Science Eight

Module Five

Fresh & Salt Water Systems

Name:

Date Received:

Date In:

Grade:

Science Digest

Middle Five

Name:

Date Received:

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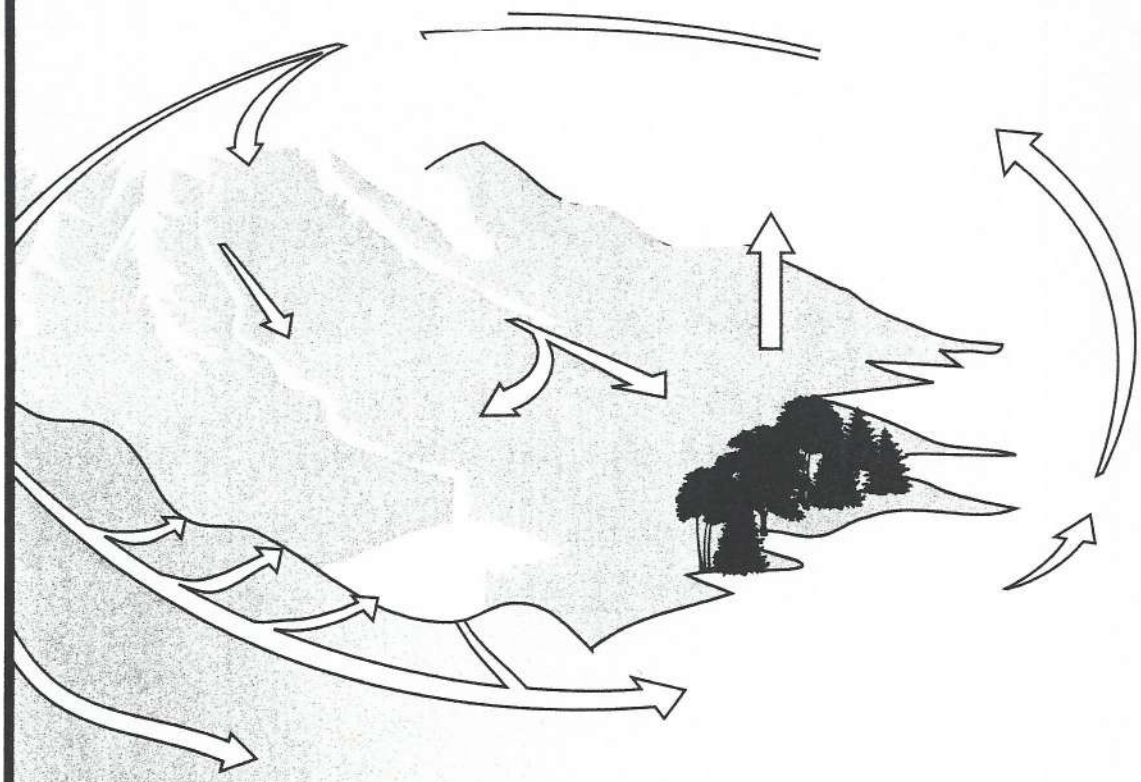
FRESHWATER AND SALTWATER SYSTEMS



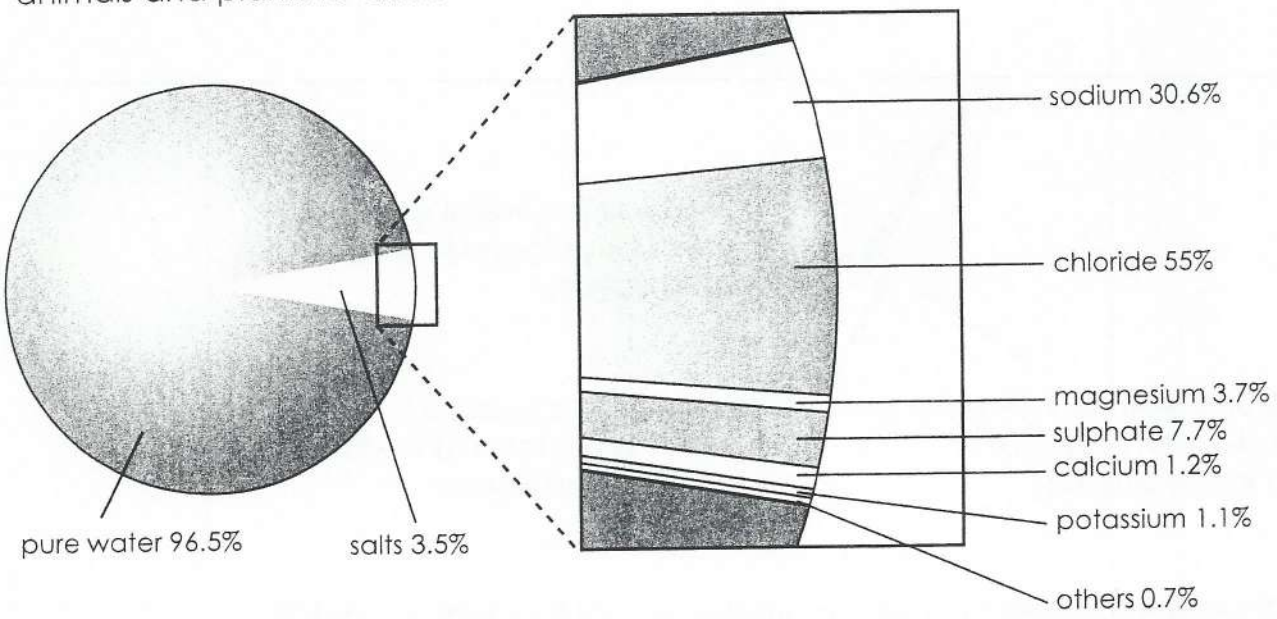
GRADE 8
TOPIC FIVE

NAME

Part B: What is the difference between saltwater and freshwater?

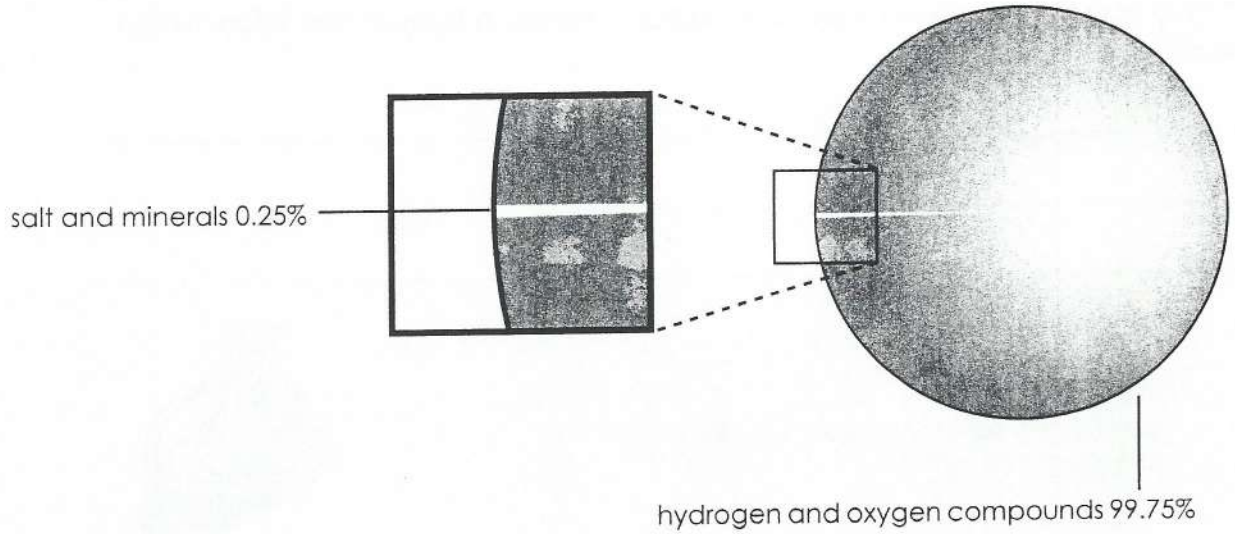
Contents of Saltwater

Saltwater is not suitable (okay) for humans and terrestrial (land) animals and plants to drink.

