**Chapter 3: Environmental Systems**

Vocabulary

Module 6

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. Biosphere | 6. Anaerobic Respiration | 11. Tertiary Consumer | 16. Detrivore | 21. Standing Crop |
| 2. Producer | 7. Consumer/ Heterotroph | 12. Trophic Levels | 17. Decomposers | 22. Ecological Efficiency |
| 3. Photosynthesis | 8. Herbivore | 13. Food Chain | 18. Gross Primary Productivity (GPP) | 23. Trophic Pyramid |
| 4. Cellular Respiration | 9. Carnivore | 14. Food Web | 19. Net Primary Productivity (NPP) |  |
| 5. Aerobic Respiration | 10. Secondary Consumer | 15. Scavenger | 20. Biomass |  |

Module 7

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. Biogeochemical Cycle | 5. Runoff | 9. Nitrogen Cycle | 13. Mineralization | 17. Phosphorus Cycle |
| 2. Hydrologic Cycle | 6. Carbon Cycle | 10. Nitrogen Fixation | 14.Ammonification | 18. Algal Bloom |
| 3. Transpiration | 7. Macronutrient | 11. Nitrification | 15. Denitrification | 19. Hypoxic |
| 4. Evapo-transpiration | 8. Limiting Nutrient | 12. Assimilation | 16. Leaching | 20. Sulfur Cycle |

Module 8

|  |  |  |
| --- | --- | --- |
| 1. Disturbance | 3. Resistance | 5. Restoration Ecology |
| 2. Watershed | 4. Resilience | 6. Intermediate Disturbance Hypothesis |

**Reversing the Deforestation of Haiti**

1. Why was Haiti deforested?
2. Give one economic impact from the deforestation.
3. Give one ecological impact from the deforestation.

**Module 6: The Movement of Energy**

1. What is an ecosystem? Give 2 examples.
2. Why did scientists have to include land outside of Yellowstone ecosystem?
3. What is the equation for photosynthesis? Cellular respiration? What do you notice about the two equations?
4. What is the difference between a heterotroph and an autotroph?
5. Draw 2 food chains: one for a terrestrial ecosystem and one for an aquatic ecosystem (you do not have to draw the organism, but rather the words and arrows showing the movement of energy). What do the pointed arrows indicate?
6. Complete the following sentences by looking at Figure 6.6:
7. Grass is a primary producer because it performs…
8. A zebra is a primary consumer because it eats….
9. A lion is a secondary consumer because it eats…
10. A hyena is a scavenger because it eats….
11. A dung beetle is a detrivore because it eats…
12. Bacteria, fungus, and earthworms are decomposers because they…
13. Using Figure 6.8:
14. Which two continental ecosystems (terrestrial ecosystems) are the most productive?
15. Which three continental ecosystems are the least productive?
16. Which two marine ecosystems (ocean related) are most productive?
17. Which marine ecosystem is the least productive?
18. Which is the relationship between biomass and NPP?
19. Explain why a slow growing forest can have a very low NPP and yet store a massive amount of biomass.
20. Explain why algae in the ocean can have a very high NPP and a very low amount of stored biomass.
21. Explain why a vegetarian diet is much more ecologically efficient than an omnivorous diet.

**Module 6 AP Review Questions**

1. 2. 3. 4. 5. 6.

**Module 7: The Movement of Matter**

In cycles there are reservoirs (also called pools) and flows (also called processes). Matter is stored in reservoirs; flows are when matter is moved from one reservoir to another.

**1. The Hydrologic Cycle**: The water cycle is driven by GRAVITY and SOLAR ENERGY. All steps in the water cycle that flow downward are driven by gravity. All steps in the water cycle that flow upwards are driven by solar energy.

a. List three examples of reservoirs in the water cycle (places where water is stored).

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b. Briefly explain the following steps in the water cycle (flows). Include whether it is driven by solar energy or by gravity.

1. Evaporation –
2. Condensation –
3. Precipitation –
4. Transpiration –
5. Runoff -

c. What three things can happen to water that falls on land?

d. Name four ways humans alter the water cycle. Be sure to include how the change impacts the water cycle.

1.

2.

3.

4.

1. **The Carbon Cycle** - As Carbon is the basis of life, this cycle is extremely important. For environmental scientists, it is also very important because the carbon cycle helps us understand global climate change by helping us understand where excess CO2 in the atmosphere might end up and how we might be able to increase storage in reservoirs besides the atmosphere.

a. List three examples of carbon reservoirs (places where carbon is stored). Label whether the reservoir stores carbon for a short while or for a long while.

