THE OCEAN - Terms and Definitions

The Bottom of the Ocean

marginal sea	A smaller body of salt water found along the margin of a major ocean.
continental margin	The region of the ocean bottom near the land areas; contains most of the sediment eroded from the land; separates a continent from the deep sea floor.
continental slope	The steeper middle part of a continental margin. (svah) VH
continental rise	The lowest part of a continental margin. (úpatí) VH
abyssal plain	Large flat area of the deep sea floor; formed by sediment flows that spill off the continental margins.
ocean basin	The low-lying earth formation that contains the ocean's water; consists mainly of dense basaltic crustal rock.
mid-ocean ridge	A system of rugged mountains that extends down the middle of the ocean basins.
Mid-Atlantic Ridge	A part of a mid-ocean ridge (Středoatlantský hřbet). VH
East Pacific Rise	A part of a mid-ocean ridge (Východopacifický práh). VH
rift valley	Deep valley in the center of the mid-ocean ridge; a site of active volcanism.
trench	A long narrow, deep trough (depression) of the deep sea floor, parallel to the edge of a continent or an island arc, usually bordered by areas of volcanic activity.
guyot [gijot]	A flat topped underwater mountain.
seamount	Volcanic cone growing upward from the ocean bottom layer by layer, usually rising more than 1000m above the floor.
Ring of Fire	The region of volcanic activity that surrounds the basin of the Pacific Ocean.
island arc	A chain of islands, usually curved, that separates a marginal sea from a major ocean.

echo sounding	A method of using noise (pings) to measure the depth of the ocean.
ocean	The entire body of salt water that covers much of the earth's surface; also, any of its major geographical divisions.

Properties of Ocean Water

salinity	Saltiness; a measure of the amount of total dissolved materials in water; grams of dissolved materials per kilogram of water (ppt = parts per thousand).
brine pool	isolated spot of hot ocean water that contains concentrated amounts of dissolved solids (solanka); it forms when deep water circulation is restricted (VH)
photic zone	The uppermost zone of the open ocean and the zone of most light.
aphotic zone	The part of the ocean that is in total darkness.
disphotic zone	A zone of reduced light in the ocean; between 200m and 1000m deep.
floe	A flat mass of ice, smaller than ice field, floating at sea.
freezing point	The temperature at which a liquid freezes.
icebergs	Floating masses of ice that broke off **fresh water glaciers**.
pack ice	A large expanse of floating sea ice that has been broken and then refrozen into jagged pressure ridges. (pole ledových ker)
sea ice	Frozen ocean water.
water mass	A large volume of water characterized by a similar temperature, salinity, and density throughout its mass.
water pressure	The force that a mass of overlying water exerts upon a submerged surface.

The Circulation of Ocean Water

gyre [džaiə]	A closed system of rotating ocean currents. (koloběh proudů)
high tide	When the waterline of a body of water reaches its highest point.
low tide, **ebb**	When the waterline of a body of water reaches its lowest point.
pounding of waves	repeated heavy blows (vlnobití)
rogue wave [rəug]	A very high wave that forms on the open ocean when high waves of about the same wavelength have their crests coincide. (ničivá vlna)
swell	A rhythmic pattern of waves. (vlnění)
surf zone	The area where breaking waves occur.
tsunami	A huge wave caused by an underwater earthquake somewhere along the ocean bottom; barely noticeable out at sea.
upwelling	A process by which deep, cold, nutrient rich water is brought to the surface and replaces lighter surface water. (výstup spodních vod)
well up	to come up to the surface and about to flow
run-up	sudden rise of sea-level
wave height [hait]	The vertical distance between a wave´s highest and lowest points.
wavelength	The horizontal distance from a point on one wave to the corresponding point on the next wave.
crest	The highest point of a wave. (hřeben)
trough [trof]	The lowest point between two wave crests. (pata vlny)
wave base	The point below the surface of water at which the orbital motion of a wave nearly disappears (1/2 a wavelength below the midheight of the wave).

