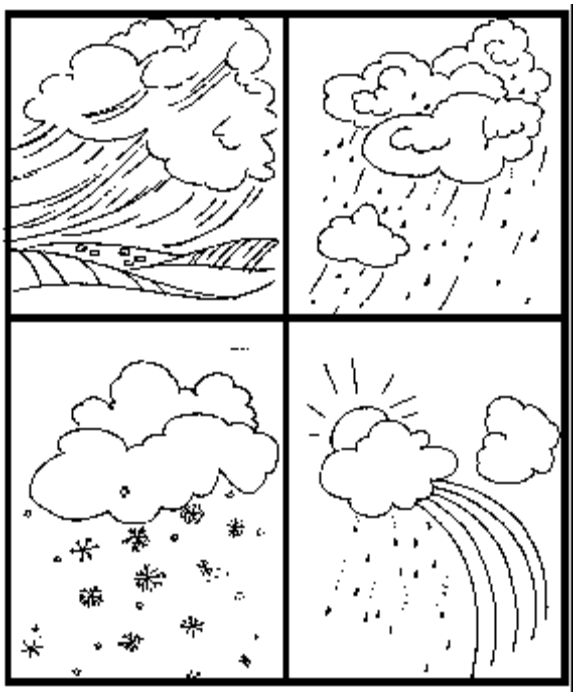
Water Cycle

The Earth's Gift

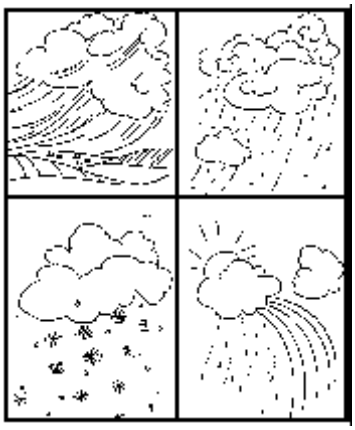
FIFTH GRADE

OCEANS



1 WEEK
LESSON PLANS AND
ACTIVITIES

WATER CYCLE
OVERVIEW OF FIFTH GRADE



WATER

WEEK 1.

PRE: *Analyzing why water is important.*
LAB: *Comparing the density of water to that of other liquids.*
POST: *Exploring how water is used in our society.*

OCEANS

WEEK 2.

PRE: *Distinguishing between fresh and salt water.*
LAB: *Exploring what lies under the oceans.*
POST: *Exploring estuarine systems.*

ATMOSPHERE

WEEK 3.

PRE: *Analyzing the composition of air.*
LAB: *Discovering that some components of air can be depleted.*
POST: *Distinguishing amongst different pollutants.*

WEATHER

WEEK 4.

PRE: *Comparing the different layers of the atmosphere.*
LAB: *Classifying clouds.*
POST: *Comparing an artist's interpretation of clouds.*

WATER CYCLE - OCEANS (5)

PRE LAB

Students look at elements in salt water.

OBJECTIVES:

1. Distinguishing between fresh and salt water.
2. Exploring the physical shape of the ocean floor.

VOCABULARY:

basin
hydrographic
marine
minerals

MATERIALS:

Physiographic hydrographic globe
worksheets

BACKGROUND:

The ocean system is complicated. The water in the oceans is salty because as the surrounding rocks (land and under the oceans) erode, they release the minerals that make up the rocks. The minerals are dissolved in water and are in solution until either chemical or biological reactions in the oceans precipitate the minerals. For instance, radiolarians, a marine protozoa, can take Si + O dissolved in the marine water and create a siliceous skeleton of a water-based quartz (opaline $SiO_2 \cdot H_2O$).

Erosion of the land also brings sediments to the oceans bottoms via rivers. The sediments drape the landscape of the ocean's bottoms, sometimes hiding the topography of the ocean's floors. The topography of the ocean floor is as varied as the continental topography.

Although we have known that the underwater topography is varied since the 1870's, most people do not even think about the seafloor. Students always see water and think that the bottom is like a bowl, smooth and curved. It has been determined that the ocean basins have an average depth of almost four kilometers. Other topographic highs include the mountainous ocean ridges, deep-sea trenches, jagged, linear fracture zones, abyssal hills, and seamounts. The continents are just the highest of the ridges. Sea level is just the arbitrary point at which the oceans meet the land. Above sea level we call it topography and below is called bathymetry. Topography is measured as positive height, whereby bathymetry goes deeper from sea level.