1.

2.

3.

b. Fill in the following chart for the carbon cycle

|  |  |  |  |
| --- | --- | --- | --- |
| **Flow** | **Description** | **Performed by** | **Why is this step important?** |
| ***Photosynthesis*** | *Atmospheric CO2 is converted into sugars* | *Autotrophs* | *Converts abiotic CO2 to biomass (base of food chain)* |
| **Respiration** includes decomposition |  |  |  |
| **Exchange** also called diffusion or flux |  |  |  |
| **Sedimentation** |  |  |  |
| **Extraction** |  |  |  |
| **Combustion** |  |  |  |

c. Name two ways humans alter the carbon cycle. Be sure to include how the change impacts the carbon cycle.

1.

2.

1. **The Nitrogen Cycle** - this is the trickiest cycle to learn, but frequently appears on the AP exam, so be sure you know it! It is a critical cycle because most of the nitrogen on earth is stored in the atmosphere, but plants can only absorb nitrogen through the soil. The nitrogen cycle allows atmospheric nitrogen to be converted into a form plants can use.
   1. Explain what is meant by a limiting nutrient. Why is nitrogen often a limiting nutrient?
   2. Where is most of the nitrogen on earth found? In what form? (provide the chemical formula and state)
   3. What two important macromolecules contain nitrogen?

d. Fill in the following chart:

|  |  |  |  |
| --- | --- | --- | --- |
| **Name of Step** | **Chemical Change** | **Performed by** | **Why is this step important?** |
| Nitrogen Fixation | N2🡪NH3 or NO3 | Nitrogen fixing bacteria (ie in legume roots) OR fires/lightning OR fertilizer manufacturing | Puts N in the soil, making it available for plants |
| Nitrification |  |  |  |
| Assimilation |  |  |  |
| Ammonification |  |  |  |
| Denitrification |  |  |  |

1. **The Phosphorus Cycle** - The only things you need to know about the phosphorus cycle are:
   1. Plants need phosphorus in the form of phosphate (PO43-)
   2. Phosphorus does not cycle through the atmosphere
   3. Phosphorus is typically a limiting factor for plants (along with nitrogen)
   4. Excess phosphorus in aquatic ecosystems leads to eutrophication

1. **The Sulfur Cycle** - the only things you need to know about sulfur are:
   1. Hydrogen sulfide (H2S) is poisonous gas that smells like rotten eggs and comes from anaerobic decomposition.
   2. Sulfur dioxide (SO2) is a colorless gas that comes from burning coal and volcanoes
   3. Sulfuric Acid (H2SO4)is the main component of acid rain - forms when sulfur dioxide and water vapor mix in the atmosphere; often as a result of burning coal.
2. The sulfur cycle and phosphorous cycle operate similarly. What general processes & characteristics make them alike?
3. Which 2 macronutrients most frequently serve as limiting nutrients in ecosystems? Do terrestrial & aquatic ones differ?

**Module 7 AP Review Questions (pg. 90)**

1. 2. 3. 4. 5. 6. 7.

**Module 8: Responses to Disturbances**

1. What types of disturbances can pose a large threat to humanity?
2. Are all disturbances bad in an ecosystem? Explain.
3. What makes ecosystems resistant to disturbances? What factors do you think influence how resistant an ecosystem is?
4. In restoration ecology, why might it be challenging to return a damaged ecosystem to original its state/function?
5. Why do scientists often select watersheds as an area to study energy and matter flows in ecosystems?
6. What have researchers learned about biogeochemical cycles by studying the Hubbard Brook watersheds?
7. Suppose ecosystem A experiences few disruptions, ecosystem B experiences an intermediate level of disturbances, and ecosystem C experiences many disruptions, but all 3 have roughly equivalent NPP and stored biomass. Which ecosystem would you expect to have the highest resistance? Which would have the highest resiliency? Why?
8. What does the intermediate disturbance hypothesis tell us about nature's capacity to endure and respond to change?

WTS: Why do golf courses have “poor environmental reputations”, and how does ACSP address that?

**Module 8 AP Review Questions (pg. 95)**

1. 2. 3. 4. 5.

**Chapter 3 AP Environmental Science Practice Exam**

1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11.

12. 13. 14. 15. 16. 17. 18.