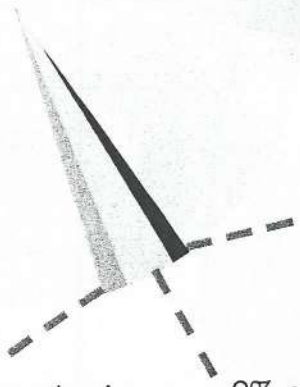


Contents of Freshwater

Freshwater is suitable (okay) for humans and terrestrial (land) animals and plants to drink.



Part A: Where in the world is our water?



97% of the world's water is saltwater in oceans and seas.

0.02% of the world's water is freshwater found in rivers, lakes and ponds.

0.63% of the world's water is groundwater (freshwater sitting in the ground).

2% of the world's water is freshwater in the form of ice in glaciers, snow and polar icecaps.

1. What does this graphic tell you about the world's freshwater supply?

_____

_____

_____

2. What do you think people should do about water, in light of the information above?

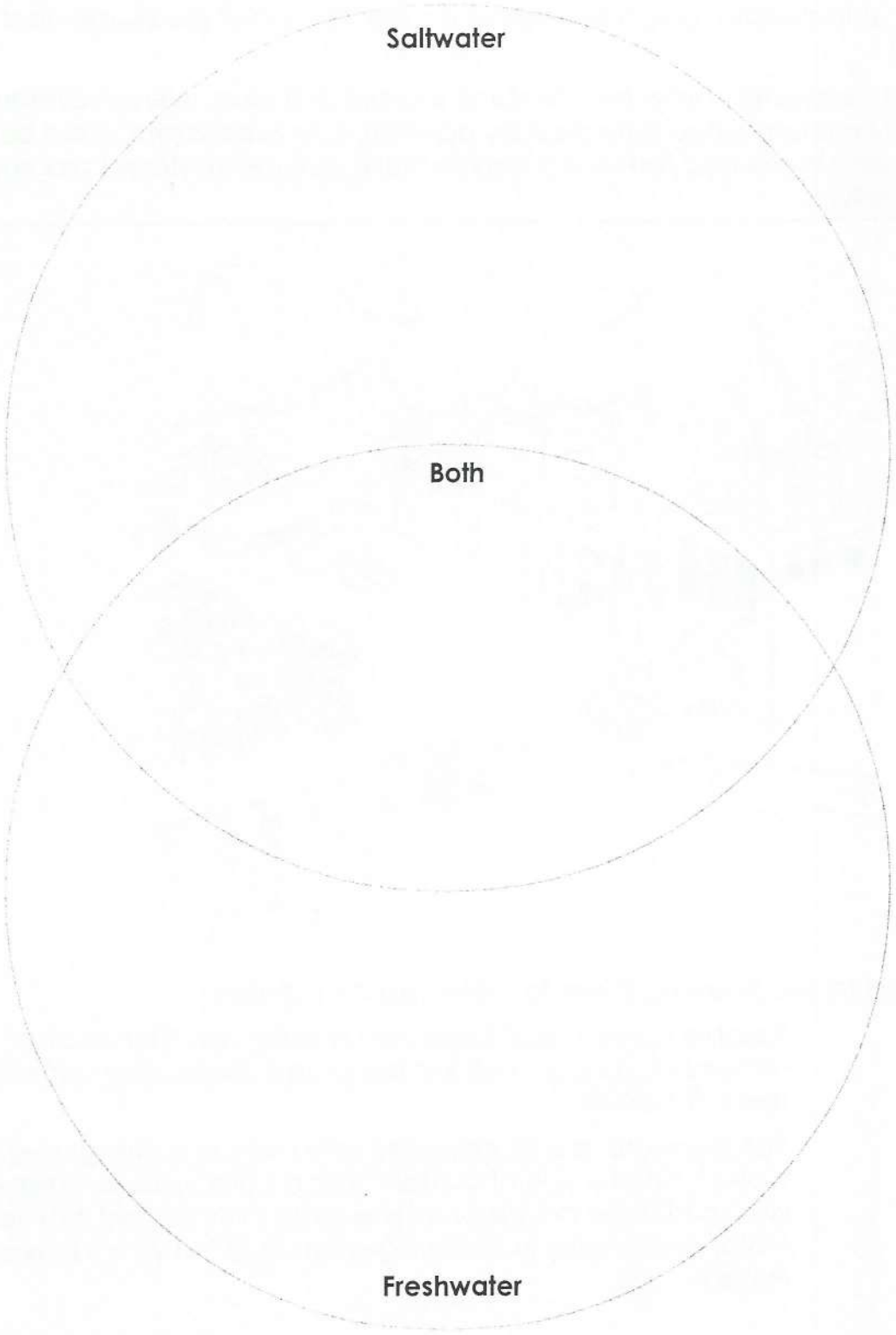
_____

_____

_____

Did you know?
Water that is safe for humans to drink is called potable water.

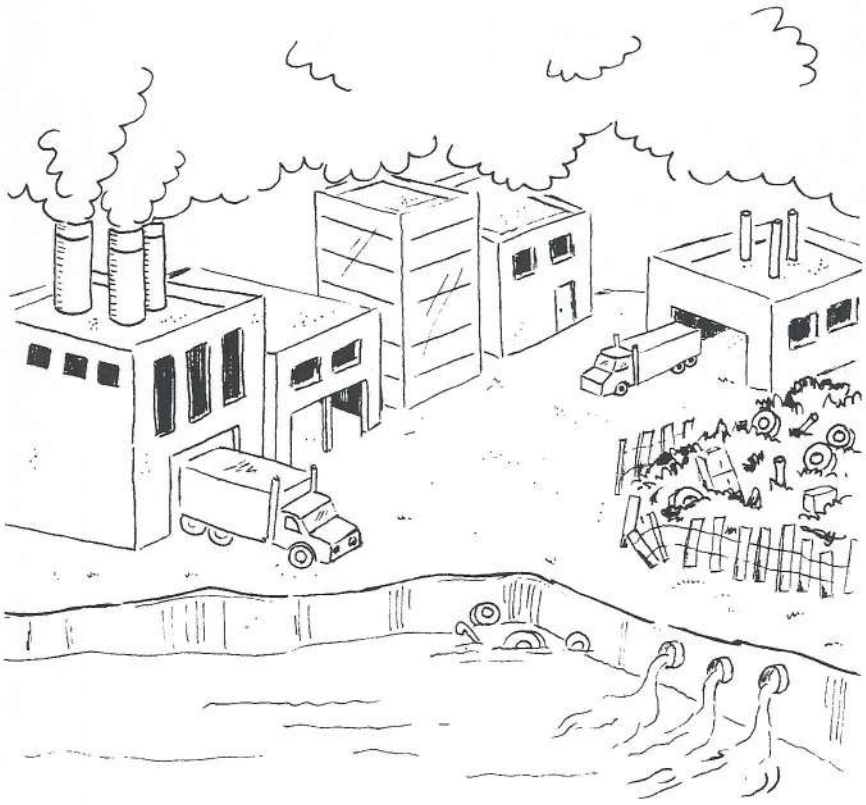
Complete this Venn diagram to show how saltwater and freshwater are both similar and unique.



Part C: How do we know when water is safe to drink?

As you know, we cannot drink saltwater, only freshwater. However, of the world's small supply of freshwater, only a tiny part of it is potable water (freshwater that is safe to drink).

In cities, most freshwater comes from "surface sources" like lakes, rivers and reservoirs that are easily contaminated (affected) by pollution. City water is processed before it is piped to your home and tested regularly to make sure the treatment process is working properly.



Water is tested for the following things to make sure it is potable:

Taste — Potable water should have very little flavour. It is important to remember, though, that just because it tastes clean, doesn't mean it is clean!

Odour — Potable water should have little or no odour. A strong smell in water is often a sign of contamination. Some odours, however, are considered acceptable. Have you ever noticed that your water smells musty in the spring when all of last year's leaves are in the runoff?

Cloudiness/Colour Potable water should be clear and colourless. The only cloudiness in drinking water should be from air bubbles and tiny sediment stirred up as it is piped. These should disappear almost immediately.

Toxicity/Pollution Water processing plants use chemicals and microscopes to examine water to make sure it is not toxic (poisonous) or polluted (filled with unwanted chemicals and materials).