PROCEDURE:

1. Discuss with students the physical shape of the ocean's floor, pointing out that 70-71% of the surface of the Earth is covered with water. Valleys and mountains can be found below the water. Use the physiographic hydrologic globe to show students the bottom of the oceans. The oceans are really just land that is lower than sea level. Use the worksheet on the ocean's basins to see if you can find the ridges and trenches.

2. Many elements are dissolved in seawater. You may want students to guess which elements are in water. Use the worksheet on "Elements in Seawater" to illustrate which ones are dissolved in seawater. Students will be surprised that there are so many elements. Some of these elements come out of solution in various forms which can be used for economic purposes. Students in lab will see manganese nodules which are potato-size masses of manganese, cobalt, and nickel. Salt is also produced by solar evaporation of salt ponds, that precipitate sodium chloride.

3. Answers: 1. H, Na, Mg, K, Ca, C, O, S, Cl, Br; 2. Sr, B, Si, F; 3. He, Ne, Ar, Kr, Xe, Rn, N, and O; 4. oxygen 4. Pacific, Bering, Canada, Siberia, Eurasia, Greenland, Labrador, NFD, Wes Europe, Norway, North America, Iberia, Canary, Cape Verde, S. Leone, Mexico, Yucatan, Caribbeam, Guatemala, Peru, Chile, Bellingshausen, Argentine, Brazil, Guiana, Guinea, Angola, Cape, Agulnas, Mozambique, Weddell, Crozet, Somali, Mascarene, Arabian, Bengal, Wharton, Australia, Wilkes, Tasman, Philippine, South Cina, Japan, Okhotsk; 5. Atlantic, mid-Atlantic Ridge; 6. Fracture zones caused by uneven movement of the crust.

WATER CYCLE - OCEANS (5)

1. List the elements that are a major constituent of seawater.

2. List the elements that are a minor constituent of seawater.

3. List the elements that are dissolved gases in seawater.

4. Which element is both a gases and a major constituent?

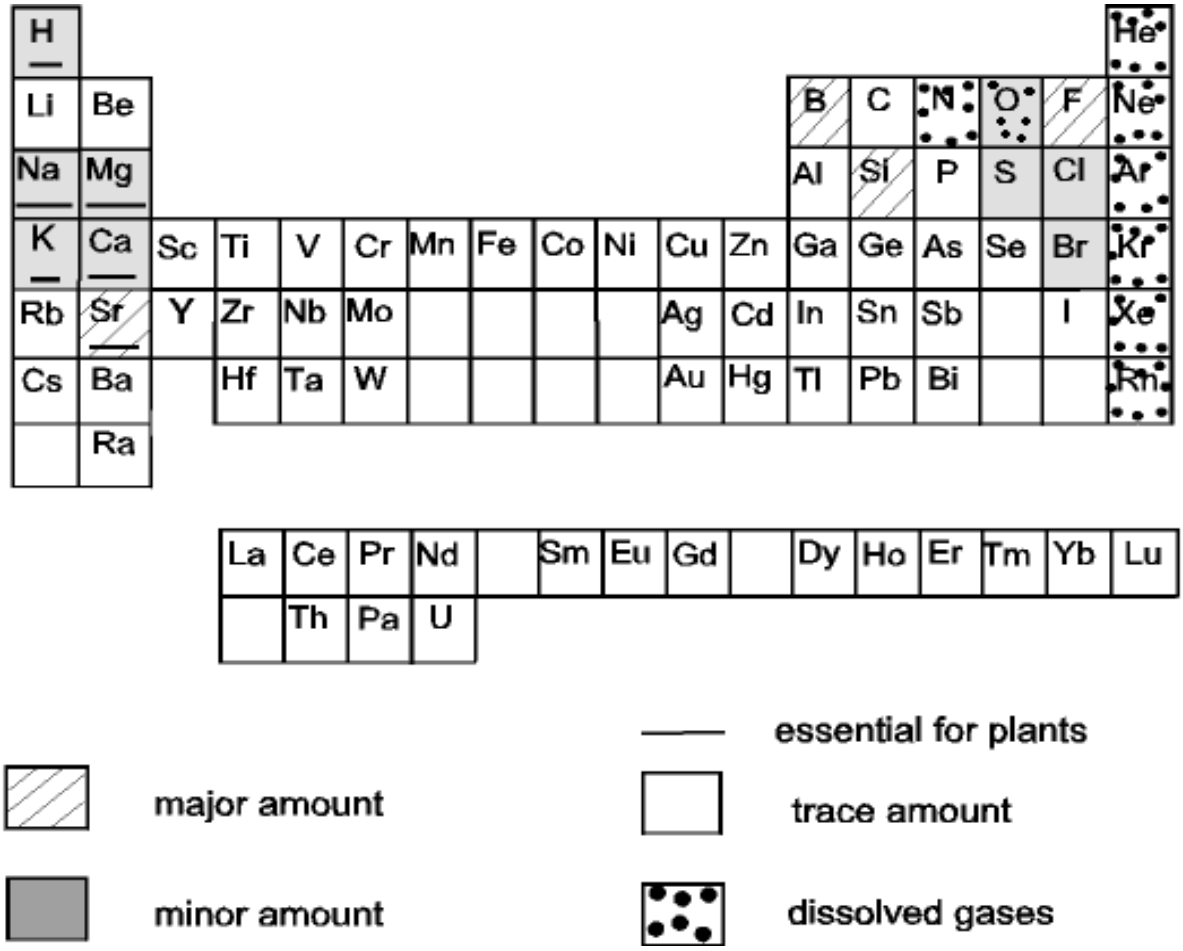
5 List the major basins.

