

1. Oceans

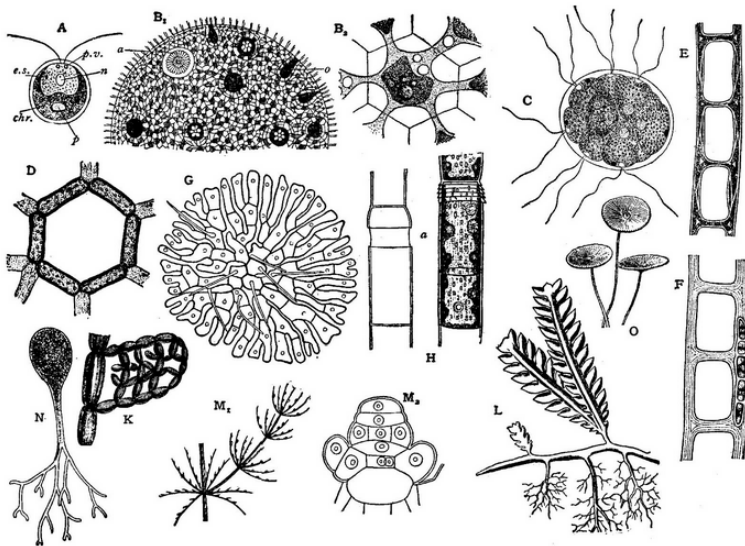
- a) **Basic facts:** There are five oceans on earth, making up about 72% of the planet's surface and holding 97% of the hydrosphere. Oceans supply the planet with most of its oxygen, play a vital role in the carbon cycle, weather and climate. Deep oceans are largely unexplored.

Example 1 Identify the 5 oceans. **Arctic, Atlantic (in between N America and Europe and between Africa and South America) Indian, Pacific and Southern(Antarctic)**



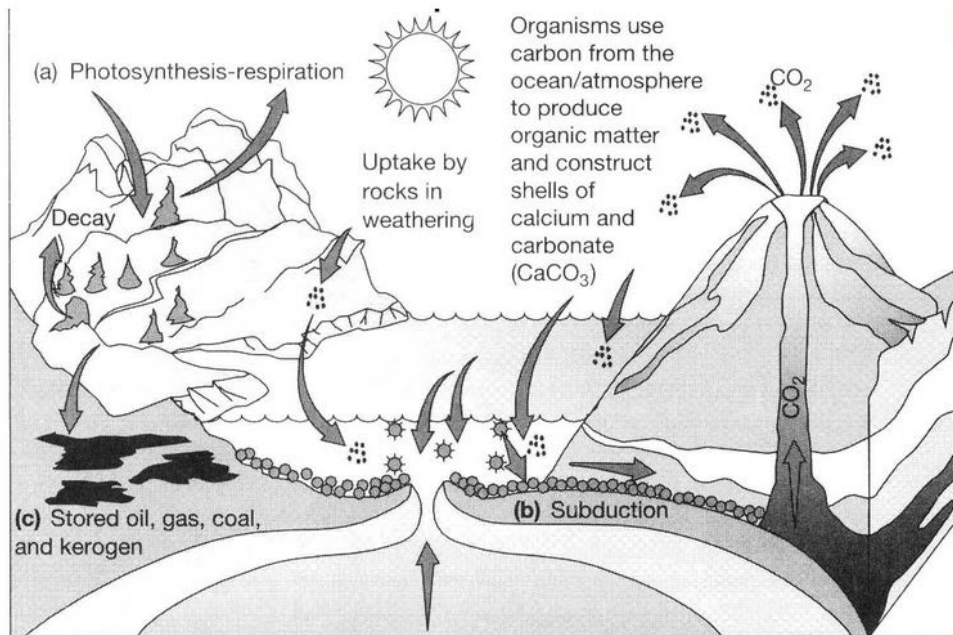
Example 2

What organisms in the ocean supply the Earth with oxygen and how?
Phytoplankton(microscopic algae) in the oceans photosynthesize and release oxygen.



Example 3

How do oceans play a role in the carbon cycle?



1. They take in hydrogen carbonate ions from weathering of rocks.
2. They have autotrophs (producers) which photosynthesize.
3. Their shelled organisms deposit carbonate.
4. The carbonate gets converted into carbon dioxide by volcanoes.
5. Oil and natural gas is formed from the slow decomposition of marine organisms.
6. They dissolve carbon dioxide from the atmosphere.

Example 4

How do oceans affect weather and climate?

1. Water has a high specific heat. That means it absorbs heat slowly but then also releases its heat slowly, so it stabilizes the temperature of keeps nearby land
2. Through ocean currents, heat from equatorial areas is distributed.
3. Warm moist air rising from the sea can also lower pressure and cause tropical storms or hurricanes.