Bacteria Most water contains some organic (living) matter. Some types of bacteria are safe, while others are not. Water treatment systems are designed to remove or "neutralize" harmful bacteria.

Mineral Content All water contains minerals such as salt and iron. In small quantities, these minerals are harmless—sometimes even healthy! The more minerals in your water, the harder it is. You can tell when water is hard because it is harder to make soap lather (get bubbly) and scaly deposits built up where water is used regularly. Water with a very high mineral content, can be harmful and needs to be treated.

pH level Potable water should have a pH level of about 7 (neutral).

Identify whether each of the following statements is **True** (T) or **False** (F) based on what you have learned so far. For the statements that are False, write the True statement on the line below.

1. ____ All freshwater is potable water.

_____

_____

2. ____ As long as water tastes and smells okay, it is safe to drink.

_____

_____

3. ____ Drinking water should be colourless and should not remain (stay) cloudy.

_____

_____

4. ____ It is okay to have some types of bacteria in potable water.

_____

_____

5. ____ Before water can be considered potable, it must have all of its minerals removed at a water treatment centre.

_____

_____

6. ____ Drinking water should have a pH level of not higher than 1 or 2 to show that it is not acidic.

_____

_____

7. ____ City water does not need much treatment because it comes from sources deep underground that are not easily affected by pollution.

_____

_____

Part D: Can saltwater be converted to fresh, potable water?

The short answer to the question above is "yes." Saltwater can be converted into freshwater in three main ways:

Evaporation

When saltwater is exposed to the sun, the water heats up and some of it evaporates. In evaporation, liquid water changes to a gas and becomes water vapour. Since salt molecules do not behave like water molecules, the salt is left behind when the water becomes a gas. This is how freshwater rain comes from our oceans. Human beings have learned to create situations where they can "catch" water vapour coming off saltwater and then change the vapour (through condensation) back into liquid freshwater.

Distillation

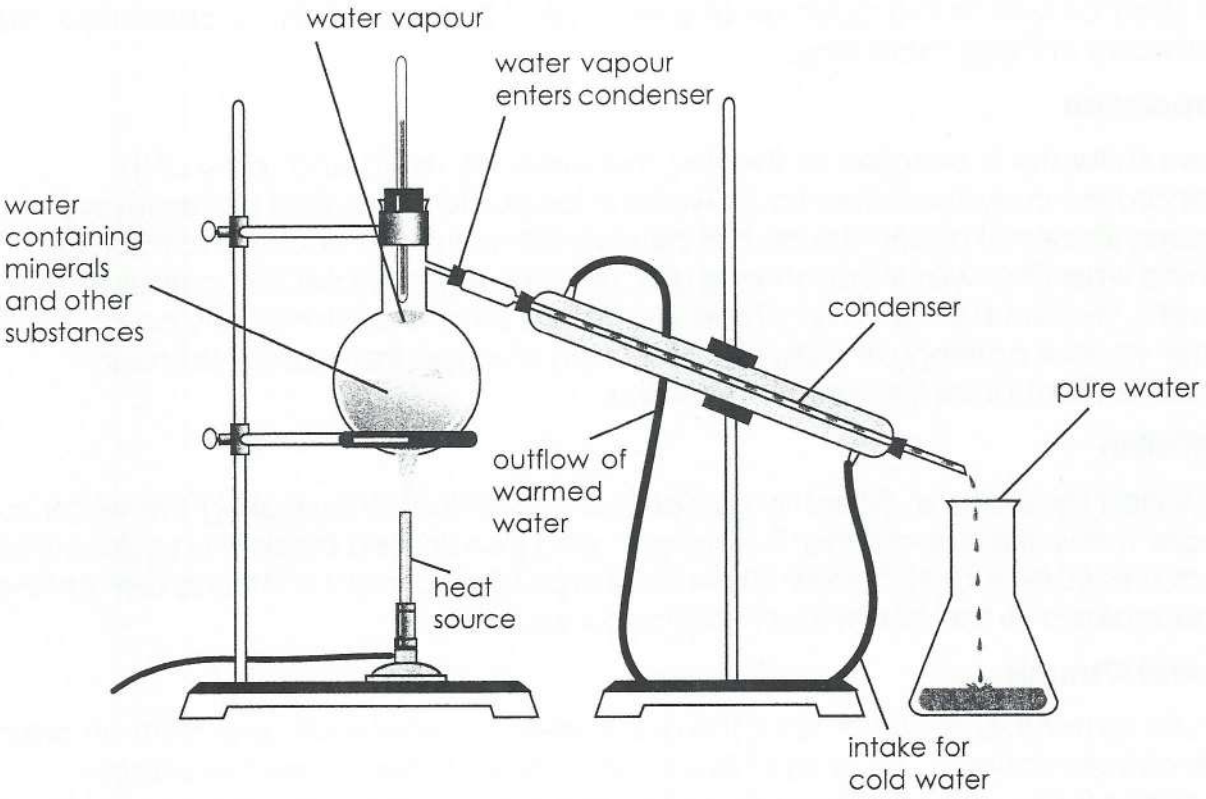
Distillation takes the evaporation process one step further by boiling the water to create the water vapour that is "caught" and condensed back into liquid water. Since the water is boiled, other minerals and possibly harmful materials are removed or neutralized so the freshwater produced is potable.

Reverse Osmosis

Do you remember that osmosis is the movement of water molecules from an area of high concentration to an area of low concentration? Well, in reverse osmosis, machines force saltwater through a filter and the molecules move from an area of lower "water concentration" (saltwater) to an area of higher water concentration. Salt and other unwanted, dissolved minerals are left behind because their molecules are too big to fit through the holes in the filter. In this way, reverse osmosis can be used to desalinate (remove salt) from water or clean impurities (like pollution) from it to make it potable.

Identify whether each of the following graphics is an example of evaporation, distillation or reverse osmosis and then answer the question that follows.

1.



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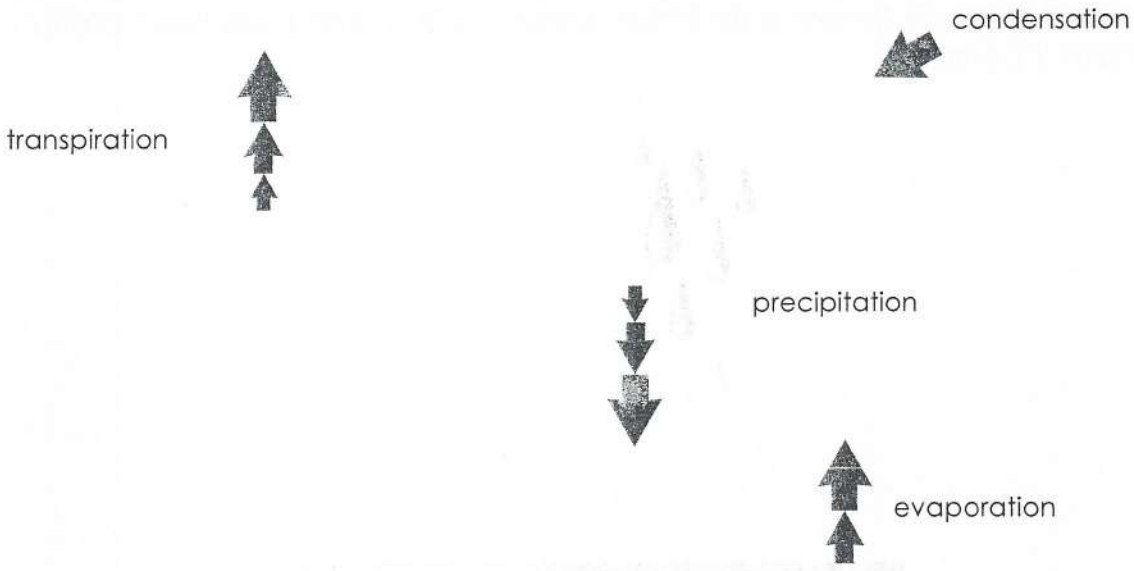

