1. Heating of the Land and Water:

<table>
<thead>
<tr>
<th></th>
<th>Daytime (warmer or colder)</th>
<th>Nighttime (warmer or colder)</th>
<th>Which cools off quicker</th>
<th>Which heats up faster?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ocean</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

2. Land Breezes vs. Water Breezes AND Ocean Currents:

a. What is heating the surface (ocean and land) of the Earth? ______________

b. Label in the diagram above the following:
   i. What is warmer during the day: land or sea/ocean
   ii. What is warmer during the night: land or sea/ocean
   iii. Where the air has a high density and a low density. (both diagrams)
   iv. What direction the ocean current will go: toward land or away from land (both diagrams)
   v. We cannot see air particles/molecules, but if you could draw what they would look like in the diagram above
      (Hint: think about density of air)

c. The sun heats the surface of the Earth (land vs. sea) evenly or unevenly: ______________
   i. This causes what in the atmosphere? ______________
   ii. This then causes what in the sea/ocean? ______________

d. Open/Closed System:
   i. The system in the diagram is showing what? ______________
   ii. What matter is flowing in the system? ______________
   iii. What is the energy in the system? ______________
   iv. Is this an open or closed system for matter? ______________ How do you know? ______________
   v. Is this an open or closed system for energy? ______________ How do you know? ______________
3. **Water Breezes:**

   a. Label the following in the diagram:
      i. North (letter A), Equator (letter B), and South (Letter C) as warmer or colder
      ii. Draw in two (2) convection currents (wind) in the atmosphere on the diagram *(Hint: think about density of air and temperature)*
      iii. In the atmosphere label where the air is more dense and less dense
      iv. What direction the ocean current will go: toward land or away from land (both diagrams)
      v. We cannot see air particles/molecules, but if you could draw what they would look like in the diagram above *(Hint: think about density of air)*

   b. The sun heats the surface of the Earth evenly or unevenly? ____________________________
      i. This causes what in the atmosphere? _________________________
      ii. This then causes what in the sea/ocean? ____________________________

4. **Land Breezes:**

   a. Label the following in the diagram:
      i. The land at Canada (letter A) vs. USA (letter B) as warmer or colder
      ii. The land at Brazil (Letter C) vs. Argentina (Letter C) as warmer or colder
      iii. Draw in two (2) convection currents (wind) in the atmosphere on the diagram *(Hint: think about density of air and temperature)*
      iv. In the atmosphere label where the air is more dense and less dense
      v. We cannot see air particles/molecules, but if you could draw what they would look like in the diagram above *(Hint: think about density of air)*

   b. The sun heats the surface of the Earth evenly or unevenly? ____________________________
      i. This causes what in the atmosphere? _________________
Blowin’ in the Wind

Cool, dense air swoops under warm and rising air of lower density to create wind, or air on the move. Air always moves from high to low areas of pressure. Some winds, however, blow persistently and over great distances because we live on a huge spinning globe that heats unevenly.

Local winds: Some local winds reflect the fact that land heats faster than water, but water retains its heat longer. Go to the beach during the day, and you will often feel a cool breeze coming off the water. This is because the land heats quickly, warming the air above it, which rises. Cooler, moist air from over the water slides beneath the rising air, creating a sea breeze on an ocean beach. At night, the water stays warm after the land has cooled, resulting in an offshore breeze. The name of a breeze always tells the direction from which the wind is blowing. A southwest breeze blows from the southwest toward the northeast. Some “local” winds can be quite regional (and seasonal) in nature, like the warm and wet monsoon winds that bring heavy rain to Southeast Asia when they blow from ocean to land.

Global winds: Solar energy pours more efficiently into the atmosphere at the equator where it enters from directly overhead. In general, warm tropical air tends to flow toward the cool poles, while polar air slides toward the equator. But the earth is large and spins, complicating things. Earth’s spin results in a Coriolis effect, where winds are shifted in opposite directions in the Northern and Southern Hemispheres. Earth’s air masses break up into cells that result in certain consistent wind patterns.

Doldrums: Consist of mostly very calm air in a band over the equator.

Trade winds: Occur between latitudes 30° north and south. These warm winds blow back toward the equator in usually clear skies.

Prevailing westerlies: Occur between 40° and 60° north and south latitudes, consisting of cool air, usually moving quickly toward the poles from west to east in both hemispheres.

Polar easterlies: The westerlies rise and cool between 50° and 60° latitude and collide with cold polar air. The wind is deflected west by the Coriolis effect, creating cold, fairly weak winds blowing from east to west.

Jet streams: Were not discovered until the 1940s. These are narrow bands of air that zip along at an altitude of 12 kilometers. They move about 180 km/h in the summer and 220–350 km/h in winter, dipping here and there in seasonal and/or daily patterns. The swirling eddy currents they cause in lower air masses may result in storms.
Amelia Darehart’s plane keeps getting caught in various winds. For each description, fill in the name of the wind she is traveling in now. Use the word bank to help yourself.

1. She is caught in a wind that blows toward the equator from about 30° N and 30° S of the equator. She is in the _____________.

2. Ahhhhh - relief. She is flying in windless conditions along the equator. This area is called the ______________. _______________.

3. Warm air moving toward the poles between 30° and 60° latitude in the northern hemisphere is pushing her along at a good speed. She is in a _____________.

4. Warm air over land rises and cool air from the water is moving in, pulling her along in air moving from sea to land. This is called _____.

5. Between the North Pole and 60° latitude, she is buzzing along in cold, dry, dense horizontal air currents called _________.

6. Moving along quickly, she is in the ___________, the narrow belt of wind near the tropopause that formed when warm tropical air met cold polar air.

7. It is night time and the warm air over the water rises and is replaced by colder air from land. This moves her along with the _________________.

Word Bank
Doldrums     Jet Stream
Prevailing Westerly  Land Breeze
Polar Easterlies  Sea Breeze
Trade Wind
Going Global

When Europeans first began exploring other continents, they quickly realized that prevailing winds and currents could either help or hinder them in a fast and safe trip across the oceans. They soon learned that they should travel across to the Americas in one part of the ocean and return to Europe at a different place in the ocean.

Global Winds and Currents
On the map below, sketch and label the global winds (Exploring Earth Science Pg. 499) in one color and the major ocean currents (Exploring Earth Science Pg. 235) in a second color.
**Global Exploration**

Suppose you are planning a trip from New York City to Australia by boat. Sketch out a route that would best take advantage of the currents and winds.