Sources:
Robert E. Fariel, Robert W. Hinds, David B.Berey: ***Earth Science***, Addison-Wesley (AW)
Plummer, Ch. - McGeary, D. - Carlson, D.***: Physical Geology,*** *Earth Revealed,*
The McGraw-Hill Companies 2001
Strahler, A.: ***Introducing Physical Geography, J***ohn Wiley & Sons, Inc. 2003
Lingea Lexicon 5, 2010

The Ocean

The Earth is divided into five different oceans although they are all connected due to ocean currents which circulate water all over the globe. The following is a list of the world's oceans by arranged by size. Unless noted, information has been obtained from the CIA World Factbook.

1. Pacific Ocean

The Pacific Ocean is by far the world's largest ocean at 155,557,000 sq km. According to the CIA World Factbook, it covers 28% of the Earth and is equal in size to nearly all of the land area on the Earth. The Pacific Ocean is located between the Southern Ocean, Asia and Australia and the Western Hemisphere. It has an **average depth of 4,028 m** but its deepest point is the Challenger Deep within Mariana Trench near Japan. This area is also **the deepest point in the world at -10,924 m (-35,840 feet)**. The Pacific Ocean is important to geography not only because of its size but it has been a major historical route of exploration and migration.

2. Atlantic Ocean

The Atlantic Ocean is the world's second-largest ocean with an area of 76,762,000 sq km. It is located between Africa, Europe, the Southern Ocean and the Western Hemisphere. It includes the includes other water bodies such as the Baltic Sea, Black Sea, Caribbean Sea, Gulf of Mexico, Mediterranean Sea and the North Sea. The **average depth** of the Atlantic Ocean is **3,926 m** and **the deepest point is the Puerto Rico Trench at -8,605 m**. The Atlantic Ocean is important to the world's weather (as are all oceans) because strong Atlantic hurricanes are known to develop off the coast of Cape Verde, Africa and move toward the Caribbean Sea from August to November.

3. Indian Ocean

The Indian Ocean is the world's third-largest ocean and it has an area of 68,566,000 sq km. It is located between Africa, the Southern Ocean, Asia and Australia. The Indian Ocean has an **average depth of 3,963** m and the **Java Trench is its deepest point at -7,258 m**. The waters of the Indian Ocean also include water bodies such as the Andaman, Arabian, Flores, Java and Red Seas as well as the Bay of Bengal, Great Australian Bight, Gulf of Aden, Gulf of Oman, Mozambique Channel and the Persian Gulf. The Indian Ocean is known for causing the monsoonal weather patterns that dominate much of southeast Asia and for having waters that have been historical chokepoints.

What are chokepoints ?

4. Southern Ocean

The Southern Ocean is the world's newest and fourth-largest ocean. In the spring of 2000, the International Hydrographic Organization decided to delimit a fifth ocean. In doing so, boundaries were taken from the Pacific, Atlantic and Indian Oceans. The Southern Ocean extends from the coast of Antarctica to 60 degrees south latitude. It has a total area of 20,327,000 sq km and an **average depth ranging from 4,000 to 5,000 m**. **The deepest point** in the Southern Ocean is unnamed but it is in the south end of the South Sandwich Trench and **has a depth of -7,235 m**. The world's largest ocean current, the Antarctic Circumpolar Current moves east and is 21,000 km in length.

5. Arctic Ocean

The Arctic Ocean is the world's smallest with an area of 14,056,000 sq km. It extends between Europe, Asia and North America and most of its waters are north of the Arctic Circle. Its **average depth is 1,205 m** and its **deepest point** is the Fram Basin **at -4,665 m**. Throughout most of the year, much of the Arctic Ocean is covered by a drifting polar icepack that is an average of ten feet (three meters) thick. However as the Earth's climate changes, the polar regions are warming and much of the icepack melts during the summer months. In terms of geography, the Northwest Passage and the Northern Sea Route have been important areas for trade and exploration.

6. References
Infoplease.com. (n.d.) Oceans and Seas - Infoplease.com. Retrieved from: http://www.infoplease.com/ipa/A0001773.html#axzz0xMBpBmBw

Source: http://geography.about.com/od/locateplacesworldwide/tp/fiveoceans.htm

Tasks for 5 groups. Each group represents one ocean.

