name (comma), first name

TITLE OF ORIGINAL ARTICLE (in quotes) “ ______________________________ (period).”

TITLE OF ORIGINAL SOURCE (in *Italics*) ______________ (colon): DATE ____________ (period).

Definitely include:

TITLE OF WEBSITE (in quotes) “ ______________________________ (period).”

DATE OF ACCESS ____________ URL (in angle brackets) < ____________________ >(period).

Sample:
“Using MLA Style to Cite and Document Sources.” *Citation Styles*: 2001. “online!” 7/12/02 <http://www.bedfordstmartins.com/online/cite5.html>.

INTERNET/WEBSITE

Fill in the blanks as you do your research.

AUTHOR (if any is given) ______________________________ (period).
last name (comma), first name

TITLE OF ORIGINAL ARTICLE (in quotes) “ ______________________________ (period).”

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TITLE OF ORIGINAL ARTICLE (in quotes) “ ______________________________ (period).”

TITLE OF ORIGINAL SOURCE (in *Italics*) ______________ (colon): DATE ____________ (period).

Definitely include:

TITLE OF WEBSITE (in quotes) “ ______________________________ (period).”

DATE OF ACCESS ____________ URL (in angle brackets) < ____________________ >(period).

Sample:
“Using MLA Style to Cite and Document Sources.” *Citation Styles*: 2001. “online!” 7/12/02 <http://www.bedfordstmartins.com/online/cite5.html>.

WORK CITED RECORDING BLANKS (5)

CD-ROM

AUTHOR (if any is given) ______________________________ (period).
last name (comma), first name

TITLE OF ARTICLE (in quotes) " ______________________________ (period)."

COMPLETE WORK TITLE (if given) ______________________________ (period).

PLACE ________________ (colon): PUBLISHER ____________ (comma), DATE ______ (period).

DISC TITLE ______________________________ (period).

PLACE OF PUBLICATION ____________ (colon): PUBLISHER ________________ (comma),

DATE OF DISC ________________ (period).

Sample:
"Acacia." Western Garden – The Complete Interactive Guide to Your Yard and Garden. Menlo Park, CA: Sunset Publishing Corporation, 1995. Sunset Western Garden CD-ROM. Menlo Park, CA: Sunset Publishing Corporation, 1995.

CD-ROM

AUTHOR (if any is given) ______________________________ (period).
last name (comma), first name

TITLE OF ARTICLE (in quotes) " ______________________________ (period)."

COMPLETE WORK TITLE (if given) ______________________________ (period).

PLACE ________________ (colon): PUBLISHER ____________ (comma), DATE ______ (period).

DISC TITLE ______________________________ (period).

PLACE OF PUBLICATION ____________ (colon): PUBLISHER ________________ (comma),

DATE OF DISC ________________ (period).

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"Acacia." Western Garden – The Complete Interactive Guide to Your Yard and Garden. Menlo Park, CA: Sunset Publishing Corporation, 1995. Sunset Western Garden CD-ROM. Menlo Park, CA: Sunset Publishing Corporation, 1995.

CD-ROM

AUTHOR (if any is given) ______________________________ (period).
last name (comma), first name

TITLE OF ARTICLE (in quotes) " ______________________________ (period)."

COMPLETE WORK TITLE (if given) ______________________________ (period).

PLACE ________________ (colon): PUBLISHER ____________ (comma), DATE ______ (period).

DISC TITLE ______________________________ (period).

PLACE OF PUBLICATION ____________ (colon): PUBLISHER ________________ (comma),

DATE OF DISC ________________ (period).

Sample:
"Acacia." Western Garden – The Complete Interactive Guide to Your Yard and Garden. Menlo Park, CA: Sunset Publishing Corporation, 1995. Sunset Western Garden CD-ROM. Menlo Park, CA: Sunset Publishing Corporation, 1995.

RESCUE DAY INVITATION

Local Students Locate Lost Families

Dear _____,

Our class has been studying about ocean currents, and the density, temperature, and salinity of the oceans as part of our S.O.S. unit. Please join us for the presentations prepared by our class as we attempt to convince the Global Emergency Travel Unit (G.E.T.U.) to send a search and rescue ship to save the stranded families.