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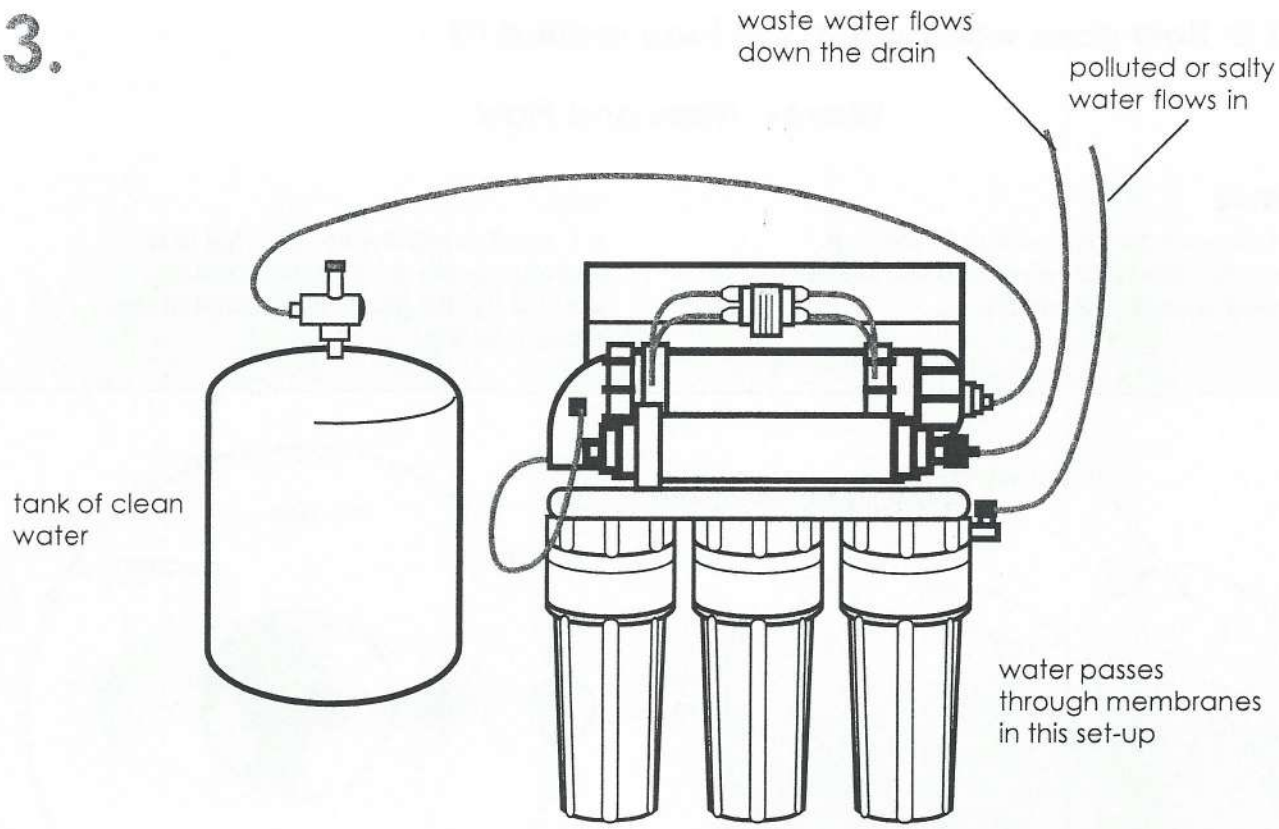


4. Which of the three water treatment processes do you think is the safest? Why do you think so?

_____

_____

_____

Independent Research!

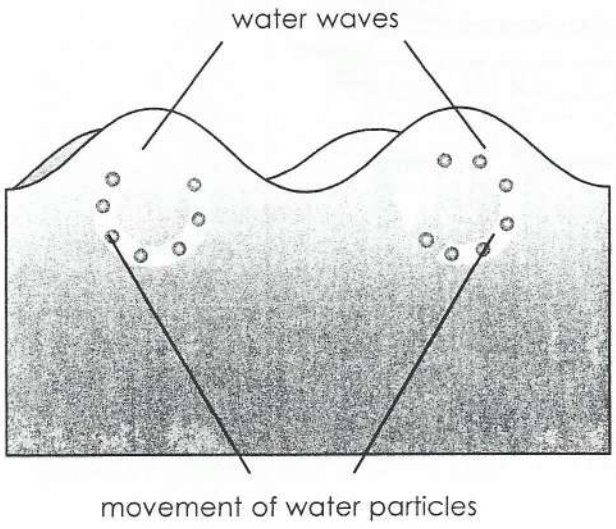
If saltwater can be changed into freshwater so easily, why isn't the ocean water used as our main water supply?

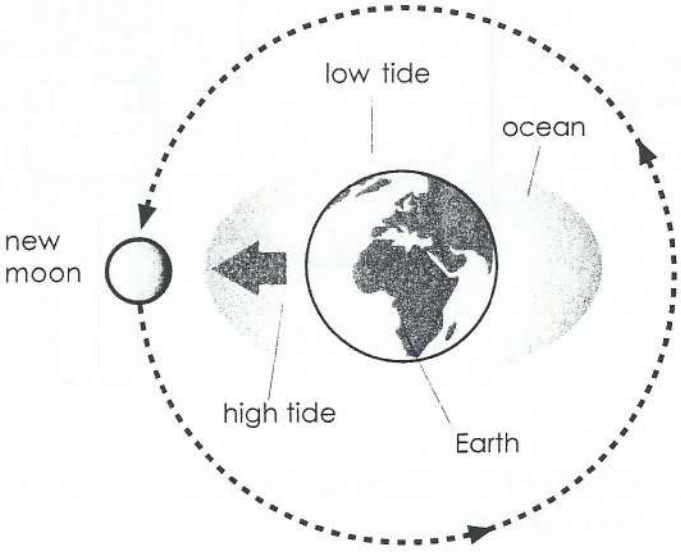
Part E: How does water affect the land around it?

Waves, Tides and Flow

Wave
A wave is the movement of surface water caused by wind and sometimes machines on the water.

Tide
A tide is the regular rise and fall of a large body of water (like an ocean) caused by the gravitational pull of the Moon and Sun.





Flow
The speed at which water is moving; for example, as it flows in rivers from an area of high elevation to an area of lower elevation.

Part F: How are water and climate connected?

Climate and the Glaciers and Polar Ice Caps

As you learned earlier in this unit, most of the world's freshwater is in glaciers and the polar ice caps.

When the glaciers were first formed, rocks ranging in size from small pebbles to giant boulders were trapped in the ice. As the glaciers became larger, they began to slide along the surface of the land carving valleys and other shapes into the land.

Today, the glaciers are melting due to global warming and, as they melt, the solid particles inside are deposited around the land.

When the polar ice caps melt, they change the composition (make-up) of the world's oceans and add water. More water on Earth = less land (because the land gets covered up).

Climate and Water Currents

Currents are streams of water that move within larger bodies of water. Currents are caused mainly by wind but can also be caused by temperature changes, salt content changes and rotations of the Earth that cause water to act in certain ways. They are different from waves because they are not surface movements, they are actual streams of water flowing from place to place. Depending on the origin of a current (where it starts from) the water may be warm or cool. A cold current of water that originates in the Arctic and then flows past the Canadian coast further south will affect the climate of the land nearby by making the surrounding air cooler. A warm current of water that originates in the South Pacific and flows northward can make a colder area warmer. A well-known warm stream, called the Gulf Stream cuts through the Atlantic Ocean. Water above the stream (to the north) is cooler, whereas water below the stream (to the south) is warmer.

How Water Affects the Climate

Because water can hold onto heat longer than the land and air around it, the land near water often has a milder climate because the water prevents the climate from being extreme in either direction (hot or cold).

Use the information on the previous page to help you answer the questions below. Write your answers in complete sentences.

1. How do glaciers change the land around them?

2. What do you think causes polar ice caps to melt?

3. How is a current different from a wave?

4. How are most waves and currents caused?

5. How does a warm current affect the climate around it?

6. How does a cold current affect the climate around it?

7. In general, how does being near a body of water affect the climate of an area?

The two main ways that water changes the land around it are by erosion and deposition.

Erosion

Erosion is when water wears or tears away at soil, rock and other solid materials at its edges and carries the solids away.

Deposition

Deposition is when the solids collected from one place are "put down" in another. This is usually because the speed of the water flow slows down so it can't carry as much anymore.