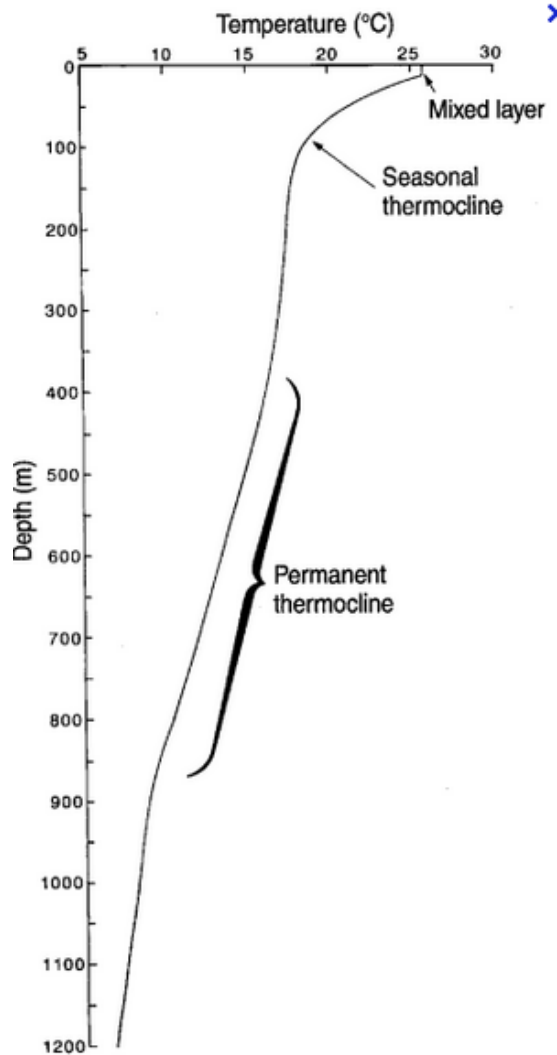
b) Ocean Temperature

Three factors affect ocean temperatures:

- (1) Depth
- (2) Season
- (3) Latitude

Example 1

The following data was collected in 1983 at 33°N and 43°W. Which ocean was it taken from and during what season?



Atlantic, summer

Example 2 What do you notice about the mixing layer's temperature? Why is this so?

Sunlight warms the upper layers of the sea.

Example 3 Why is the temperature so low at a depth of 1100 m?

Light does not reach the depths of the ocean..

Example 4 How will seasons affect the curve in the previous example?

Only the upper layers to the left (colder) get shifted significantly

Example 5 How do seasonal ocean temperature changes compare to those from the continent?

They are less drastic because of water's high specific heat compared to that of the land.

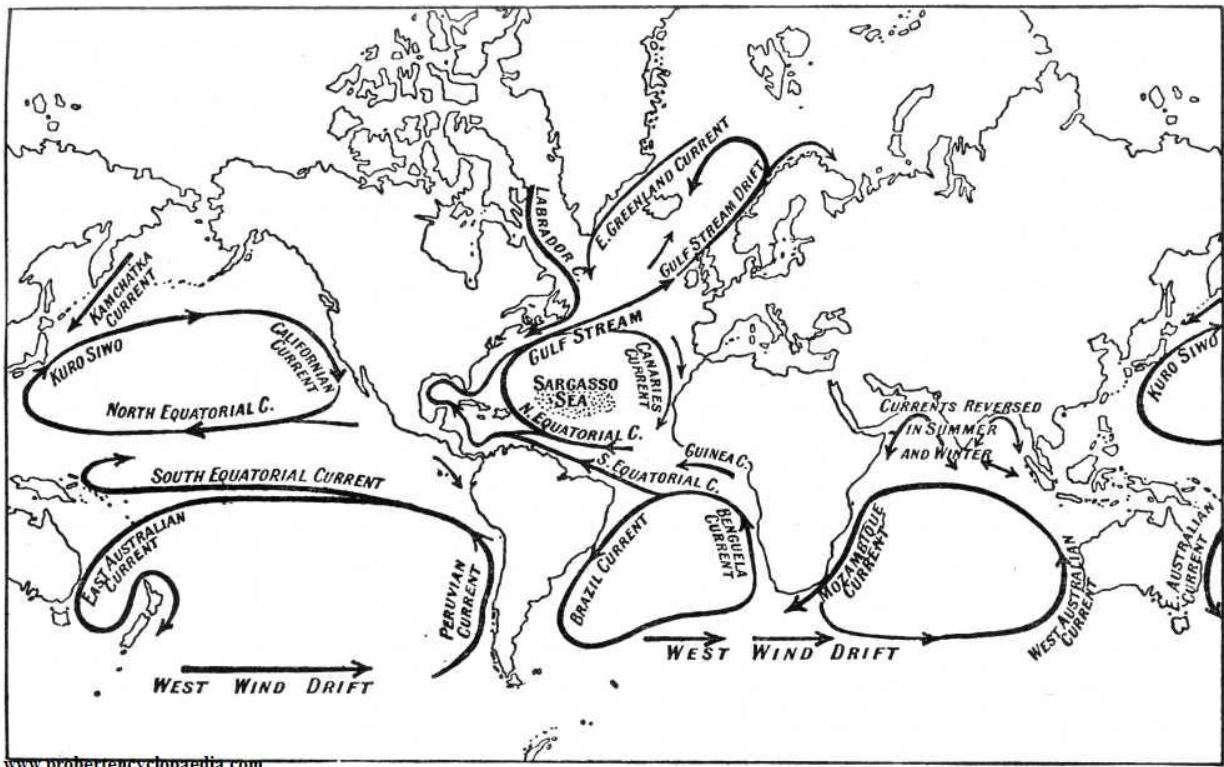
Example 6 Which latitudes will have the warmest ocean temperatures?