We would like you to attend.

The Date is: _____

Room # _____

The Time is: _____

We hope that you will enjoy this special day!

Love,

_____

PRESENTATION INSTRUCTIONS AND CHECKLIST (1)

Presentation Instructions

It costs over $3,000 for the G.E.T.U. to send out a search and rescue ship and crew. Your team must persuade the G.E.T.U. that you have, indeed, determined the location of a stranded family. Your team will prepare and present the information you have learned while working on S.O.S.

1. **State the Facts!!**
   You need to be very clear in your instructions to the G.E.T.U. Be sure that you answer the following questions with facts:
   - Where was the bottle found?
   - Where is your family stranded?
   - What are common landforms?
   - What fauna are found in your area?
   - What currents did your bottle take?
   - What is the climate of your area?
   - What flora are found in your area?
   - What natural resources are found in your area?
   - Is there any other information you want to add to support your findings?

2. **Visual Aids**
   Use exciting, creative visual aids in your presentation (for example, computer graphics, posters, perhaps artifacts, etc.) Include:
   a. World Map
      - Show where the family started their journey and where the family was stranded. Use your knowledge of currents to trace the route. Use a RED pencil.
      - Show where the bottle originated and where the bottle was discovered. Use your knowledge of currents to trace the route. Use a GREEN pencil.

   b. Location Display (four sections)
      - Landforms — Short paragraph and pictures
      - Plant Life (flora) — Short paragraph and pictures
      - Animal Life (fauna) — Short paragraph and pictures
      - Climate — Short paragraph and map

   c. Rewrite the Help Letter—completely fill it in with the information from the clues.
   d. Display all CSI Clues—If you received a news flash, display that also.

3. **Oral Presentation**
   a. Each member of your team must help organize the information for your presentation.
   b. Each member of your team must contribute to the oral presentation.

4. **Working as a Team**
   All team members should contribute to developing and making the presentation.
   a. Share the tasks and responsibilities.
   b. All team members check the presentation materials for accuracy and effectiveness.

5. **Quality Assurance**
   a. Your presentation should be organized, neat, accurate, creative, and **convincing.**
   b. Spelling, grammar, and punctuation are important.
   c. Include your sources (Bibliography in proper form).(Your teacher may require a minimum number of sources.)
   d. Use the **Content Rubric** and **Presentation Rubric** on page 8 of your Student Guide to guide your work.

Presentation Checklist

State the Facts

_____ Where the bottle was found

_____ What currents your bottle took

_____ Where your family is stranded

_____ Climate of the area

_____ Landforms of the area

_____ Plant life (flora) found in your area

_____ Animal life (fauna) found in your area

_____ Natural resources found in your area

_____ Additional information to support your findings

Visual Aids

World map

_____ Route showing where family started and where they were stranded in **red**.

_____ Route showing where the bottle started and where the bottle was found in **green**.

Display

_____ Four sections that illustrate climate, landforms, flora, fauna, and natural resources.

_____ The Help Letter is retyped with all the needed clues.

_____ All clues displayed, including the news flash.

Quality Assurance

_____ Presentation is organized, neat, accurate, creative, and **convincing**.

_____ Spelling, grammar, and punctuation are correct.

_____ Bibliography included in proper form.

**You are presenting as a team. Remember each of you should check the entire project and make sure the project is complete.

Good Luck!!

Content Rubric

Team: _____

4 — EXCEEDS!!! You did a great job!!!
You followed all the directions for the *Rescue Day* Presentation and have gone significantly beyond what was expected or asked.

3 — MEETS!! You did a good job!!
You followed all the directions for the *Rescue Day* Presentation.

2 — NEARLY THERE. Oops, something is missing.
You completed almost all the directions for the *Rescue Day* Presentation, but there was missing information.

1 — UNSATISFACTORY
You did not complete the *Rescue Day* Presentation as required.