Did you know?

Sediment load is the amount of material, such as soil, rocks and organic matter, that the water is carrying.

Identify (by circling the words) whether each of the following examples show **erosion** or **deposition** and whether each is caused by a **wave**, **tide** or **flowing** action.

1. On the coast of New Brunswick, a boy wanders along the wet sand and collects new shells every morning. He must remember not to be caught on the beach later in the day though, because the water will come in and cover it.

   erosion / deposition caused by wave / tide / flow

2. On the edge of the lake in front of our cabin, green algae we call "sludge," collects and we have to rake it up to keep our beach clean.

   erosion / deposition caused by wave / tide / flow

3. At my friend's cabin across the lake, they don't have to clean up any sludge because the wind causes the algae to move away from their shore.

   erosion / deposition caused by wave / tide / flow

4. My dad goes fishing to his favourite spot every spring. He knows he is nearly there when he reaches the point along the bank where the water rushes strongly around a corner. Every year, though, the water seems to get wider and the bank seems to get narrower.

   erosion / deposition caused by wave / tide / flow

5. Further down the river, the water slows down and piles of rock, pebbles and debris have formed a quiet, deep pool where my father always finds a lot of fish.

   erosion / deposition caused by wave / tide / flow

6. Draw a picture that shows erosion or deposition caused by a wave, tide or the flow of water in a river. Label your picture or write a sentence beneath that explains what is happening.

Part G: What about the living things in our water?

As a general rule, warmer water is able to sustain (provide an healthy environment for) more different kinds of life than colder water. Both freshwater and saltwater can be both cold and warm, but usually plants and animals are adapted for living in one type of water or the other, not both. Many more different kinds of organisms live in saltwater than freshwater because the oceans have many different kinds of environments. Two-thirds of all living organisms spend all or part of their lives in saltwater.

Freshwater Ecosystems

An example of a freshwater ecosystem is a lake. Lakes can generally be divided into three zones. The upper zone begins at the shore where the water is shallow and extends (reaches) until the plants stop growing. Plants like bullrushes and water lillies, and animals like small fish, snails, worms, leeches and frogs live in the upper zone. The middle zone is the part of the lake that is open (deep) water that light can still penetrate (shine into). Phytoplankton (tiny plants) float around in this area and are eaten by fish. The lower zone is the water where the lake is deepest. No plants grow here as light does not reach this depth. The fish and animals that live at the bottom feed off the waste products that float down from above.

Saltwater Ecosystems

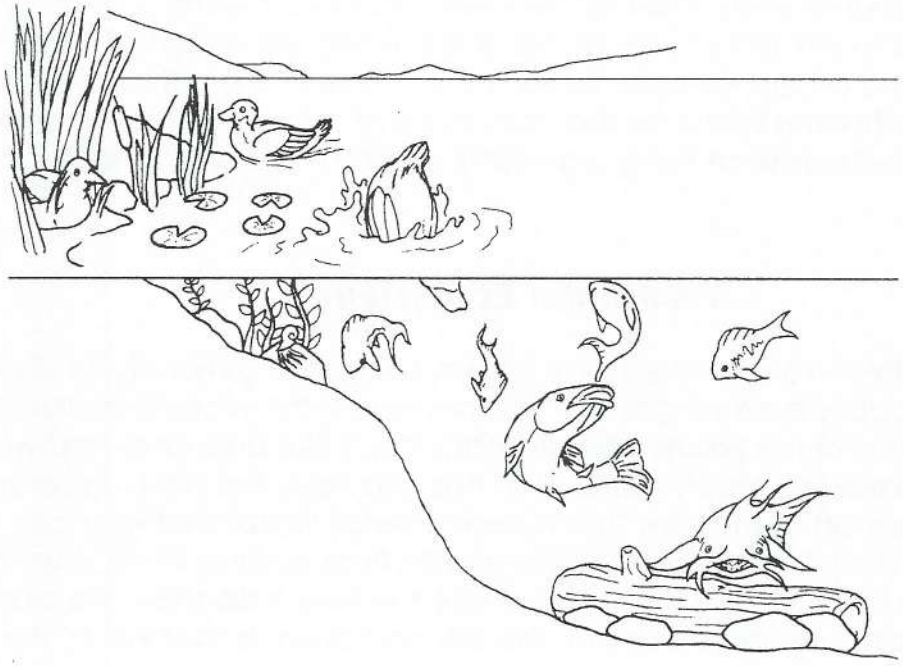
An ocean has four main zones: estuaries, intertidal zones, continental shelves and the oceanic zone. An estuary is a place where freshwater flows into the ocean. Somewhere in the middle, the water is brackish because it is a mix of both fresh and saltwater. Estuaries are usually marshy and support animals and plants that can tolerate the mixed water. The intertidal zone is the area along the shoreline where waves crash and the tide moves in and out. A continental shelf is a piece of land that stretches out under the water keeping it shallow for a great distance. This allows the sun to heat the water and so the environment sustains a great deal of plant and animal life. The oceanic zone is the water beyond the continental shelves —the deepest water of the ocean. Animals living near the surface eat plants and other animals but, further down where the light does not penetrate (reach), organisms feed on waste products that float down from the surface.

Did you know?

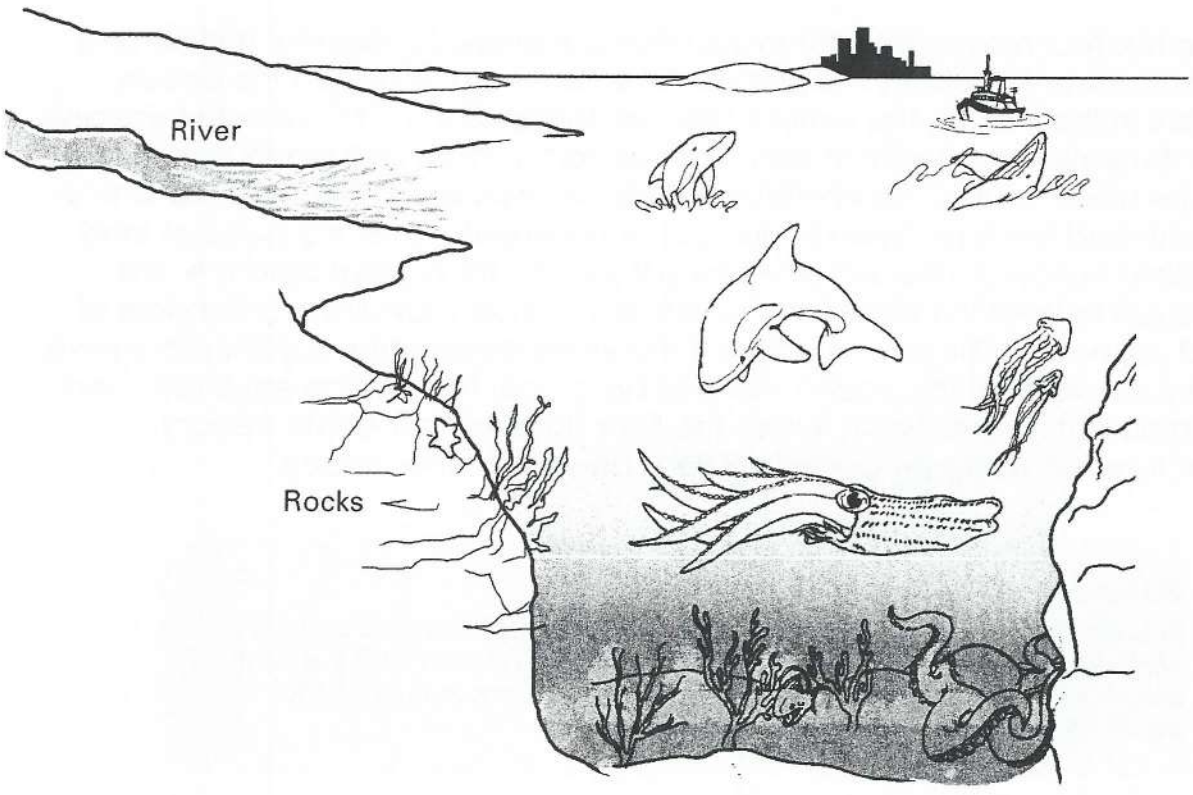
Estuaries act as pollution containers because many microscopic organisms live in the brackish water and break down pollution that runs off the land before it enters the ocean. What do you think happens to animals that eat or drink from pollution-filled estuaries?

