Unit 10 Review Key – Ocean Circulation

Reference Materials: Fluid Earth pages 184-194, Introduction to the World's Oceans Chapter 8, Class notes, discussions, and PowerPoint.

Vocabulary List

current	western intensification	Longshore current
gyre	upwelling	Rip current
eddys	downwelling	El Nino
Ekman spiral	equatorial upwelling	La Nina
Coriolis effect	Sargasso sea	ENSO
	Garbage gyre	Global conveyor belt

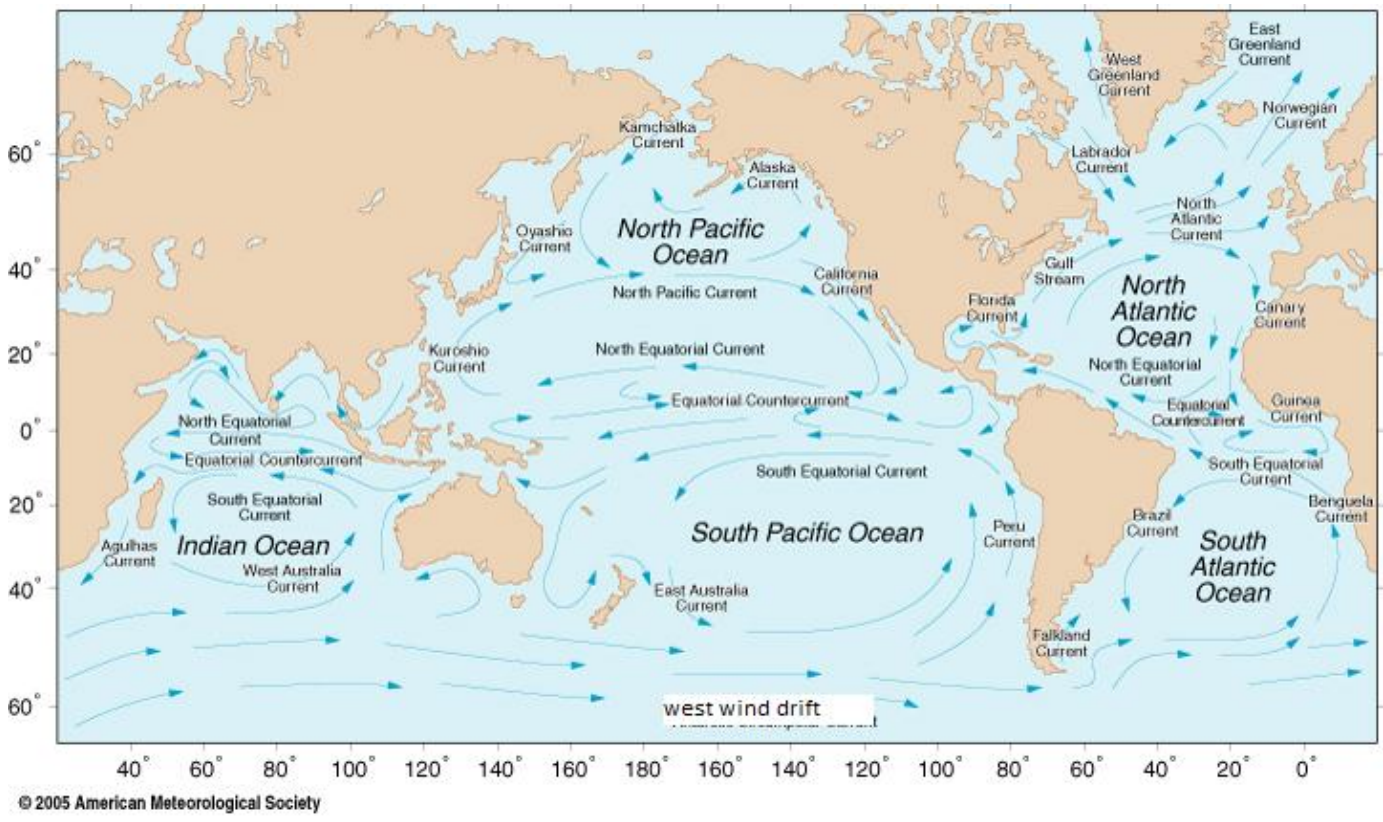
Surface Currents

1. What is the primary cause (driver) of surface currents around the world? **WIND**

2. Describe how surface currents are steered and in what direction they tend to turn in the northern and southern hemispheres **They are steered by the Coriolis effect due to the Earth's rotation. Because currents are moving slower than the winds they are more affected by the Coriolis effect than the winds. This is called the Ekman Spiral. Due to the Ekman Spiral, currents turn to the right (clockwise) in the Northern Hemisphere and to the left (counterclockwise) in the Southern Hemisphere**