Content Rubric

Team: _____

4 — EXCEEDS!!! You did a great job!!!
You followed all the directions for the *Rescue Day* Presentation and have gone significantly beyond what was expected or asked.

3 — MEETS!! You did a good job!!
You followed all the directions for the *Rescue Day* Presentation.

2 — NEARLY THERE. Oops, something is missing.
You completed almost all the directions for the *Rescue Day* Presentation, but there was missing information.

1 — UNSATISFACTORY
You did not complete the *Rescue Day* Presentation as required.

Content Rubric

Team: _____

4 — EXCEEDS!!! You did a great job!!!
You followed all the directions for the *Rescue Day* Presentation and have gone significantly beyond what was expected or asked.

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1 — UNSATISFACTORY
You did not complete the *Rescue Day* Presentation as required.

Content Rubric

Team: _____

4 — EXCEEDS!!! You did a great job!!!
You followed all the directions for the *Rescue Day* Presentation and have gone significantly beyond what was expected or asked.

3 — MEETS!! You did a good job!!
You followed all the directions for the *Rescue Day* Presentation.

2 — NEARLY THERE. Oops, something is missing.
You completed almost all the directions for the *Rescue Day* Presentation, but there was missing information.

1 — UNSATISFACTORY
You did not complete the *Rescue Day* Presentation as required.

Presentation Rubric

Name: _____

4— EXCEEDS!!!
Your voice was loud and very clear. You maintained eye contact with your audience. You effectively used visual aids.

3 — MEETS!!
Your voice was loud and clear. You made eye contact with your audience. You used visual aids.

2— NEARLY THERE.
Your voice could have been louder and/or clearer. You seldom made eye contact with your audience. You did not effectively use visual aids.

1 — UNSATISFACTORY.
The audience could not understand your presentation.

Presentation Rubric

Name: _____

4— EXCEEDS!!!
Your voice was loud and very clear. You maintained eye contact with your audience. You effectively used visual aids.

3 — MEETS!!
Your voice was loud and clear. You made eye contact with your audience. You used visual aids.

2— NEARLY THERE.
Your voice could have been louder and/or clearer. You seldom made eye contact with your audience. You did not effectively use visual aids.

1 — UNSATISFACTORY.
The audience could not understand your presentation.

Presentation Rubric

Name: _____

4— EXCEEDS!!!
Your voice was loud and very clear. You maintained eye contact with your audience. You effectively used visual aids.

3 — MEETS!!
Your voice was loud and clear. You made eye contact with your audience. You used visual aids.

2— NEARLY THERE.
Your voice could have been louder and/or clearer. You seldom made eye contact with your audience. You did not effectively use visual aids.

1 — UNSATISFACTORY.
The audience could not understand your presentation.

Presentation Rubric

Name: _____

4— EXCEEDS!!!
Your voice was loud and very clear. You maintained eye contact with your audience. You effectively used visual aids.

3 — MEETS!!
Your voice was loud and clear. You made eye contact with your audience. You used visual aids.

2— NEARLY THERE.
Your voice could have been louder and/or clearer. You seldom made eye contact with your audience. You did not effectively use visual aids.

1 — UNSATISFACTORY.
The audience could not understand your presentation.

POSTTEST (1)

Name_____ Date: _____

Directions:

Circle the correct response for each of the following questions.

1. Which lines on a glove run north or south of the Equator?
   a. longitude
   b. latitude
   c. equator
   d. climate

2. Which lines show distances east or west of the Prime Meridian?
   a. longitude
   b. latitude
   c. equator
   d. climate

3. Zero degrees latitude is called the _____?
   a. Prime Meridian
   b. Tropic of Cancer
   c. North Pole
   d. Equator

4. There are _____ hemispheres on the earth.
   a. three
   b. two
   c. four
   d. six

5. The hottest climates are located between the _____ and the _____.
   a. Equator/Tropic of Cancer
   b. Tropic of Capricorn/Equator
   c. Tropic of Capricorn/Tropic of Cancer
   d. Tropic of Cancer/South Pole