Use the information on the previous page to help you label the zones in the water environments below.

Freshwater Environment



Saltwater Environment



For each of the adaptations described below, identify (by circling) whether you think the creature lives in a freshwater or saltwater environment and in which zone.

1. Starfish have incredibly powerful "suction-cup like" undersides that allow them to cling to rocks and avoid being carried away by powerful waves and tides.

   freshwater / saltwater zone: _____

2. Sea otters are great swimmers that enjoy warm water, breath air and eat shoreline animals.

   freshwater / saltwater zone: _____

3. Catfish live at the bottom of lakes where there is little light and have down-turned mouths that help them feed off the wastes of other organisms.

   freshwater / saltwater zone: _____

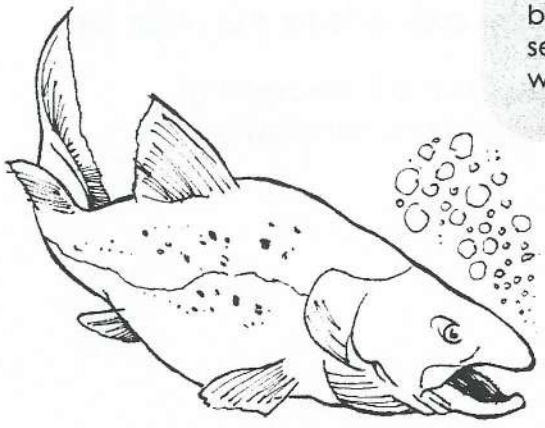
4. Rainbow trout feed off flies that fly close to and/or land on the surface of lakes and rivers.

   freshwater / saltwater zone: _____

5. Whales swim down deep in the ocean "sucking in" plankton (microscopic plants) and return to the surface to breath.

   freshwater / saltwater zone: _____

Did you know?
Salmon are unusual creatures because they can survive in both freshwater and saltwater. This is important because salmon are born in freshwater, travel out to sea to live their lives, and then return to where they were born to lay their eggs and die.



Part H: Why do aquatic populations change?

A population is a group of organisms of the same species that live in a particular area. There are three main ways that aquatic populations change:

Seasonal Changes

Seasonal changes in populations happen for two main reasons. The first is that animals and plants are better suited to live when the weather is warmer and often die, hibernate or become dormant when the weather is colder. Lifecycles are also seasonal. When organisms are in the egg and larval stages of their life, there seems to be fewer of them than when they are adults swimming and flying around.

Short-Term Changes

Short-term changes usually happen quickly and don't last for long. Unlike seasonal changes, they don't happen every year. Short-term changes can happen because of unusual weather patterns (like droughts) or because of human activities that affect life cycles such as water sports killing minnows in lakes.

Long-Term Changes

Long-term changes are usually permanent changes that are caused by nature or by human beings. These changes affect the environment or the organisms in an ecosystem forever.

For each of the changes described below, identify whether you think the change is **seasonal**, **short-term** or **long-term**.

1. _____ Frogs sleep through the winter.

2. _____ Plants die when a lake dries up but then regrow when it rains.

3. _____ A landslide causes the mouth of a river to be blocked off and the animals and plants living in the valley die.

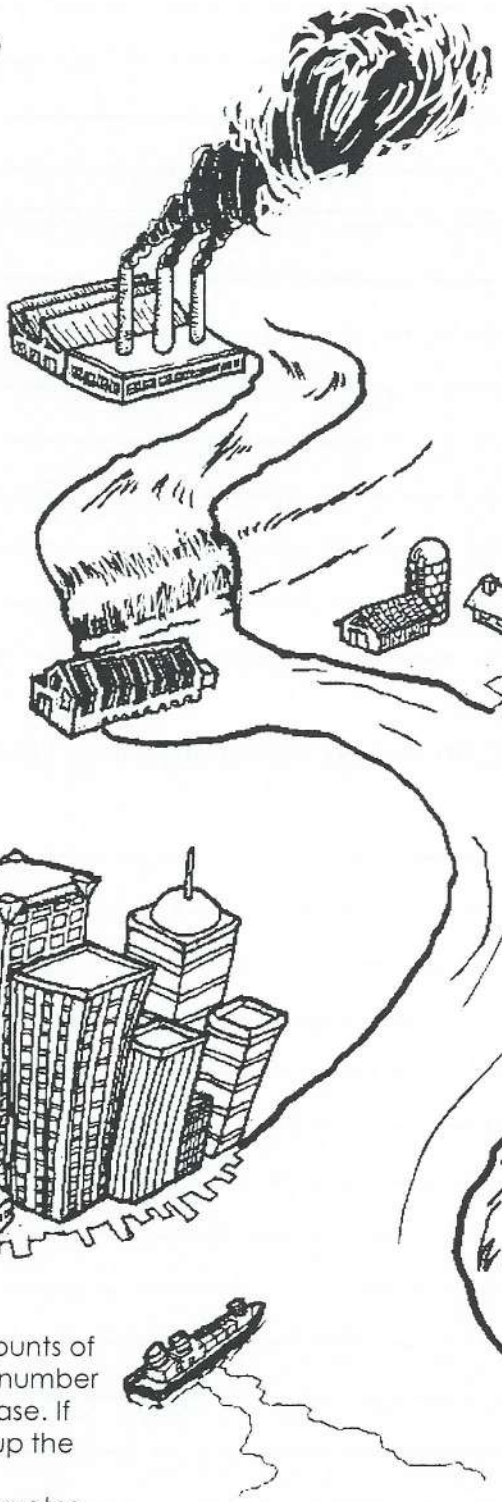
4. _____ Humans stock a lake with a new kind of fish that eat all of a certain type of insect so there are none for the other fish.

5. _____ Cod fishing reduces the population off the coast of Canada to the point where there are very few left.

Part I: How do human beings affect the water supply?

Power stations sometimes discharge warm water into lakes or rivers that can kill some animals and encourage excessive plant growth.

Factories might add dangerous chemicals to the water or practice thermal pollution, killing aquatic plants or animals. Some of these chemicals can cause tumours, birth defects, or make organisms unable to breed.



Runoff from farmland contains fertilizers that can cause excessive plant growth. It may also contain herbicides or pesticides that can kill animals and plants that grow in the water.

Runoff from city streets contains large amounts of oil and other chemicals, including salt. These substances affect plants and animals.

Habitat destruction takes away the places that animals can live and plants can grow.

Sewage contains large amounts of nitrogen, which causes the number of micro-organisms to increase. If these micro-organisms use up the oxygen, fish will suffocate. Phosphorous in sewage promotes plant growth that can also change the whole ecosystem.

Oil spills from ships can harm animals in, on, and near the water.

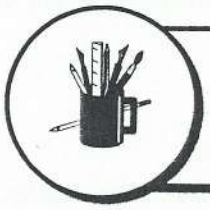
Write a paragraph that summarizes the information in the graphic on the previous page.

Write a response to the graphic on the previous page (i.e., your thoughts and opinions on the information).

Grade 8 Unit E: Freshwater and Saltwater Systems

Human Impact on Water Supplies

1. In a group, brainstorm and record different ways that humans use water. Think about how water is used at home and in the community.



Use Tool Brainstorming a Topic.

2. People pollute water sources by allowing chemicals, garbage and other things to run into lakes, rivers, groundwater and oceans. Common things that pollute our water systems include:

- domestic sewage
- fertilizers
- industrial wastes
- pesticides (e.g., DDT, dieldrin)
- leachate from landfill sites (municipal, industrial)
- petroleum and petroleum products
- PCBs, dioxins, polyaromatic hydrocarbons (PAHs)
- pharmaceutical products (including hormones and antibiotics)
- radioactive materials
- metals such as lead, mercury, cadmium

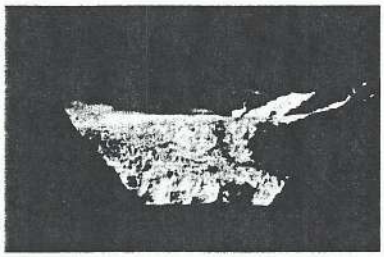
Source: http://www.ec.gc.ca/water/en/manage

Aquatic ecosystems are also affected by damming and diverting water from rivers, deltas and lakes.