6. Which ocean has the longest chain of underwater mountains.

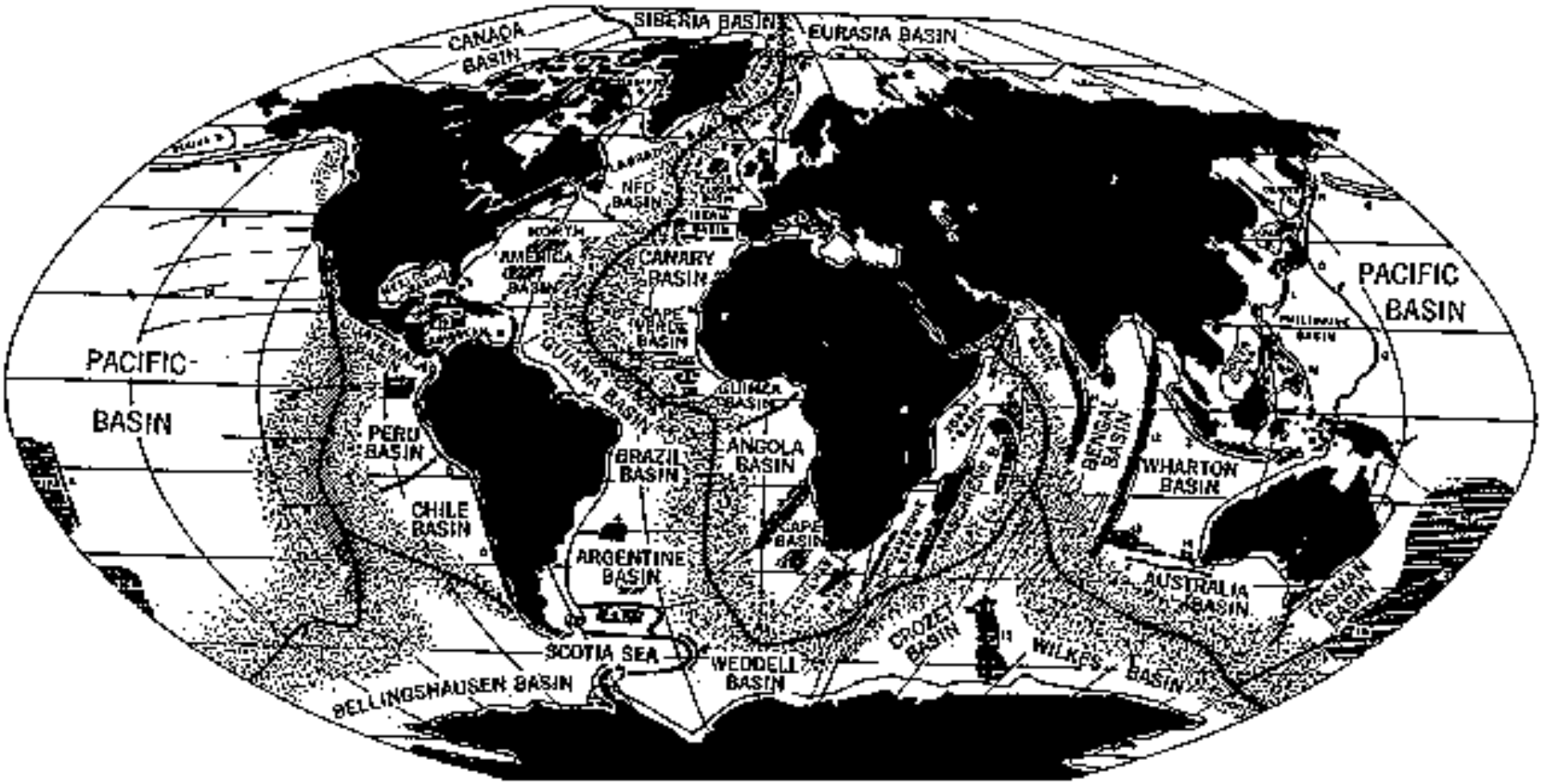
7. What are the lines going east to west in the eastern part of the Pacific Ocean? What causes these?

