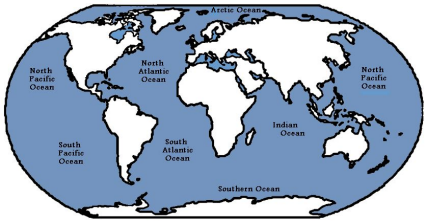
Oceans

Presented by Kesler Science

Oceans

Earth's oceans

- Five oceans from largest to smallest
  1. Pacific
  2. Atlantic
  3. Indian
  4. Southern
  5. Arctic
- Home to an incredibly diverse web of life



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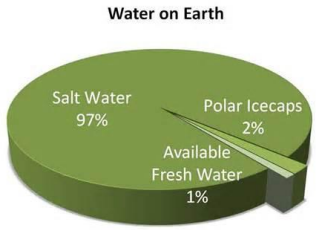


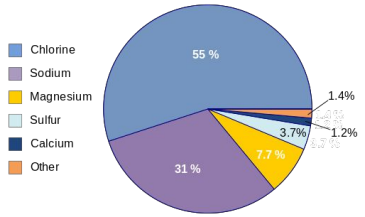
Water on Earth

- 70%+ of the planet is covered by oceans
- 97% of the water on Earth is in the oceans
- 2% is locked in glaciers and ice caps
- 1% is fresh water in lakes, rivers, and aquifers

Oceans

Ocean's Elements

- The ocean water is made up of hydrogen and oxygen (water or H_2O).
- The other two main elements in ocean water are chlorine and sodium (salt or NaCl).
- Magnesium, sulfur and calcium are the next most abundant elements.

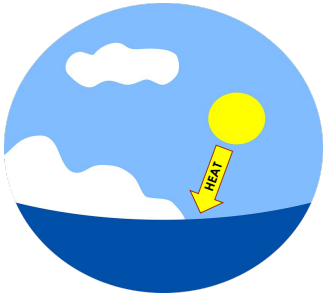


Quick Action – Oceans

Get with a partner and answer the following questions.

1. Name the 5 oceans.
2. How much of the earth is covered by water?
3. What are the main elements in the ocean?

Oceans



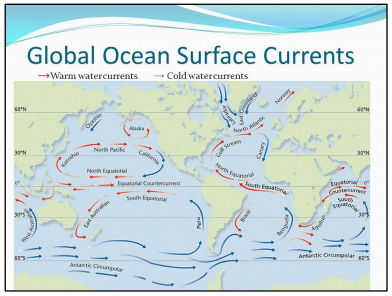
Sun's Effect

- Much of the Sun's radiation is absorbed in the oceans in the form of heat, particularly at the equator.
- The oceans help distribute this heat around the globe.
- Some of the heat evaporates into the atmosphere, and some remains in the oceans.

Oceans

Surface Ocean Currents

- A continuous flow of water in a particular direction, created mainly by surface winds.
- Surface ocean currents drive weather patterns.
- Warm water is transported from the equator towards the poles.
- Cold water is transported from the poles towards the equator.



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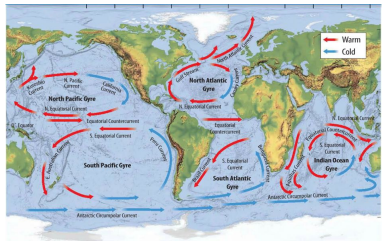
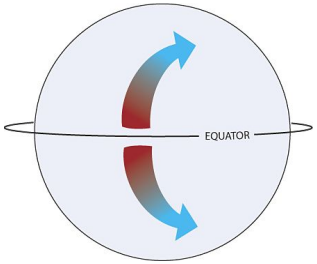


Surface Ocean Currents

- Ocean currents help regulate global climate even if an area is hundreds of miles from the coast.
- Without currents, regional temperatures would be more extreme – super hot at the equator and frigid at the poles.
- Much more of the land would be unusable.