Choose an example of how people have polluted a water source and what is being done to improve the water quality (if anything). Create a presentation that describes the problem and solution. Include information on how the organisms that live in or near the water have been affected. Possible examples include:

- CN train derailment at Lake Wabamun, Alberta (August 2005)
- Drying out of the Peace Athabasca Delta due to damming
- Pollution problems in the Great Lakes
- Dumping of raw sewage at Halifax Harbour

11. Glaciers and icecaps cover about 10 percent of the Earth's land area and hold most of the fresh water supply. They appear to be melting. With a partner or individually, investigate the following questions.



- What is causing the glaciers and icecaps to melt?
- What impact are climate and weather having on the Rocky Mountain glaciers?

Draw conclusions about the effects of glacial melting on communities in Alberta.

12. For further interest, investigate the following questions.
    - What might happen to water levels in oceans?
    - What might happen to cities and towns on the coast, e.g., Vancouver, Halifax?
    - What might happen to our fresh water supply?
    - What might happen to your community?

Share your answers with classmates.

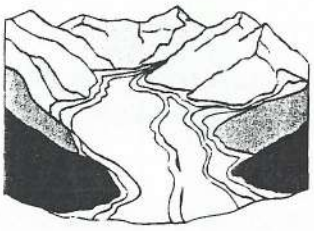
9. Investigate and discuss the following question as a class:

   How do waves deposit sediments (particles) along a shoreline and how can this affect a shoreline?

Did You Know? The Columbia Icefield in Canada's Rocky Mountains covers approximately 325 km^2 and feeds (drains water or ice to) six glaciers, three large rivers and three oceans.

Glaciers

Glaciers form when snow falls faster than it melts. The snow on the bottom gets compressed (pressed down) and forms ice. When the snow gets really deep, the layer at the bottom melts from the pressure. The glacier slides downward on the layer of water.



Glaciers cause erosion when they move downward, and deposition when they melt back (recede).

10. Investigate the effects of erosion or deposition from glaciers in Alberta. Share your information using a fan-fold display or other presentation.

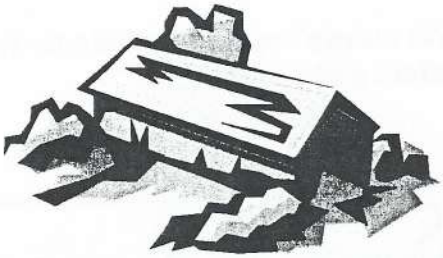
    Check out this Web site: http://www.mcgrawhill.ca/links/sciencefocus8.

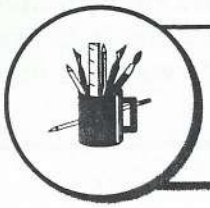
Use Tools Evaluating Sources V and Fan-fold Display Planner.

Ice cap: A glacier that forms on level (flat) land, slopes downward in all directions from the centre and does not move easily.

7. Find an example of a stream near your school or home. Investigate and describe the characteristics of the stream.

   Share your findings with the class in a computer-generated or other presentation.

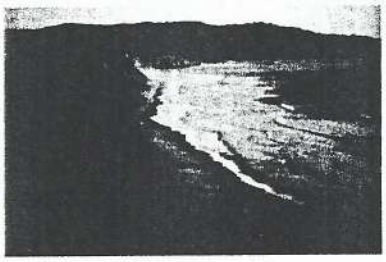




Use Tool Slide Show Planner II.

Coastal erosion (or **shoreline erosion**) is the loss of land along the coastline due to natural processes such as waves, winds and tides.

The ability of waves to cause the erosion of a coastline depends on things such as the hardness or 'erodibility' of the rocks at the base of the cliff and whether or not there is a beach. Beaches help absorb wave energy and can provide some protection to the cliff.



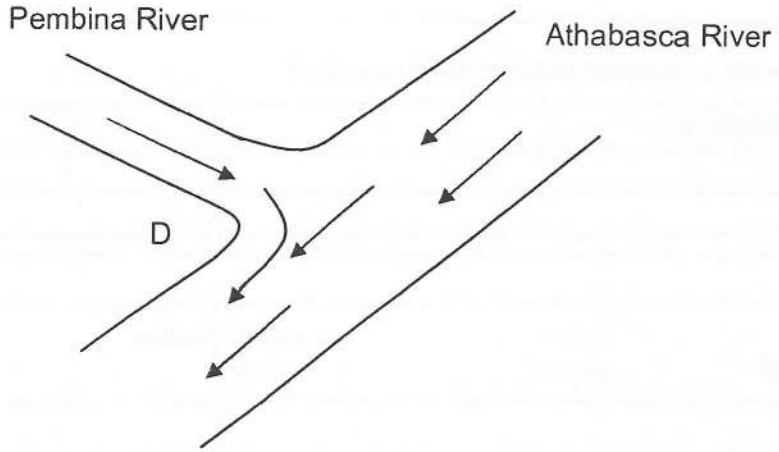
8. Investigate coastal erosion and the problems it can cause people who live near the shoreline. Choose one example of coastal erosion from the news and use a 5Ws and 1H format to summarize what happened.

Use Tool Question Organizer I

6. Alone or with a partner, complete the following activity. Make sure you understand the process of Scientific Inquiry and Safety in Science before you begin.

Question
How does the movement of water create erosion?
Hypothesis/prediction
_____ _____
Materials
paint tray, ruler, cup or beaker soil or sand, pencil, water
Procedure
1. Fill the paint tray 3 cm deep with soil or sand. 2. Use the ruler to level out the surface. 3. Pack the soil or sand down gently with your hands. 4. Use the pencil to make a channel (empty stream) in the soil—be sure to make curves in the channel. Place some rocks in the channel. 5. Starting at the top of the pan, slowly pour the water from the beaker into the channel. 6. Record your observations.
Diagram/sketch
Results: List your findings below or on a separate page. Use a chart and/or graph to show your results.
_____ _____
Conclusion: Compare findings with prediction and classmates' results. Write a conclusion and/or inference statement.
Write or discuss your answers to the following questions. • Where did most erosion occur in the channel? Why? • How did the path (straight or curved) of the channel affect the speed and pattern of erosion? • Where did deposition occur? **Write a conclusion and/or inference statement about the stream and changes.** • What are some possible long-term effects of erosion? • What are some possible long-term effects of deposition?

4. Use the diagram below to write an inference statement explaining why the delta forms at "D." Remember, fast moving water carries more sediments.



5. Review the processes of Scientific Inquiry and Safety in Science. Plan a trip with your class to a local river or fast-moving stream.

   - Record your observations about the water quality and flow.
   - In clear containers, collect water samples from the surface, middle and bottom (if possible) of the river or stream.
   - Record your observations about the water quality of each sample.

Use Tools Planning an Experiment, Experiment/Investigation Template I and Analyzing and Interpreting Experiment Results.

Did You Know? In 2002 in Edmonton, Alberta, several houses built at the top of the North Saskatchewan riverbank fell down the bank and were destroyed due to the erosion of the riverbank below.

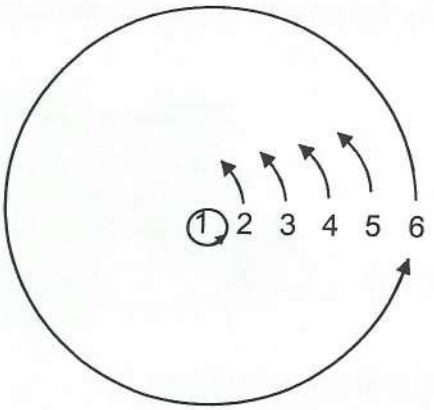
Erosion: The movement of sediment (particles) from one place to another by water or wind.

Deposition: When sediment (particles) is deposited (put down again) by water or wind.

Example:

Deltas are formed when a stream enters a river. Deltas are piles of sediment deposited when water slows down.

3. With your teacher's approval, go to a large open area of your school or school yard. Link hands with 6–10 classmates and stand in a straight line. Have the person at one end of the line turn on the spot, while the others walk in the same direction and try to maintain a straight line (as shown in the diagram below).