6. Circle the two kinds of ocean currents.
   a. Surface
   b. Trade
   c. Deep-water
   d. Flotsam

7. Currents on top of the ocean are driven by:
   a. waves
   b. wind
   c. fish
   d. rain

8. Currents on the bottom of the ocean are driven by _____.
   a. wind
   b. fish
   c. density
   d. ships

9. Winds blow in different directions because the sun makes them different temperatures.
   True
   False

10. The winds that blow over the United States are called _____.
    a. Easterlies
    b. Hurricanes
    c. Trade Winds
    d. Westerlies

11. Warm water is more dense than cold water.
    True
    False

12. The Earth's primary source of energy is
    a. the ocean
    b. the wind
    c. the sun
    d. electric energy

13. Ocean currents are formed from wind, temperature, and _____.
    a. waves
    b. density
    c. land forms
    d. fish

14. Ocean currents travel very short distances.
    True
    False

15. Which has the MOST density?
    a. water from an estuary
    b. ocean water
    c. rain water
    d. spring water

POSTTEST (2)

Name_____ Date: _____

16. The two things that can change the density of water are _____ and _____?
    a. salt
    b. food coloring
    c. fish
    d. temperature

17. All plants (flora) and animals (fauna) survive because of _____ to a particular ecosystem.
    a. adaptation
    b. moon phases
    c. birth
    d. destruction

18. The climate of a region can change because of the wind that blows there and the currents that travel there.
    True
    False

19. An ecosystem is a complex community in nature where plants (flora) and animals (fauna) interact with their environment.
    True
    False

20. Materials that fall off a cargo ship and float in the ocean are called _____.
    a. flotsam
    b. jetsam
    c. debris
    d. trash

21. Materials that fall off ships can travel very far because one ocean current can run into another ocean current.
    True
    False

22. The sun makes water on earth evaporate, and it comes back down to earth as _____.
    a. pressure
    b. salt
    c. precipitation
    d. gravity

23. All the water that is on the Earth now has been here since the beginning of time because of our water cycle.
    True
    False

24. Rate this unit on a scale of 1 to 10 (10 is BEST) _____

    What parts did you like best?

    _____

    _____

    _____

    _____

    _____

    _____

    _____

    What parts did you dislike?

    _____

    _____

    _____

    _____

    _____

    _____

    _____

Exemplary Team Presentation

Presented to:

_____

_____ _____

Date **Presented by**

Crime Scene Investigation
Laboratory

Exemplary Individual Presentation

Presented to:

_____

_____ _____

Date **Presented by**

Crime Scene Investigation
Laboratory

Exemplary Research

Presented to:

_____

_____ _____

Date **Presented by**

Crime Scene Investigation
Laboratory

Exemplary
Cooperative Work

Presented to:

_____

_____ _____

Date **Presented by**

Crime Scene Investigation
Laboratory

Teacher Feedback Form

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Release Form for Photographic Images

To Teachers:

To help illustrate to others the experiential activities involved and to promote the use of simulations, we like to get photographs and videos of classes participating in the simulation. Please send photos of students actively engaged so we can publish them in our promotional material. Be aware that we can only use images of students for whom a release form has been submitted.

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I give permission for photographs or videos of my child to appear in catalogs of educational materials published by Interact.

Name of Student: _____ (print)

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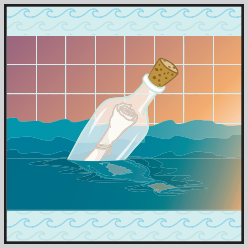

STUDENT GUIDE

Student Name: _____

S.O.S.

For immediate release ::::::::

ATTENTION Investigators!

Due to decreased funding this year, GLOBAL EMERGENCY TRAVEL UNIT (G.E.T.U.) can no longer launch small Search and Rescue missions. We are asking you to assist us in locating some families who have been reported missing and may be stranded. We have recovered several bottles that have washed ashore in various locations around the world.