1) Compare the average depth. Which ocean has the least average depth?
2) Where does your deepest point lie? (location + depth)
Where does the deepest point in the world lie?
3) Choose 1 interesting fact about your ocean to say it to the class.

Marginal seas formed in three different ways:

1. When continents came together. The Mediterranean Sea and the Black Sea are thought to have formed when two continents enclosed them.
2. Some marginal seas are separated from major oceans by curved chains of islands called **island arcs,** e.g. the Caribbean Sea and the China Sea.
3. Some marginal seas are thought to have formed as the result of a structural break in a land mass, e.g. the Red Sea and the Gulf of California. In the case of the Red Sea, the continental crust was not only split, but it separated. Ocean crustal rocks have been found in the area of separation.

Note the nominative + passive "are thought" + past infinitive in the text above.

The Bottom of the Ocean (Part 1)

Task: Complete the text on **The History of Sounding the ocean bottom**

In 1492, when Columbus sailed across the Atlantic Ocean, a common notion was that the ocean bottom [1]_____. The only method known to determine the depth of the ocean water was to lower a heavy weight tied to the end of a rope into the water [2]_____ . Then the length of line was measured. Sailors were usually interested in the position of the ocean bottom only if the water became so shallow [3]_____ . Consequently they did not carry enough rope to reach the deep ocean bottom.
Four hundred years later, people were still using the same method. By that time, however, [4]_____, and a power-driven winch was used to lower and raise the weight on the end of the wire. Many scientists continued to believe that the ocean bottom was mostly flat. They based their belief on the fact that the bottoms of reservoirs usually become flat because of sediment that settles out of the water.
The voyage of the Challenger represents the first organized expedition which took place in 1872-1876. The surface vessel worked on 350 observation stations throughout the earth´s oceans and collected enough data [5]_____ .
In 1925, a more modern method of measuring the depth of the ocean was used in a detailed survey of the ocean bottom. In this method, which uses sound and is called **echo sounding,** a sharp noise called a ping travels from the ship to the ocean bottom [6]_____ . The length of time it takes the ping to make the trip down and back is measured and [7]_____.
A precision depth recorder makes a continuous record of ping echoes on a moving paper providing an echogram. The pings are sent out continuously as the ship moves, and the paper record is a scale representation of the ocean bottom [8]_____.
Thousands of these types of records have shown that the ocean bottom has [9]_____.

a) providing profiles of the topography
b) until it hit bottom
c) and bounces back as an echo
d) was flat and featureless
e) an even more varied topography than does the land
f) that their ship might hit the bottom
g) then the distance can be calculated
h) wire had been substituted for rope
i) to form the basis of a new science - oceanography

Tasks

1) Sum up the history of measuring the depth of the ocean bottom.
2) What gave the basis of oceanography?

3) Use the BBS source in the syllabus for the following tasks. Listen to Don Walsh who was in the first sub to reach the deepest place.
What problems did they face? When did the dive take place?
4) Watch the Fly through the mariana Trench to see today´s technique. (source BBC)

The topography of the ocean bottom

Ocean basins are at a much lower level than the land, formed mainly of dense basaltic rock, whereas continental rocks are mostly granite and granite gneiss. The depth can vary greatly from one location to another, but there are several general features associated with certain earth processes.

An area near the continents is known as the **continental margin.** It is made up of continental crustal materials and rocks. Most sediment eroded from the land is deposited in this part of the ocean.

Features: The **continental shelf**, the part nearest the land, has on the average a very gentle slope. At a depth of about 200 m the steepness increases and the **continental slope** begins. At the base of this slope is another, much gentler slope that leads down to the abyssal plain. This gently sloping area is known as the **continental rise** (= úpatí, necessary to distinguish from oceanic rise = oceánský práh či hřbet).
Erosional valleys and **canyons** cut across the margin. Some of them are deeper and wider than the Grand Canyon in Arizona. They were probably formed by rapidly flowing turbidity currents - mixtures of sediment and water, and river erosion during times of lower sea level, but they might also have been formed by glaciers during the last Ice Age.

