**Examples of assessment questions**

Below are a few examples of multiple choice questions:

The **net transport of the surface water package** by the **Ekman transport** in the **Southern Hemisphere** is \_\_\_\_\_\_\_\_\_ degrees\_\_\_\_\_\_\_\_\_ to the wind direction.

a. 45; right b. 90; left c. 45; left *d. 90; right*      e. same direction and angle as wind

The **center of large circulation gyres** in the major ocean basins are associated with:

a. divergence and downwelling b. convergence and upwelling

c. divergence and upwelling *d. convergence and downwelling*

e. high density surface water sinking

Zones of **surface convergence** are regions of \_\_\_\_\_.

a. exceptional productivity b. upwelling c. low temperature

*d. all of the above* e. none of the above

What is the **process** that brings **nutrient and CO2 rich cold water** to the **surface**:

(a) convergence *(b) upwelling* (c) advection (d) divergence

**Upwelling** usually:

(a) increases the temperature of surface waters

(b) decreases productivity of surface waters

(c) decreases the nutrients in surface waters *(d) decreases the temperature of surface waters*

(e) none of the above

Which of the following best describes **upwelling zones**?   
a. cold water is brought to the surface, causing low biological productivity   
b. warm water is brought to the surface, causing low biological productivity   
*c. cold water is brought to the surface, causing high biological productivity*   
d. warm water is brought to the surface, causing high biological productivity   
e. cold water is brought to the surface, but they have nothing to do with biological productivity

Multiple choice questions using either the lettered schematic map or the profile (next pages):

*See activity answer key for answers to questions below. Answer letters will be different depending on if using map or profile.*

Which letter represents the **oceanic deserts**?

Which letter or letters represents **regions of divergence**?

Which letter or letters represents regions of **downwelling** due to higher density surface waters?

Which letter represents the location of **very low surface water primary productivity**?

Which letters represent locations of **cold, nutrient rich water**?

Which letter represents region of **downwelling due to piling up of surface water**?

Which letter or letters represent areas **below which you would expect to find siliceous oozes**?

Which letter or letters represent areas of **greatest coriolis deflection**? (for map only)

Which letters represent regions of **high surface water productivity**?

Which letter is the location of **an eastern boundary current**? (for map only)

Which letter represents the location of a **western boundary current**? (for map only)

Which letter represents region of **water pile up due to offset of geostrophic circulation?** (for map only)

Which letter or letters represent regions of **upwelling due to water moving away from coastline**? (for map only)

Lettered map for questions on second page

**A**

**C**

**D**

**B**

**A**

**A**

**A**

**D**

**Equator**

Surface Ocean Circulation

Line along Profile of Sea Surface Height

Northern

High Latitudes

Southern

High Latitudes

**SA**

**NA**

**Europe**

**Africa**

Lettered profile for questions on second page

**Profile (side view) of Variation in Sea Surface Topography (height) across the North and South Atlantic Oceans**

**Southern**

**High Latitudes**

**S. Pacific**

**N. Pacific**

**Northern**

**High Latitudes**

Sea Surface Topography

Profile Line from Figure 1 & Average Sea Level

Water Moving into Gyre Center

**A**

**A**

**B**

**B**

**B**

**C**

**C**

**D**

**D**

**D**

Labeling question:

**Figure 2**, below, shows a **profile or side-view** of the **shape of the sea surface** from the north Atlantic through the south Atlantic across the major surface circulation ocean gyres.

**Label in blanks 1-4 below (ONLY IN THE BLANKS)**, the locations where Ekman Transport causes **surface water convergence** and **divergence** which result in the occurrence of **upwelling** and **downwelling. Each term will be used once!!**

Profile **(side-view**) of Variation in Sea Surface Topography (height) across the North and South Atlantic Oceans

Sea Surface Topography

Profile Line from Figure 1 & Average Sea Level

Water Moving into Gyre Center

Southern

High Latitudes

**S. Atl.**

**N. Atl.**

Northern

High Latitudes

**1.** \_\_Divergence\_\_\_ **2**.\_\_\_Convergence\_\_\_\_\_

**3. \_\_\_**Upwelling**\_\_\_\_\_ 4.\_\_\_**Downwelling**\_\_\_\_\_\_**

Short Answer/Essay Question:

Explain in a few sentences: (a) **where** the geographic regions of **highest primary productivity** are found and **why (think processes)**; and (b) **where** the location of the “**oceanographic deserts**” (very low primary productivity) are found and **why (think processes)**.