We are sending the bottles to you. Attached to the neck of each bottle is an ID tag telling you where the bottle washed ashore and where the families were last seen before they became stranded. Inside the bottle is a note. Unfortunately, it appears that the bottles have leaked. Some parts of the notes are unreadable. But do not worry. We have sent the original note to a local Crime Scene Investigations (CSI) unit. They should be able to decipher the missing information. Every day, the CSI unit will report what they have salvaged. This information may help your team determine where a stranded family is waiting.

Use the CSI clues and any information you gain through research to trace the journey the bottle must have made. In 14 days, your team must present clear and precise evidence as to the whereabouts of the stranded families. G.E.T.U. will then decide if your facts are valid and whether or not to send out a search and rescue ship.

DO NOT TAKE THE NOTE FROM YOUR BOTTLE until tomorrow. Your first job as an investigating team is to locate where your bottle was found. Use your Ocean Currents Map on pages 4–5 and the latitude/longitude coordinates found on the bottle ID tag.

Remember, you all must work together and help each other to successfully determine where to send the rescue ships! Submit your findings within 14 days. Good Luck!

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Product Code: INT976SG
Revised 2010

S.O.S. is divided into three phases. In Phase 1, you will select a bottle that contains a note from a stranded family. You will learn about the ocean currents that carried the bottle to where it was found. You will also complete experiments to understand density, a concept important to understanding how currents form. In Phase 2, the local CSI unit will analyze the bottle's contents, decipher the note inside, and send you a report each day. In Phase 3, your team will organize and present the evidence that shows the Global Emergency Travel Unit (G.E.T.U.) where to send their ships to rescue the family.

Roles and Responsibilities

Supervisor—organizes the team and delegates/directs individuals as needed. The Supervisor also keeps the team motivated and on task. This member submits the Team Folder to the teacher at the end of each day.

Reader—reads handouts and **CSI Clues** to the group, clarifies, and repeats as necessary.

Recorder—maintains the **Daily Discovery Logs**, checks that teammates have reported all research, and organizes the Team Folder.

Manager—collects and returns supplies and materials needed for the team experiments and daily work. Returns all reference texts.

Technician—if your team has more than four members, your extra member is the Technician. The technician assumes the role of any team member who is absent for that day. If no one is absent, this member assists other team members in their tasks.

All team members—maintain a bibliography of all sources that you use (using **Work Cited Recording Blanks**), share the research responsibilities, and complete your own **Verified Team Information Chart** on pages 6–7 of this Student Guide.

COOPERATIVE GROUP WORK RUBRIC

4 — EXEMPLARY — You *consistently* and *actively* help your group achieve its goals by communicating well with other group members, by encouraging the group to work together, and by *willingly* accepting and completing the necessary work of your daily role.

3 — EXPECTED — You *usually* help your group achieve its goals by communicating with other group members, by encouraging your group to work together, and by accepting and completing the necessary work of your daily role.

(If your evaluation is less than EXPECTED,
try to use your cooperating skills more consistently.)

2 — You *sometimes* help your group achieve its goals.

1 — You *do very little* to help your group achieve its goals.

Background

With each day, the CSI unit will be analyzing the contents of the bottle and deciphering what the note says. Their report will provide you with the information you need to find the families. Each clue will help you to narrow the search. To keep your research on track, you will use the **Daily Discovery Logs**, your personal research papers, and the **Verified Team Information Chart** on pages 6–7 of this guide.

How to Track a Clue

Let's suppose the CSI reported on the first day that there was evidence of *lava* from an *active volcano*.
Step One—Start thinking about active volcanoes. Where do you find them in the world? You don't have enough info yet, but the Recorder should write it down on the **Daily Discovery Log**.

What if they also said that there was evidence of Kaolin and Limestone?
Step Two —The Supervisor should direct the Recorder to add these two clues to the **Daily Discovery Log**. He/she should also assign team members to research these two words. Team members should take notes and report back to the team at the end of the day.

What if the next day, the CSI unit reported evidence of a Spectacled Bear and a Marine Otter?
Team members would research the two animals and take notes that tell where they live. At the team meeting, they should report what they discovered to the team.