WATER CYCLE - OCEANS (5)

PERIODIC TABLE
ELEMENTS FOUND IN SEAWATER



WATER CYCLE - OCEANS (5)



WATER CYCLE - OCEANS (5)
LAB

Students look at dredge samples.

OBJECTIVES:

1. Exploring what lies on the ocean floor.
2. Discovering the importance of the oceans.

VOCABULARY:

dredge
echo sounding

MATERIALS:

Water Cycle - Oceans (5)
Swift GH microscope
magnifying glass


Diatoms

BACKGROUND:

The bottom of the oceans is rich in deposits of sediments with some economic importance. In some areas of the ocean they mine for lime, sand, and gravel that are used in the concrete industry. In other areas the oil industry may find oil reserves.

However, we must look at the ocean bottom differently than if we are looking on land. The water distorts our view and we must use indirect methods to look at the floor of the oceans. There are many different techniques used in underground or undersea exploration and prospecting. They can take indirect pictures of the seafloor by using seismic techniques. This allows energy waves to penetrate an area and then a geologist will interpret the pictures that are derived from this method.

A core sample is a roughly cylindrical piece of subsurface material removed by a special drill and brought to the surface for examination. Coring devices helps to recover samples of fine-grained deposits on the seafloor in such a way as to preserve the depositional history through time. By studying the mineral grains, microfossils, and water in the pore spaces, scientists have been able to infer the past oceanic events.

PROCEDURE:

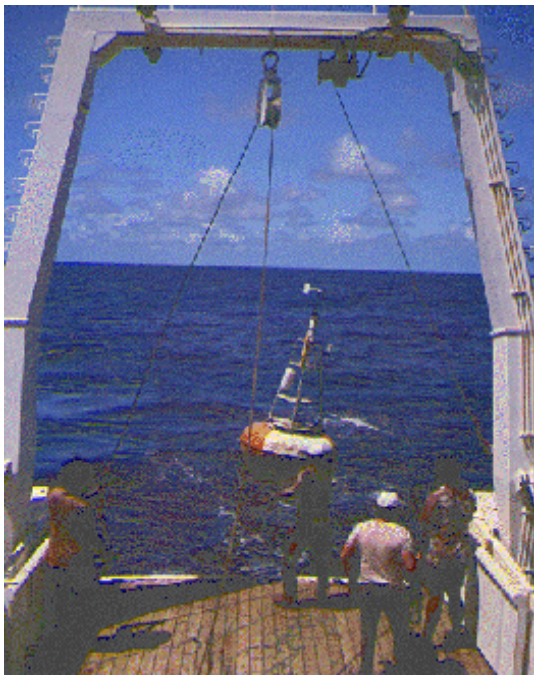
1. This lab looks at the features of the ocean floor. Remind the students that it is very difficult to know what is down there. First students will look at echo soundings and seismic records of the bottom of the oceans. These help scientists look at the surface of the ocean and to look at the structure of the rocks. Then students will look at different components of the

bottom. Students will determine that some of the materials that you find underneath the oceans are similar to what we see on land. Some of the samples are not really from the location because of cost factor. However the manganese nodules and pillow basalt displays are the real substance. The material was obtained from the U.S. Geological Survey.