Oceans

Coriolis Effect
Due to Earth's rotation



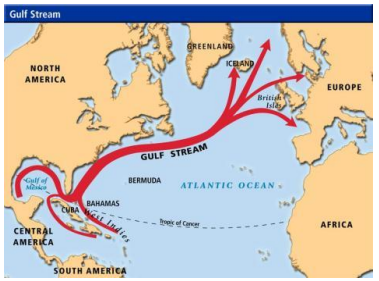
Coriolis Effect

- Because the Earth rotates on its axis, circulating air is deflected toward the right in the Northern Hemisphere and left in the Southern Hemisphere.
- This is the Coriolis Effect.
- The water at the ocean surface (Surface Ocean Currents) is moved primarily by winds due to this certain pattern.

Oceans

Example - Gulf Stream

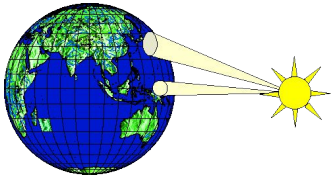
- A powerful, warm, swift ocean current flowing in the Atlantic.
- Originates in the Gulf of Mexico and travels up the east coast of the U.S. before combining with the North Atlantic Drift.
- Brings much milder temperatures to Western and Northern Europe than would otherwise occur.



Quick Action – Oceans

Surface Ocean Currents

Using the diagram at the right, explain why the ocean waters are warmer at the equator than at higher latitudes.



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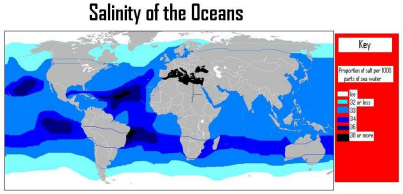


Salinity

- Measure of the amount of dissolved salt in the water. (salinity = saltiness)
- Measured in parts per thousand (ppt)
- Average ocean salinity is 35ppt. For every 1000 grams (1kg) of seawater, 35 grams are salt.
- Average river salinity is 0.5ppt.

Oceans

Salinity and Density

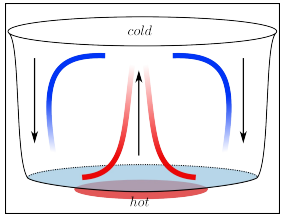
- Density is affected by **salinity.**
- Water with dissolved salts (higher salinity) is more dense.
- Water without dissolved salts (lower or no salinity) is less dense.
- The Great Salt Lake has very high salinity (28ppt). This makes it easy to float.

Oceans

Temperature and Density

- Density is affected by **temperature.**
- Water with colder temperatures is more dense.
- Water with higher temperatures is less dense.
- Convection currents in the ocean move warm water towards the surface and cold water deep into the ocean.

Convection



In what other context have you heard of convection?

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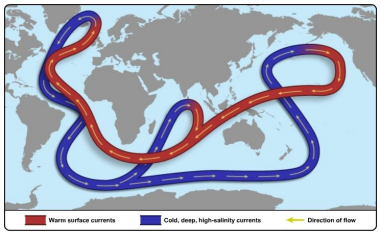
Referred to as the ocean's conveyer belt



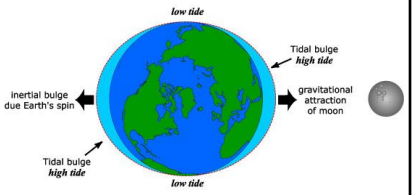
Deep Ocean Currents

- Driven by density differences in salinity and temperature
- Lowest temperature and highest salinity is the most dense ocean water.
- Flows under the surface of the ocean
- Moves nutrients, oxygen, and heat with them.

Oceans

Tides

- Due to the gravitational attraction of the moon
- Causes the oceans to bulge out in the direction of the moon
- Another bulge occurs on the opposite side of the Earth.
- Because of the Earth's rotation, this happens twice a day.