Farther from shore, at a greater depth, is the deep sea floor. This area is affected by the earth processes of sedimentation and volcanism. All ocean crustal rocks are volcanic, formed by underwater eruptions of dark-colored basaltic flows.
Features: ***Seamounts*** **–** underwater volcanic cones that grow upward from the bottom, layer by layer, usually rising more than 1000m above the floor. Sometimes they reach the ocean surface and form islands. Virtually all islands in the ocean were formed by volcanic activity. Igneous activity beneath these volcanic features causes additional bulges in the ocean crust.
Because of wave action or ocean crustal movement, volcanic islands can disappear beneath the surface of the sea. If the volcanoes have become extinct, then the wave action is able to erode the tops of the seamounts down to sea level. Sometimes the ocean crust beneath extinct volcanoes sinks, lowering the eroded seamounts well below the ocean's surface, forming flat-topped underwater mountains called **guyots.** They are found in deeper parts of the basins and can rise to nearly 1000m above the floor. *Where does the word guyot come from?*

Sporadic turbidity currents spill off the continental margins into the deep ocean. Through time, abyssal hills near continental margins can be covered with

hundreds of layers of sediment. Turbidity currents can also extend for hundreds of kilometers across the bottom, leaving large flat areas called **abyssal plains** (roviny)**.** Most of them make up the deeper parts of the major ocean basins at about 5 km depth. These plains are an example of the flat area that many scientists once thought the entire ocean bottom was like.

A very small percent of the ocean basin has long deep **trenches** that extend downward to about 11.5 km. They are usually bordered by enough volcanic activity to create island arcs. In the case of Peru-Chile Trench, the volcanic activity forms part of the Andes Mountains. The region of volcanic activity that surrounds the basin of the Pacific Ocean is called the **Ring of Fire** and is generally associated with deep sea trenches. Trenches and island arcs indicate areas of collision between separate oceanic crustal plates.

The rest of the ocean basins is made up of the world's biggest and longest mountain system, the **mid-ocean ridges.** The system is about 65 000 km long. In the Atlantic Ocean, the **Mid-Atlantic Ridge** occupies the central third of the entire basin from the Artic Ocean to about the latitude of the southern tip of Southern America. Iceland is a part of the ridge that became an island through volcanic growth. As shown in Fig.8-9 on p.380, the mid-ocean ridge passes between Africa and Antarctica and into the Indian Ocean, where it splits. One branch heads north and forms the Red Sea, the other branch extends southeast and east between Australia and Antarctica and then across the southern portion of the Pacific Ocean where the ridge is less rugged and as a result, it is called the **East Pacific Rise.** It continues under the southeastern part toward Central America where it branches. Part of it disappears near Panama and the other part disappears near Baja California. The mid-ocean ridge system is offset by hundreds of breaks in the crust – fracture zones and is extremely rugged. The fairly deep central **rift valley,** with high peaks near, is a site of active volcanism. Much heat from the volcanic action is absorbed by ocean water. In addition, new ocean-floor crust forms at the ridges.

Check yourself

1. *List the ocean bottom features of the continental margin and describe them.*

2. *List the features associated with the deep basins and distinguish them.*

3. *Describe the mid ocean ridge system in Fig.8-9 on p.380.*

Resources of the ocean bottom

Resources found in and on the continental margins.

Fish, shellfish, natural gas, crude oil, gold, diamonds, titanium ores and other heavy substances, sand and gravel for construction materials.

Resources associated with the deep ocean floor.

Manganese nodules with copper, cobalt, zinc and other valuable metals and minerals formed around hot springs of the mid-ocean ridge system. The ocean floor also serves as a dumping of waste chemicals.

What do you think the following phrases mean?