	What We Know
Animal Life (fauna)	
Spectacled Bear	Found in Venezuela, Columbia, Ecuador, Bolivia, and Peru. www.Encarta.com
Marine Otter	Found off the coast of Ecuador World Book, Vol. 12, p. 206

LEARNING TIP

In the chart, write the URL or book title + page number of where you found the information.

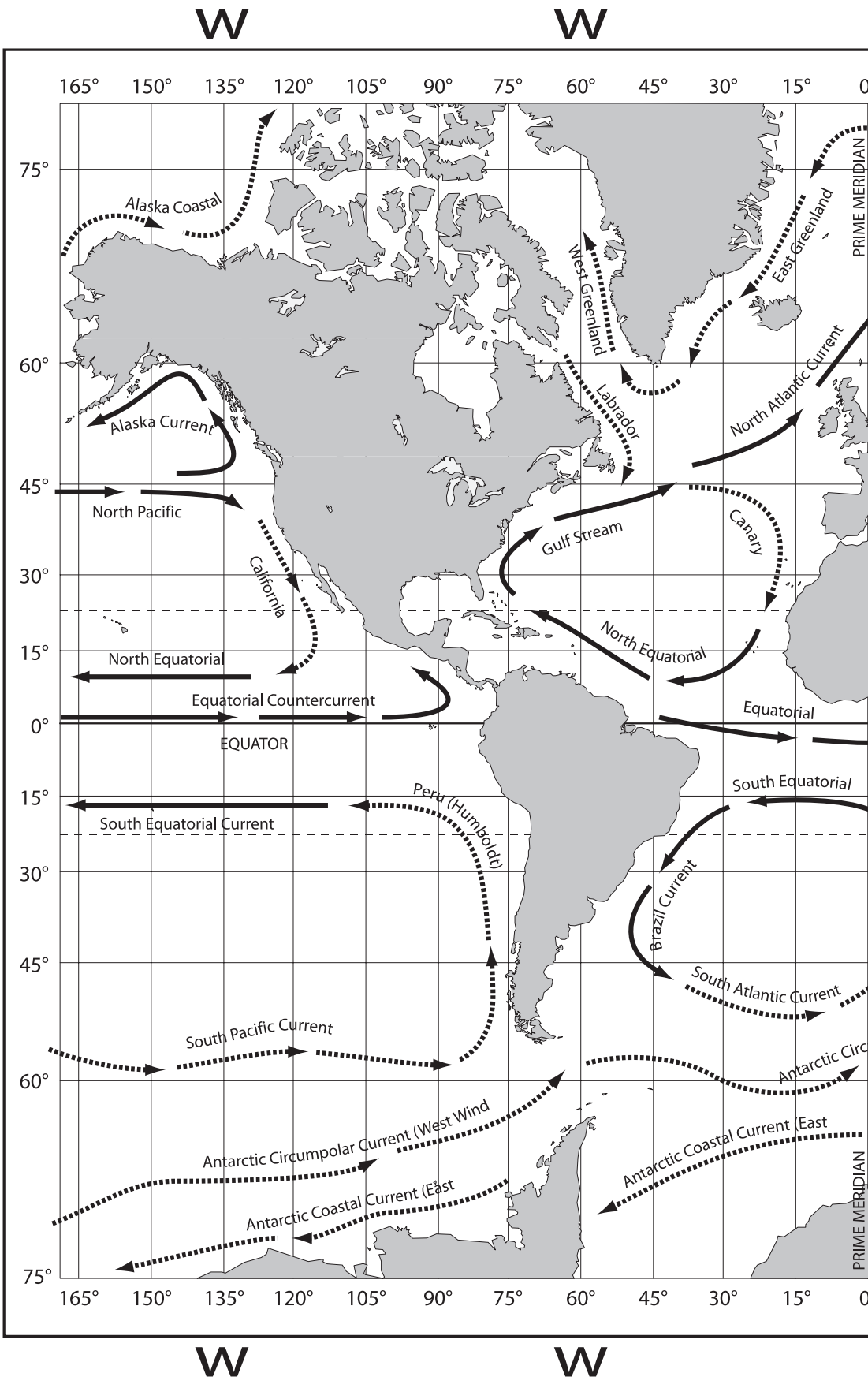
Step Three—As a team, start looking to see if a particular location is associated with more than one clue. For example, Ecuador is home to spectacled bears and marine otters. Check to see if Ecuador has any active volcanoes.
Step Four—Evaluate all the clues that CSI sends, to see if the plant life and climate match Ecuador. If yes, continue your research to support your conclusions. If no, keep an open mind to see if it might be a place nearby or return to the web sites to see if there was more information you overlooked.
Step Five—Summarize and record all the clues and research on the **Daily Discovery Log**. When you confirm information, write it on the **Verified Team Information Chart** on pages 6–7 of your Student Guide. You will need facts to build a strong case for sending the G.E.T.U. rescue team to the right place.