2. EXERCISE I. Echo sounding devices use an instrument similar to that used when a doctor looks at a baby in a mother's womb by giving an impression of the surface of the ocean floor (topography). The breaks in each of the pictures are just a consequence of the system. Echo soundings are taken when an instrument from the ship makes a noise which is then recorded on the ship when the sound "bounces" back from the bottom.

The other sheet in the module is a seismic profile to be used as a display. This gives the scientist more detail of can be found on the bottom and can be read by geologists to determine what kind of rocks are down there. A seismic profile uses different types of "waves" to look at the rocks below the surface.

3. EXERCISE II. Marine geologists determine what can be found on the ocean floor by taking dredge samples. A dredge sample is obtained by "scraping" up parts of the ocean floor using a crane-like device. This is not very scientifically correct or standard, but it helps. There are many other ways to look at the bottom of the oceans. The samples used in this lab are dredge samples from various parts of the ocean. Samples 1,3, and 4 are like dredge samples that you would find. Sample 2 is a real manganese nodule from the oceans. The pillow basalt sample is real from the area around Hawaii in the Pacific Ocean. The main objective is for students to recognize the oceans contain many things.



SAMPLE 1. Bahamas. DESCRIPTION: whole shells and broken up shells, mixed together with some small rock pieces; light brown in color, some plant matter. Used as sand in concrete.

SAMPLE 2. Manganese "crusts" found west of Hawaii in the Pacific Ocean. DESCRIPTION: large to small (brown-brown, yellow) rock pieces; some pieces look like coal. Used for manganese, cobalt, and nickel.

SAMPLE 3. Monterey Canyon, off of Moss Landing; a canyon deeper than the Grand Canyon DESCRIPTION: medium to large grains of sand, black minerals and pink minerals. The Monterey Canyon is so deep that it is not mined, but the sand could be used in the

concrete business.

SAMPLE 4. Southern California (near Catalina Islands) DESCRIPTION: fine tan-brown particles. There are large areas of the oceans with fine particles. The real material would have tiny skeletons of organisms called foraminifera and radiolarians with diatoms (one celled plant). This area is noted for its accumulation of oil. The tiny organisms produce oil droplets (mainly the diatoms) and are covered by sand size particles. With time and a little heat this will become crude oil. Geologist want to know the structure of the bottom of this area, so they can find oil.

WATER CYCLE - OCEANS (5)

PROBLEM: How can you find out if there are any important materials on the ocean floor?

PREDICTION:_____

EXERCISE 1. **MATERIALS:** echo soundings

1. What is the location of your map? _____

2. What features can you see on the ocean floor? _____

3. How did you recognize and know what those features were?
_____

EXERCISE 2. **MATERIALS:** dredge samples, magnifying glass or microscope

PROCEDURE: Using your magnifying glass or microscope, describe and identify as many items as you can in each sample. Be sure to include size, color, and shape. Be specific!

SAMPLE LOCATION	DESCRIPTION	PREDICT IMPORTANCE
1.		
2.		
3.		
4.		

CONCLUSION: Is there anything of value under the oceans? Explain.

WATER CYCLE - OCEANS (5)

POST LAB

Students use a worksheet to explore the San Francisco Bay Estuary.

OBJECTIVES:

1. Exploring estuarine systems.
2. Discovering the San Francisco Estuarine System.

Estuary near Sugar Dome in Brazil.

VOCABULARY:

brackish
estuary

MATERIALS:

worksheets

BACKGROUND:

The San Francisco Bay estuarine system is a complex of interconnected embayments, sloughs, marshes, channels, and rivers. The Bay system is comprised of the Delta Area (north), receiving the waters of the Sacramento and San Joaquin river systems and the San Francisco Bay proper (south), into which the Delta waters flow. Geographically and hydrodynamically the estuary can be divided into the northern bay, which passes south, and westward from the Delta through Suisun and San Pablo bays, and the south bay which extends southeastward toward San Jose. They join in the central bay near the Golden Gate, the connection with the Pacific Ocean.