To be in a dump –

To dump sb –

Homework:

Tranform sentences 1-3

1. It is possible that canyons and valleys were formed by glaciers during the last Ice Age.
   The canyons and valleys may…

2. We think that the Mediterranean Sea was formed when the two continents enclosed it.
   The Mediterranean Sea is …

3. Is there much variation / diversity in the depth of the ocean basins?
   Does the depth of the ocean basins …….

4. They built their thought /supposition (domněnku)on the fact that …
   Use synonyms of the underlined words:

5. Jaké neobvyklé druhy organismů se nacházejí v obohacených vodách kolem aktivních vulkanických riftových údolí? *Translate:*

Text adapted from Robert E. Fariel, Robert W. Hinds, David B.Berey: ***Earth Science***, Addison-Wesley, tasks by Věra Hranáčová.

Properties of Ocean Water (Part 2)

Salinity

The words *saline [seilain] = salty* and *salinity [sə'liniti] = saltiness are* from Latin *sal*
Salinity is a measure of the amount of total dissolved materials in water defined as grams per kilogram of water – parts per thousand (ppt).
Do you know the salinity of average ocean water? –
Six elements make up over 99% of the salinity of ocean water. *Pronounce them correctly:* chlorine [i:], sodium [səudiəm], sulfur [salfə], magnesium [mæg 'ni:ziəm], calcium [kælsiəm], potassium [pə'tæsiəm]. *What is the pronunciation of the form of the dissolved materials – ion?*
Note that two of them are by far the most abundant and they make up common table salt – what is the chemical formula?

Prepare the table and compare the environmental changes that affect the salinity of the Mediterranean Sea and the Black Sea – AW page 387.

	The Mediterranean Sea	*The Black Sea*
River inflow		
Evaporation		
Salinity		
Parts per thousand		

In the major oceans, three fourths of the water is below one kilometer depth, where the salinity is nearly constant at 34.5 to 34.9 parts per thousand. Along the center of the mid-ocean ridges, however, isolated spots have hot springs which often contain concentrated amounts of dissolved solids. When deep water circulation is restricted, these hot waters can form **brine pools** (=solanky se silně mineralizovanou vodou). The bottom of the Red Sea has brine pools with salinities as high as 257 parts per thousand.
Give the opposites of the following words:
Containing sugar –
Rare / Scarce –
Insufficient –
Unlimited –
Deep - verb: noun:
Wide - verb: noun:

Fill in the suitable or zero preposition:
Few large rivers enter ____ the Mediterranean Sea.
The Black Sea has a narrow, shallow connection _____ the Mediterranean Sea.
Salinity is defined as grams of dissolved materials _____ kilogram of water.

Sodium and chlorine make ____ table salt.
Majority of the water is _____ one kilometer depth.

Temperature

Temperature is one of the most frequently measured properties of ocean water. Water layer in which temperature changes rapidly in the vertical direction is referred to as **thermocline.** Deep ocean water at the equator is about the same temperature as the surface water near the poles.

Sea ice

One of the consequences of the temperature, salinity, and density relationship is the lack of sea ice in most of the world's oceans. Salinity affects the **freezing point** of water. The saltier the water is, the colder it must be before it freezes.
How cold must average ocean water be in order to start freezing? Find the answer in the graph in Fig. 8-17 on p. 393.

Cooling of ocean water occurs at the surface because of cold winter winds. The spray from winter waves can coat the decks and rails of a ship with ice. And yet, the surface of the ocean has no ice. This is because of the relationship between temperature and density. As the surface water gets colder, it becomes denser than the water beneath it and sinks being replaced by less dense water, which is not as cold. This sinking can be stopped only by the bottom or by denser water mass.
In the Arctic Ocean, the middle and lower levels have a high salinity water mass that forms a barrier to the downward mixing of the cold surface waters, that become cold enough to freeze and form **sea ice.** Because of the length of the cold season and the extreme cold, the sea ice eventually forms very thick masses called **pack ice** (=pole ker).
The water in the open Atlantic, Pacific and Indian Oceans never gets cold enough from top to bottom to freeze, but sea ice might form around the margins where the bottom is shallow and horizontal mixing is restricted. It might also form in **bays** and **estuaries** that have salinity of less than 24.7 parts per thousand. Such bodies form ice fairly easily during winter months because such water does not become continuously denser as it is cooled. The water will reach a maximum density at some temperature above the freezing point. Then, as the water gets colder, it becomes less dense and floats on the surface, becoming colder and colder until it freezes. This is the same way that freshwater ponds and lakes freeze.
When you think of ice in the ocean, you might also think of **icebergs,** but those are masses of ice that broke off freshwater glaciers.