Close to the equator.

c) **Ocean Currents**

1. **Definitions:**

- An ocean current is the movement of the seawater in a certain direction and over a large distance .
- Ocean circulation refers to the combined movement of several ocean currents.



Example 1 Which current bring cold waters to Quebec and Maritime beaches?

Labrador

Example 2 What will be warmer in the winter: eastern or western Florida waters? Why?

The tip is warmer due to the North equatorial current

2. Factors Affecting Currents

Oceanic currents are driven by several factors.

- One is the rise and fall of the tides, which is driven by the gravitational attraction of the sun and moon on Earth's oceans. Tides create a current in the oceans, near the shore, and in bays and estuaries along the coast. These are called "tidal currents." Tidal currents are the only type of currents that change in a very regular pattern and can be predicted for future dates.
- A second factor that drives ocean currents is wind. **Winds drive currents that are at or near the ocean's surface.** These currents are generally measured in meters per second or in knots (1 knot = 1.15 miles per hour or 1.85 kilometers per hour). Winds drive currents near coastal areas on a localized scale, and in the open ocean on a global scale.
- A third factor that drives currents is thermohaline circulation - a process driven by density differences in water due to temperature (thermo) and salinity (haline) in different parts of the ocean. **Currents driven by thermohaline circulation occur at both deep and shallow ocean levels and move much slower than tidal or surface currents.**

Example 1 What kind of tide would result in a tidal current away from the land?

Low tide

Example 2 What movement of the planet combines with wind to create the curved effect of ocean currents?

It spins on its axis. The curved effect is a resultant force from the coriolis force (spin) and gravitational effects of density differences.

Example 3 Will warm water near the equator sink or will it remain above colder water to the north? What effect does this have on the water in Northern latitudes?

It tends not to sink because warm water is less dense and that helps the heat spread as far as + 30° or -30° in latitude.

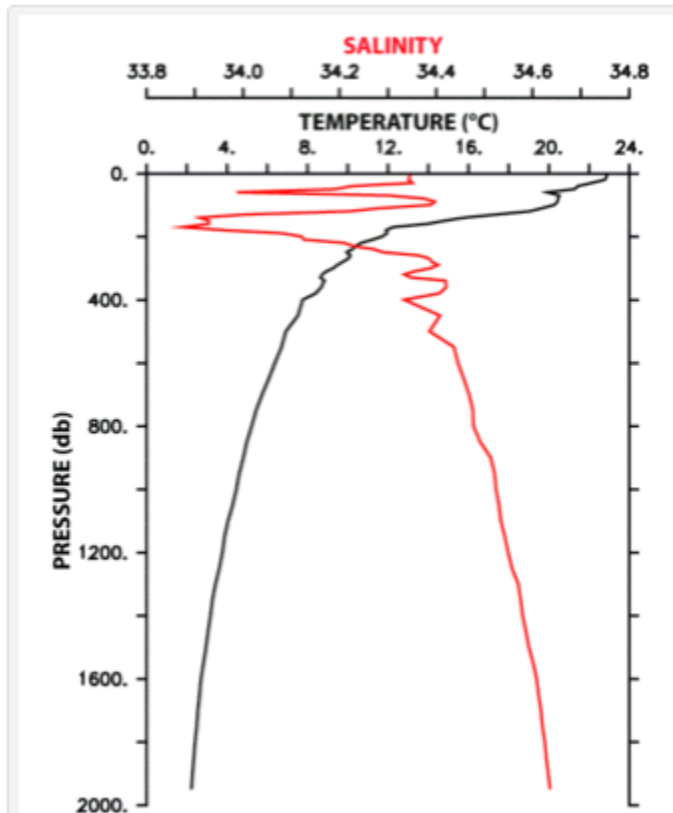
Homework

1. What part of the hydrosphere supplies the Earth with most of its oxygen?

The ocean

2. Give two reasons why Boston is generally warmer than nearby Worcester, especially in late fall and winter.

It's on the Atlantic which buffers (prevents extremes) temperature. Land (what Worcester is surrounded by) will cool off more quickly.