The waters of the San Francisco Bay are a mixture of the salt water flowing in from the Pacific Ocean and the fresh water flowing from rivers that feed into the bay. The water in the bay is neither salty nor fresh, but brackish. This entire system is known as an estuary. The San Francisco estuarine system is made up of three bays: San Francisco in the south and the San Pablo and Suisun Bays in the north. There is only one outlet to the Pacific Ocean for all 3 bays, a small opening underneath the Golden Gate Bridge (connecting San Francisco and Marin). The force of tides (caused by gravitational attraction of the Moon and Sun) causes water to move into and out of the bay. The influence of this mass movement caused by the tides flushes the estuarine system.

The San Francisco estuarine system is a very productive area. It is important to the entire ecosystem of the western United States. Many organisms depend on the bay for food,

safety and shelter. Migrating birds need to rest here on their trips to warmer climates and nest during breeding seasons. The animals in the estuarine system are varied. Mammals, birds, reptiles, amphibians, invertebrates, protozoa, and fish are all components of this system. The system has many parts to it because of the need of the larger animals to feed on the smaller animals. This process is called the food chain and it give us clues to why animals eat and live where they do.

The bays today are very shallow, 85% of the water is less than 30 feet deep. There are deep, narrow channels that cut the bottom of the bay, the Golden Gate (about 400 feet deep) and the Carquinez Strait (about 100 feet deep). Circulation of the bays is dependent mainly on the strong tidal action, especially in the south bay and river inflow, especially in the north bays. Winds, storms and bottom topography change these patterns locally.

Salt marshes of the San Francisco Bay area are highly productive and extremely valuable to the bay's ecology. Salt marshes contain a variety of plants, but there are only a few common to all California salt marshes. The plant groups occur in four distinct zones due mainly to the amount of salt in the soil, texture of soil, rates of sediment deposition, and the length of submergence. The specific location of each zone changes in response to time of the year and environmental conditions, but their relative positions remain the same.

Some of the most common plants found in the salt marshes are the following. Salt bush is a common low shrub of the salt marshes. These are hardy plants with numerous seeds and are tolerant of the salty soils, commonly found along disturbed areas such as roadways. Salt grass has long and narrow grass like leaves growing out from its stiff and erect stem and is about one foot in height. Cordgrass is a perennial, that dies in the fall, that can tolerate many hours of submergence. It reaches a height of over 4 feet with long and narrow leaves. It's system can rid itself of the salt, by filtering the salt out and the salt crystals form on the leaves. Pickleweed has stems that are pickle like in appearance and are attached end. The leaves form scales on the joints of the uppermost segments. Its leaves do not excrete salt but absorb it. In the fall the "pickles" turn red, dry up and die.

The San Francisco Bay has evaporative ponds that produce salt for commercial markets.

PROCEDURE:

1. Oceans and land meet in different ways. An estuary, which is a place where salt water meets fresh water is a habitat that is full of organisms living in a dynamic oceanographic system. If you live near an estuary you should find information about that area and the importance in area. Estuaries usually act as a filter to help naturally sort nutrients and sediments from water before it goes out to the ocean.

2. The east coast has many estuaries compared to the west coast. This exercise looks at the San Francisco Bay Estuary system. Students are to look at the geographic setting and try to determine where the fresh water turns into brackish (partly salt) and then to full saline water.

3. ANSWERS: 1. 1. Dumbarton Bridge; 2. San Mateo Bridge; 3. Bay Bridge; 4. Golden Gate Bridge; 5. San Rafael-Richmond Bridge; 6. Carquinez Bridge; 7. Bencia Bridge; 2. There are 3 bays - San Pablo, Suisun, and San Francisco Bay. The San Francisco Bay is the largest. 3. A peninsula is land surround on three sides by water. The land that the city of San Francisco is on. 4. Brackish water is where fresh water meets salt water which would be in the Suisun and San Pablo Bay. 5. Pacific Ocean. 6. Sacramento River. 7. The salt marshes are in the southern part of San Francisco Bay and in some areas in San Pablo Bay.

WATER CYCLE - OCEANS (5) POST

1. Can you locate seven bridges? If you live in the San Francisco Bay can you name them?

_____

_____

_____

2. How many bays can you find? Name them. Which is the largest?

_____

_____

3. What is a peninsula? Is there on this map?

_____

4. Where is there brackish water? _____
5. Where is there true ocean water? _____
6. Where is there fresh water? _____
7. Where are there salt marshes? _____

WATER CYCLE - OCEANS (5)