Check yourself

1. *Where might sea ice form in the Atlantic, Pacific and Indian Oceans?*
2. *How cold must average ocean water be in order to start freezing?*
3. *Find the synonyms to these words in the text above:*
   effects - insufficiency - cover with thin layer - in the end - limited

Water absorbs light

Pictures taken underwater frequently look blue because blue color is absorbed less rapidly than the other colors of the spectrum. The ocean environment can be divided into three zones, depending on the amount of light that has penetrated to that zone.
Photic zone (from Greek phós = light) extends to a depth of 200m. The light is strong enough for the growth of algae (one-celled plants) and basic food source for many animals.
Disphotic zone (dis = reduced, half) ranges between 200 and 1000 m
Only a very tiny, almost immeasurable amount of light - no more algae, only some organisms with extremely sensitive eyes and bioluminescent animals, e.g. the angler [g] fish, which produce the brightest light in this zone in the similar way as fireflies do.
Aphotic zone – the bulk of the ocean
Total darkness except for bioluminescence and underwater eruptions of lava. Some scavengers [dž] and "pockets" of life based on a food chain beginning with sulfur-eating bacteria (no photosynthesis involved).

Explain <u>the bulk of</u> =
Angler fish= *scavengers=* *fireflies=*
Supply negative prefix: ____measurable, ____photic

Reading for specific information

*Read about **water pressure** on page 394 and answer the following questions:*

1. *What is the rate of pressure change with ocean depth?*

2. *What is the approximate atmospheric pressure (in bars) at sea level?*
3. *How are divers with air tanks able to breathe at depths of twenty meters?*

4. *What would happen to a swimmer if he extended his snorkel tube to 1 m?*

According to the text of this section, decide whether the following statements are ture or false and correct the false ones.

1. True/false: Concentrated amounts of dissolved solids can be found anywhere along all the mid-ocean ridges.
2. *True/false*: Salt water freezes at lower temperature than zero Celcius.
3. *True/false*: Icebergs are large pieces of floating sea ice.

Translate: Když je omezena cirkulace hlubokých vod, mohou se v horkých pramenech vytvářet solanky.

Resources of ocean water

Ocean water resources are quite important to people.

□ The bulk of the fishing industry relies on the water over or near the continental margins. Fish are concentrated in these areas because of the greater abundance of smaller organisms and nutrients in the water. Fish are used for food, oils, fertilizer, and livestock feed.

□ Ocean water is 96.5% water. Desalination plants can remove the 3.5% dissolved materials and produce fresh water from ocean water. In some coastal areas, desalination is more economical than other sources of fresh water.

Is desalination an economical way to obtain fresh water?

□ Scientists have been able to find many elements dissolved in ocean water. Although not all elements have yet been detected, many scientists believe that they will eventually be found as better analytical tests are developed. At present, only sodium chloride (table salt), magnesium, and bromine are commonly derived from dissolved elements in ocean water.

□ Differences in water temperature between the surface and the depths can be used to generate electricity. OTEC (Ocean Thermal Energy Conversion) has been tried near Hawaii and offers great promise for the future.

□ Many industries use ocean water as a coolant for their machinery and equipment. The water is circulated through heat exchangers where excess, unwanted heat is absorbed.

□ For recreational purposes, the ocean's waters offer sports fishing, swimming, diving, boating, and water skiing.

□ The ocean provides a habitat for maintaining a great number of different types of life forms. This is ecologically important in order to maintain the quality of life in general and to provide a resource base for future needs. *Pollution* has been responsible for destroying life in the ocean. Offshore oil wells have caused much pollution and destruction of life. Chemical fertilizers are washed down rivers into the ocean. Chemical wastes from factories as well as human sewage have ended up in the ocean.

Check yourself

1. List the seven major resources of ocean water.
2. What substances are presently derived from the dissolved elements in ocean water?