3. The data shown was collected at 20N, 121 W, between Asia and N America.

a) Which ocean was measured?

Pacific

b) Which season was the water's temperature recorded in?

summer

c) Why is so cold past a couple of hundred meters in depth?

Light doesn't reach there and there's little mixing.

d) Are deeper waters saltier?

yes

e) Why?

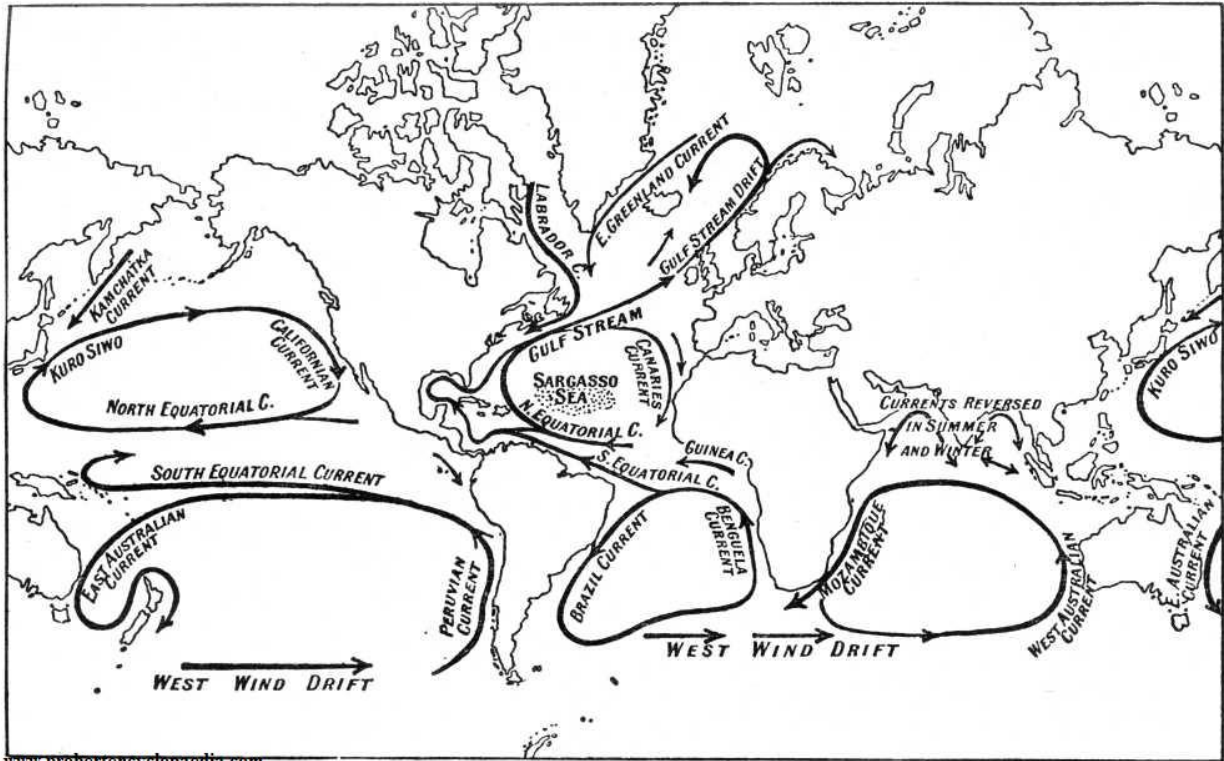
Salt water is more dense than less saltier water.

9.

a) Which are the two coldest oceans?

Southern and Arctic oceans

b) Which is the warmest of the 5 oceans? **Indian**



10. a) Examine the above map and figure out why California waters are cold in the winter.

The California current brings in cold waters from the North Pacific.

a) In which ocean does the Labrador current originate?

Arctic Ocean

11. What three factors affect ocean currents?

Surface currents are affected by wind, temperature and salt concentrations. Deeper currents are only affected by temperature and salt.

12. Why is Arctic water less salty than the Indian Ocean?

It gets mixed with melted freshwater ice from Baffin Islands and especially Greenland.