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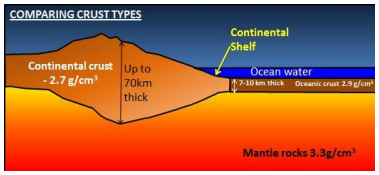


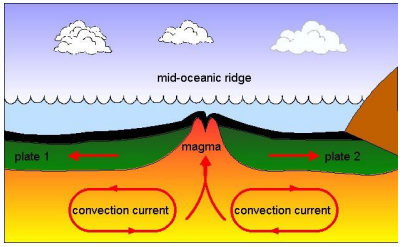
Oceanic Crust

- A thick layer of rock that separates the Earth's oceans from the hot mantle beneath it.
- Different from continental crust in several ways.
  - Thinner
  - More dense
  - Younger
  - Different chemical composition

Oceans

Sea Floor Spreading

- Plates 1 and 2 move apart.
- Magma rise, cools, and solidified forming new igneous rock.
- This happens at mid-ocean ridges.
- The youngest rocks are found closest to the ridge.
- Subduction occurs at plate boundaries.



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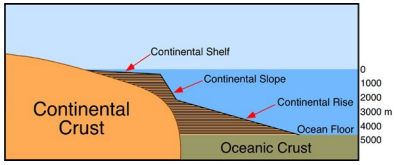
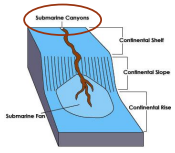


The boundary of the continent is not the coastline but rather the edge of the continental shelf.

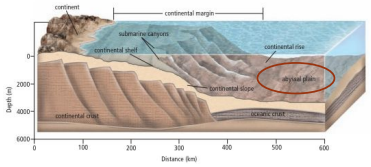
Seafloor Features

- <u>Continental Shelf</u> – edge of the continent that lies under the ocean
- <u>Continental Slope</u> – the break that descends toward the seafloor
- <u>Continental Rise</u> – final boundary between the continental crust and oceanic crust

Oceans



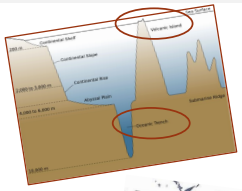
Submarine Canyons

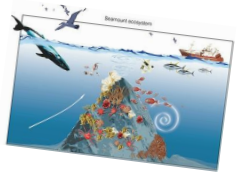


Seafloor Features

- <u>Submarine Canyons</u> – deep channels cut through the continental shelf
- <u>Abyssal Plain</u> – underwater plain usually lying between the continental rise and mid-ocean ridge – covers more that 50% of the Earth's surface

Oceans

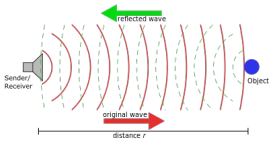


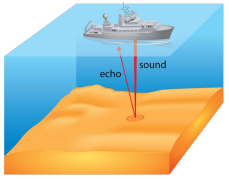


Seafloor Features

- Trench - Long, narrow depressions on the seafloor formed when plates collide (Mariana Trench – deepest part of the ocean almost 7 miles deep)
- Sea Mounts – undersea mountains formed by volcanic activity – biological hotspots
- Volcanic Island – Sea Mount that breaks the surface.

Oceans





Mapping the Seafloor

- Sonar is used to identify ocean features.
- Sound waves are bounced off of the ocean floor.
- The time it takes the sound wave to return back as an echo indicates the depth of the seafloor.
- The equipment is mounted on the bottom of the boat.

Oceans

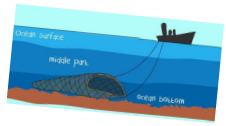
Dependence on Oceans

- Evaporation supplies us with fresh water
- Provides oxygen and absorbs excess carbon dioxide through plants
- Fishing for food and fish oils
- Jobs
- Tourism and recreation
- Effects our weather patterns
- Mining and oil

Oceans

Human Impact

- Unsustainable Fishing – over fishing or threatening fish environments
- Pollution – 80% of marine pollution comes from land (runoff)
- Tourism/Development – disrupts fragile marine environments
- Climate Change – sea surface temperatures rise impacting climate; also, sea levels rise



Check for Understanding

Can you…

Identify the elements in the ocean?

Associate salinity with temperature and density?

Recognize that the Sun provides the energy that drives convection within the ocean, producing surface and deep ocean currents?

Give examples of seafloor stuctures, including locations?

Recognize human dependence on ocean systems and explain how human activities have modified the oceans?