Text from Robert E. Fariel, Robert W. Hinds, David B.Berey: *Earth Science*, **Addison-Wesley**

The Circulation of Ocean Water (Part 3)

Interactive practice of cloze tests in ROPOTS:

The beginning, middle, and end of a wave - Effects of wave action

Match the suitable words to form meaning pairs:

dissolved	ice
freezing	nutrients
pack	point
severe	pressure
snorkel	salt
table	tube
water	winter

Task:
Read the text on tides on the following page and write a summary.
Follow the steps to write the summary in an effective way.

1. Read the passage and **mark** the key ideas.
2. Write down the key words.
3. Put away the original and rewrite your notes in your own words.
4. Change the order of the points if necessary to make the construction more logical.
5. Re-read your summary (after some time) to check that you have included **all the important information clearly and expressed it as economically as possible**.

Key words:

Summary:

Tides

If you've ever built a sand castle on an ocean beach, you've probably noticed that over a period of time the waterline moves either toward the castle or away from the castle. This happens because the level of the sea at a particular location rises and falls during the course of a day.

About once every twelve hours, the waterline reaches what can be called the high water mark. When the waterline reaches this level, the ocean at that location is said to be at **high tide**.

After the waterline reaches the high water mark, the waterline then moves back down toward the open sea until it reaches a low water mark. When the waterline reaches its lowest point, the level of the sea in that area is at **low tide**.

High tide is the result of huge bulges in the level of the ocean. The bulges are caused mainly by the moon and the movement of the earth and moon. Figure 8-30 shows the bulges in sea level in relation to the position of the moon.

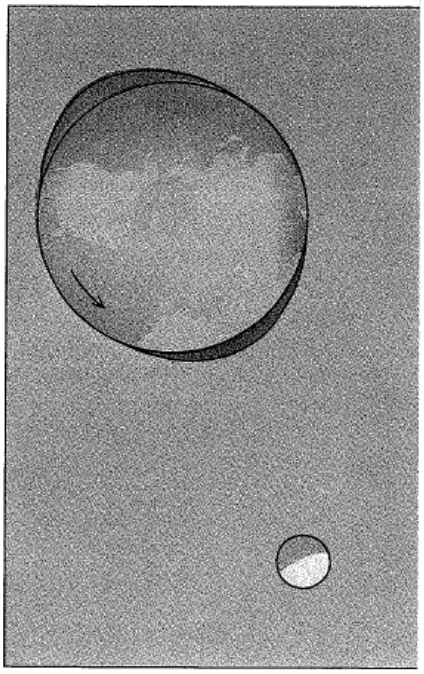
You will notice that there are actually two bulges. The one nearest the moon is caused by the force of gravity from the moon attracting objects on the earth's surface. The moon pulls on all parts of the earth. But the pull is strongest at the points closest to the moon. The earth's solid surface is not greatly affected by the moon's gravitational pull. But the water on the earth's surface is noticeably affected because water is fluid and can change its shape. The bulge directly opposite the moon, on the other side of the earth, is caused by the rotation of the earth and moon through space.

The fact that sea level at any location goes from high tide to low tide and back again is due to the earth rotating on its axis. The solid earth is actually rotating under the bulges of water.

Tides affect the kinds of plants and animals that can live along the margins of the oceans. Tides can cause alternate wetting and drying of land areas. Rising and falling tides create tidal currents in coastline environments. Incoming tidal currents can bring salt water into an area that has fresher water at low tide. Incoming and outgoing tidal currents also affect the temperature of an environment.

Tides also affect people who live, work, or travel near the water's edge. Tidal changes affect the depth and the water speed and direction in harbors and along coastlines. For that reason, ships frequently schedule their arrivals and departures to coincide with a certain tidal condition. Other nearshore and offshore activities, such as fishing and recreation, are also affected by tides.

Figure 8-30. How does the moon affect the level of the ocean's surface on the earth?



Text adapted from Robert E. Fariel, Robert W. Hinds, David B.Berey: ***Earth Science***, Addison-Wesley, tasks by Věra Hranáčová.