Warm Water Currents:

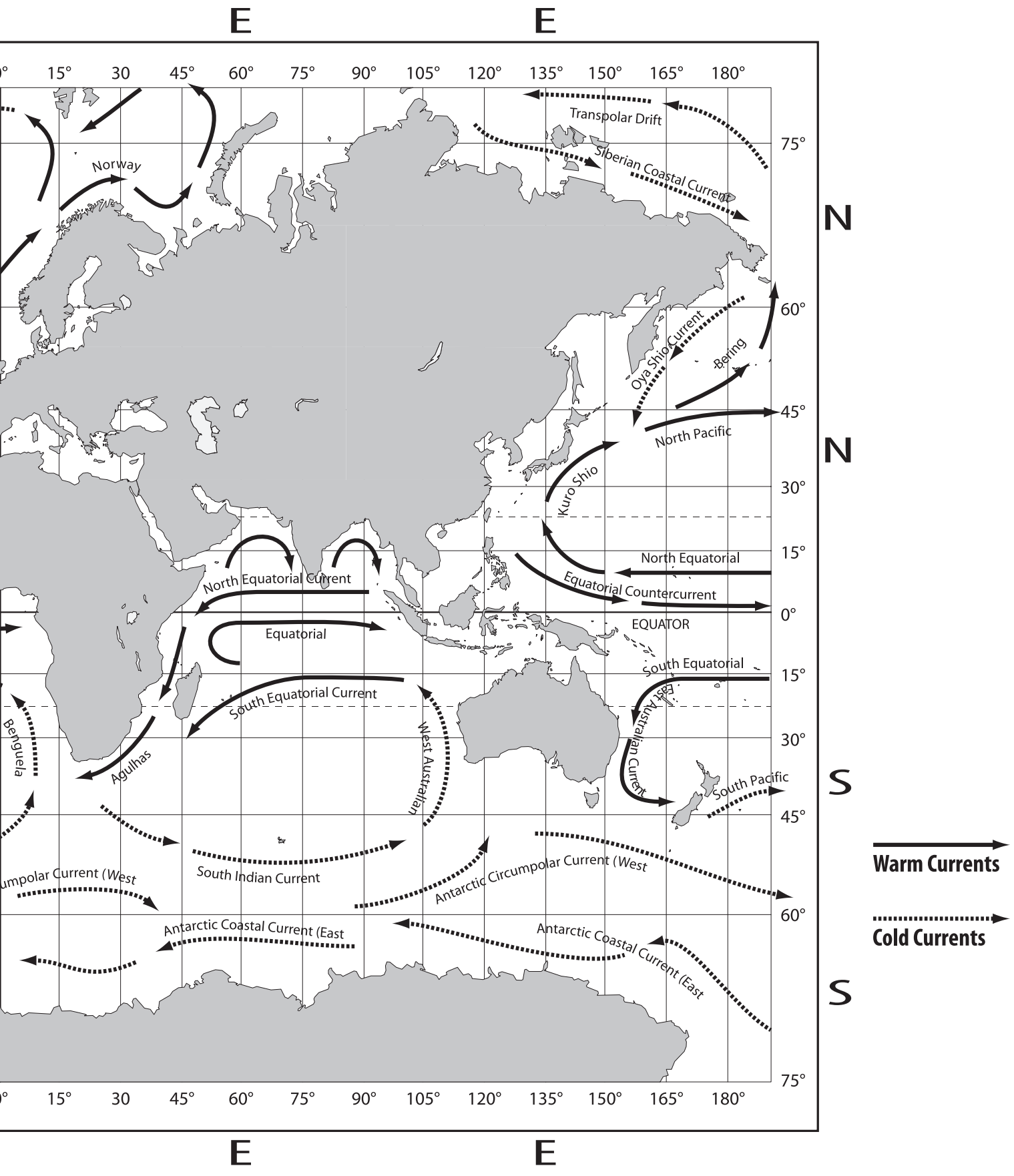
- Agulhas
- Alaska
- Bering
- Brazil
- East Australian
- Equatorial Countercurrent
- Gulf Stream
- Kuro Shio
- North Atlantic
- North Equatorial
- North Pacific
- Norway
- South Equatorial