Respond to the following questions.

- Which person moves the least and slowest?
- Which person moves the most and fastest?

Write a conclusion statement about the speed of students at various points in the circle.

Grade 8 Unit E: Freshwater and Saltwater Systems

Water, Land and Climate

Did You Know? There is more water in the ground than in all of the world's lakes and rivers.

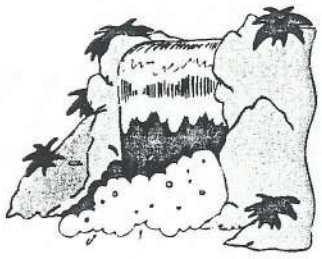
Water supplies: Sources where people get their water. Three types of water supplies are rivers, lakes and wells (ground water).

1. With a partner, find information and create a diagram of a simple water cycle.
2. With your class, find out what water source is used by the people in your community (where the water comes from).

   Make a list of questions to guide your investigation.

   Examples:

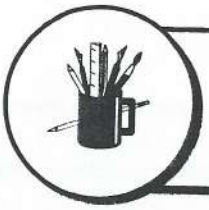
   - Is the water source natural or man-made?
   - What process is involved in getting the water from the source into your taps?



   Make a poster or another presentation to share your findings with others.

Use Tools Question Organizer I, Question Organizer II and Poster Planner.

6. Compare the organisms found in a saltwater ecosystem to those found in a freshwater ecosystem and organize your findings in a Venn diagram.

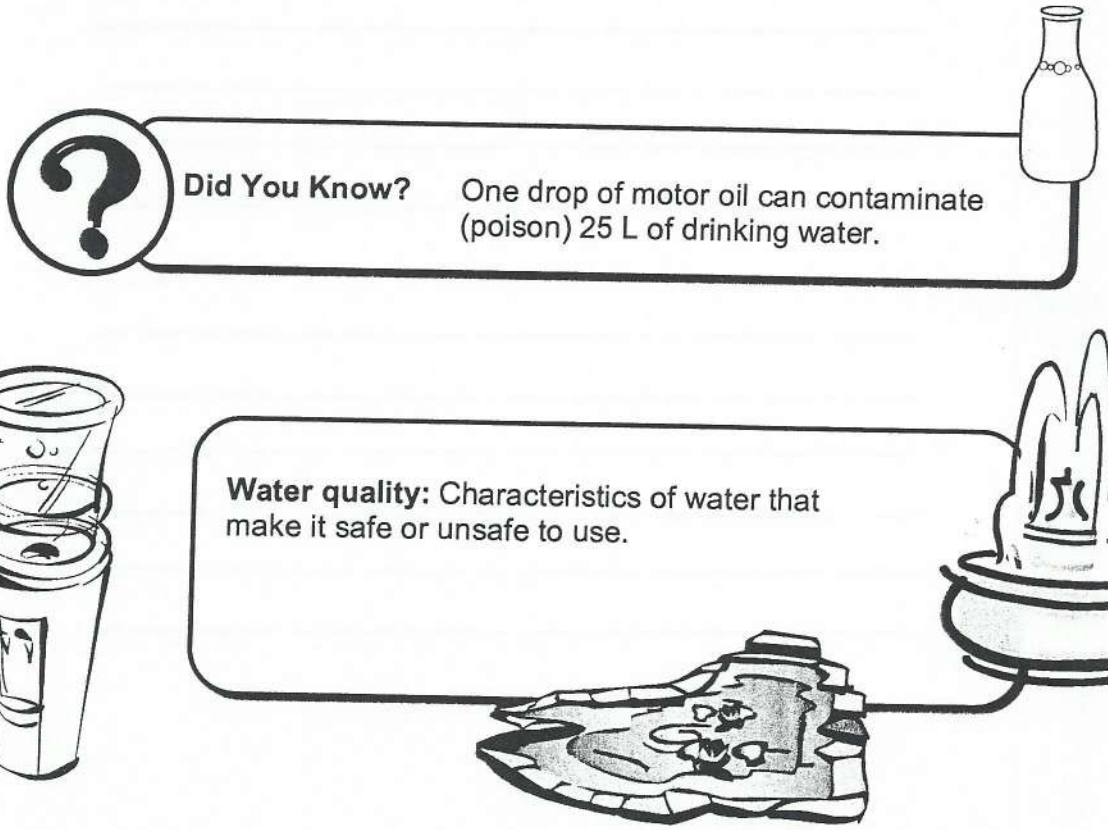


Use Tool Venn Diagram.

Evaporation: The process in which a liquid is heated and becomes a gas (e.g., steam).

Distillation: A method of separating chemical substances.

7. With a group, investigate how fresh water can be made from salt water by using evaporation and distillation. Create a diagram that shows this process.



Did You Know? One drop of motor oil can contaminate (poison) 25 L of drinking water.

Water quality: Characteristics of water that make it safe or unsafe to use.

5. Investigate saltwater ecosystems in Canada. Answer the following questions based on your findings.

What do saltwater ecosystems look like?

What plants are found there?

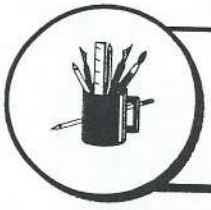
What animals are found there?

2. List, or sketch and label terrestrial and aquatic ecosystems in your community. Review Processing and Displaying Data for hints on creating a scientific diagram.

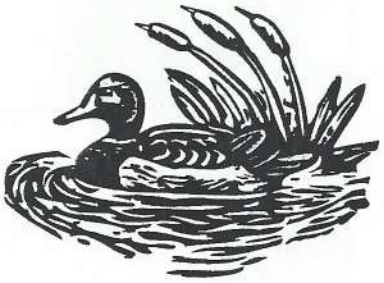
3. Use atlases or other sources to identify where key water sources are located in Alberta, Canada and the world. Create your own maps to show where these water sources are located. Include the names of the sources, where available.

4. Choose and investigate an aquatic ecosystem in your community or region. Use the following questions to guide your investigation:

   - Where is the ecosystem found?
   - What are the main types of animals and plants in the ecosystem?
   - What specific adaptations (unique characteristics) do the plants and animals have that make it easier to live where they do?
   - How do the living things interact (live together)?
   - How do nonliving things, such as soil, water and sun, affect living things?
   - How do the living things adapt (change) when the weather changes (e.g., seasons, storms, extreme weather)?
   - How has this ecosystem changed over time (e.g., the past 10, 50 or 100 years)? Consider asking Aboriginal elders from your community for information on these changes.



Use Tools Finding Sources and Note Taking I, Note Taking II or Note Taking III.



Share the information with classmates in a fan-fold display or other presentation.

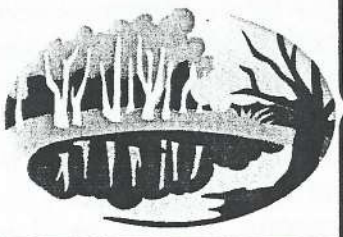
Use Tool Fan-fold Display Planner.

Grade 8 Unit E: Freshwater and Saltwater Systems

Aquatic Ecosystems

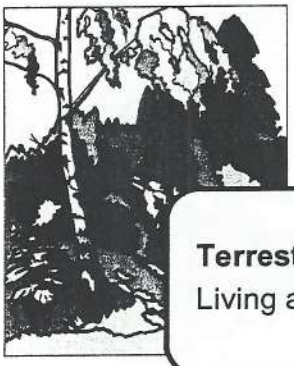
Did You Know? Aquariums and terrariums are examples of man-made ecosystems.

Ecosystem: Living and nonliving things interacting in a specific location.



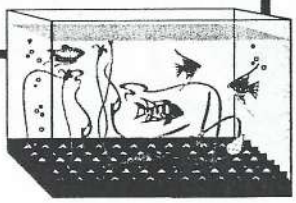
Living things are plants and animals.

Nonliving things include water, rocks and soil.



Terrestrial ecosystem: Living and nonliving things on land.

Aquatic ecosystem: Living and nonliving things in water.



1. With your class, small group or partner, brainstorm and list examples of terrestrial and aquatic ecosystems.

Terrestrial ecosystems	Aquatic ecosystems
desert	coral reef