3. What is the predominant direction of current flow between 0-30 degrees latitude (near the equator) and what is the primary direction of current flow between 30-60 degrees latitude? **To the west near the equator and to the east between 30 and 60 degrees latitude**

4. On the map below, draw in and label the following major currents: (A) Gulf Stream, (B) North Atlantic, (C) Canary (D) North Equatorial, (E) Kuroshio, (F) North Pacific, (G) California, (H) West Wind Drift, and (I) Labrador



5. Which direction does the Ekman spiral deflect wind-driven water in the northern hemisphere? __**right**__ in the southern hemisphere? __**left**__

6. What is "western intensification?" and are currents stronger on the western or eastern sides of the oceans? **Due to the Coriolis Effect, currents on the western side of each ocean or ocean gyre are stronger, narrower, and deeper than on the eastern side of each ocean or gyre. This means, for example, the the Gulf Stream and Kiroshio currents are stronger and deeper than the California and Canary currents**

7. What are some climate effects of warm water currents? **They bring warm most air to northern latitudes, they produce a warm humid coastal climate, they transport heat from the tropics to the northern latitudes, and they have a moderating effect on the climate of adjacent land areas**

8. What are some climate effects of cool water currents? **They bring cool dry air to the adjacent coastlines, they result in a dry coastal climate**

9. What is the difference between upwelling and downwelling? Which brings nutrient rich water to the surface? **Upwelling brings cool nutrient-rich water to the surface and it occurs when surface currents flow away from land along a coastline. Downwelling brings warm nutrient-poor waters to coastal areas and occurs when winds blow towards land along a coastline.**

10. Where is the Sargasso Sea and what currents surround it? **The Saragasso Sea is located in the middle of the North Atlantic Gyre and is surrounded by the Gulf Stream, North Atlantic, Canary, and North Equatorial Currents**

11. What is the primary type of garbage in the North Pacific garbage patch? **Plastic**

12. What are longshore currents and rip currents? **Longshore currents run parallel to coastlines and are responsible for the formation of barrier islands. Rip currents are small currents running away from land and occur when two waves converge along a beach.**

El Nino-Southern Oscillation

13. Describe what happens to surface water temperatures in the equatorial Pacific during El Nino? **The warm surface waters of the western tropical Pacific move eastward towards the coast of South America because the western-blowing trade winds reverse direction.**

14. Describe what happens to surface water temperatures in the equatorial Pacific during La Nina? **The western-blowing tradewinds intensify which brings colder surface water to the equatorial Pacific**

15. What does ENSO stand for? **El Nino-Southern Oscillation**

16. What are some climate effects of El Nino? **Weather patterns reverse around the globe. The Desert Southwest gets more rain than normal. Typhoons are more common in the Pacific and Hurricanes are less common in the Atlantic. Fish and seabird populations crash off the coast of South America.**

17. What are some climate effects of La Nina? **North America experiences colder than normal weather. There are les Typhoons in the Pacific and more Hurricanes in the Atlantic. Fish populations thrive off the coast of South America due to increased upwelling.**

18. How does El Nino affect upwelling and the fisheries off the coast of South America? **Upwelling of cold deep nutrient rich waters slows or stops during an El Nino. This cuts off the nutrients necessary to maintain the food web along the coast of South America. As a result fish populations crash as do populations of other species that rely on fish such as seabirds.**

Deep Water Currents

19. What is the primary force that drives deep water currents? **They are driven by differences in density that are caused by differences in temperature and salinity. This is called thermalhaline circulation.**

20. What two factors affect thermohaline circulation? **temperature and salinity**

21. What is the Global Conveyor Belt? **It is the global circulation pattern of deep ocean currents.**

22. Where does it start? **In the North Atlantic when cold salty dense water sinks and begins to move south.**

23. How does the Global Conveyor Belt and ocean currents affect atmospheric carbon dioxide? **The oceans are a carbon sink. The Global Conveyor Belt carries dissolved carbon dioxide and carbon from plankton away from the atmosphere and sequesters it in the deep oceans for thousands of years.**