Cold Water Currents:

- Alaskan Coastal Current
- Antarctic Circumpolar Current (West Wind Drift)
- Antarctic Coastal Current (East Wind Drift)
- Benguela
- California
- Canary Current
- East Greenland
- Labrador
- Oya Shio
- Peru (Humboldt)
- Siberian Coastal Current
- South Atlantic
- South Indian
- South Pacific
- Transpolar Drift
- West Australian
- West Greenland



OCEAN CURRENTS MAP



VERIFIED TEAM INFORMATION CHART (1)

	What We Know
Where Bottle Was Found	
Land Forms	
Major Bodies Of Water	
Climate	
Plant Life (flora)	

VERIFIED TEAM INFORMATION CHART (2)

	What We Know
Animal Life (fauna)	
Natural Resources	
Latitude/Hemisphere	
Ocean Currents/Route	
Miscellaneous Information	
Location Of Search and Rescue Mission	

Directions

In 3 to 7 minutes, your team must convince G.E.T.U. to send a ship to rescue the stranded family. You and your team must prepare a detailed presentation filled with facts! Your teacher will assess your presentation using the rubrics at the bottom of this page. The **Content Rubric** is a team assessment. The **Presentation Rubric** is an individual assessment. Follow these directions to make your case:

1. Every team member must speak/present during the 3 to 7 minute time frame.
2. Include visual aids, such as maps, pictures, diagram, or charts. Also, you must show the audience the bottle.
3. State the facts that the CSI unit gave you and the facts your team found out through research. Include landforms, animal life (fauna), climate, soil analysis, vegetation (flora), and latitude reading.
4. Trace the currents where the bottle drifted, and tell G.E.T.U. where you think the family is stranded. (This does not have to be an exact location, but a general location based on the facts.)
5. Submit a bibliography for all the sources you used (both reference and Internet).

CONTENT RUBRIC
(Team Assessment)

4 — EXCEEDS!!! We did a great job!!!
- We followed all the directions for the Rescue Day Presentation and have gone significantly beyond what was expected or asked.

3 — MEETS!! We did a good job!!
- We followed all the directions for the Rescue Day Presentation.

2 — NEARLY THERE. Oops, we forgot something.
- We completed almost all the directions for the Rescue Day Presentation, but there was missing information.

1 — UNSATISFACTORY
- We did not complete the Rescue Day Presentation as required.

PRESENTATION RUBRIC
Volume, clarity, eye contact, & visual aids
(Individual Assessment)

4— EXCEEDS!!!
- Your voice was loud and very clear. You maintained eye contact with your audience. You effectively used visual aids.

3 — MEETS!!
- Your voice was loud and clear. You made eye contact with your audience. You used visual aids.

2— NEARLY THERE.
- Your voice could have been louder and/or clearer. You seldom made eye contact with your audience. You did not effectively use visual aids.

1 — UNSATISFACTORY.
- The audience could not understand your presentation.