Name: _____ Date: _____ Block: _____

2.2

Nutrient Cycles in Ecosystems

Read pages 68 - 90 of BC Science 10 and complete the following.
*Starred questions are thinking questions... the answers are not found directly in the textbook.

PART A. INTRODUCTION TO NUTRIENT CYCLES (p.68 - 71)

1. The Earth's biosphere is like a sealed terrarium in which all _____ that support life and all _____ that are produced are constantly _____ within its boundaries.

2. What was the mission of the eight scientists who sealed themselves within Biosphere II in Arizona on September 26, 1991?

3. Like Earth's biosphere, Biosphere II was intended to be entirely self-sustaining and all chemicals and atoms had to be _____.

   What did Biosphere II contain?

5. What happened to the oxygen levels in Biosphere II?

6. What happened to the levels of carbon dioxide and nitrous oxide in Biosphere II?

7. What happened to insect populations in Biosphere II?

8. What happened to vertebrate species in Biosphere II?

9. What happened to the plant pollinators in Biosphere II?

10. What are nutrients?

11. What are nutrient stores?

12. What are nutrient cycles?

13. Nutrient cycles are nearly in balance, because, without _____, the amount of nutrients flowing into and out of nutrient stores is nearly the same.

14. Read the word connect on the sidebar of page 69.
    a) What does the pre-fix "giga" mean?
    b) What does the pre-fix "mega" mean?

15. Name at least six human activities that affect nutrient cycles.

16. How do these human activities affect nutrient cycles?

17. Which five nutrients are most important in living things?

18. Where are the elements carbon, hydrogen, and oxygen found in living things?

19. Where is the element nitrogen found in living things?

PART B: THE CARBON CYCLE (p.71 - 76)

1. All living things contain billions of carbon atoms in their _____.
2. Where is carbon stored in the short-term?
3. What part of the ocean contains long-term carbon stores?
4. When did long-term stores of carbon such as coal, oil, and gas form?
5. What is sedimentation?
6. What is carbonate?
7. Over time, what sedimentary rock does carbonate turn into?

8. According to the table on page 73, where is...

   a. the largest amount of carbon stores on Earth?

   b. the smallest amount of carbon stores on Earth?

9. Name 6 ways that carbon is cycled through ecosystems naturally.

10. What is photosynthesis?

11. Does photosynthesis trap carbon dioxide or release it?

12. What is cellular respiration?

13. Does cellular respiration trap carbon dioxide or release it?

    What is the role of decomposition in the carbon cycle?

15. The process of ocean _____ moves carbon throughout the world's oceans and pumps more carbon into the ocean.

16. Carbon dioxide is also released when a _____ erupts.

17. Carbon dioxide is also released from _____ trees and during forest _____.

PART C: HUMAN ACTIVITIES AND THE CARBON CYCLE (p.77)

1. Since the Industrial Revolution, around 1850, what has happened to the amount of carbon dioxide in the atmosphere?

2. This is because human activities that involve burning _____ _____ have reintroduced carbon intothe cycle that was removed long ago.

3. Carbon dioxide is a _____ gas, and contributes to climate change.

4. Other human activities such as clearing land for _____ and expansion of _____ reduces the total amount of carbon taken from the atmosphere.

PART D: SUMMARY OF THE CARBON CYCLE

In the space below, draw a simplified version of the carbon cycle. (see fig. 2.27, page 76)

PART E: THE NITROGEN CYCLE (p.78 - 82)

1. In all living things, nitrogen is an important component of _____ and _____.
2. In plants, nitrogen is important for _____.
3. The largest nitrogen store is the _____, which contains _____% nitrogen.
4. What is nitrogen fixation?

5. Is atmospheric nitrogen (N_2) useable by plants?

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6. What two forms of nitrogen are useable by plants?

7. Lightning can convert nitrogen gas (N_2) into nitrates and other nitrogen-containing compounds. Is a large amount or a small amount converted in this way?

In the soil, nitrogen-fixing bacteria can convert nitrogen gas (N_2) into _____.

9. What plants to *Rhizobium* bacteria live in?

10. What is one tree species that is important to nitrogen fixation?

11. What type of bacteria fix nitrogen in aquatic ecosystems?

12. What is nitrification?

13. What are the two stages of nitrification?

    a.

    b.

14. Other types of decomposer bacteria and fungi are able to convert nitrogen found in DNA and proteins back into _____.

15. What is denitrification?

16. Other than by denitrifying bacteria, what is another way that nitrogen is returned to the atmosphere?

17. Excess nitrate and ammonium eventually settle to _____, _____, or _____ bottoms in sediments, and eventually form rock.

PART F: HUMAN ACTIVITIES AND THE NITROGEN CYCLE (P.82 - 83)

1. Human activities have _____ the available nitrogen in the biosphere over the last 50 years.

2. Millions of tonnes of nitrogen oxide (NO) and nitrogen dioxide (NO_2) result from the combusion of _____ _____.

3. Clearing _____ and _____ by burning also releases trapped nitrogen.

4. Acid rain is formed when dissolved nitrogen compounds mix in clouds and fall to Earth as _____ acid. (HNO_3)

5. The use of chemical _____ has grown rapidly, especially since the 1940's, to meet the demands of a growing human population.

6. Chemical fertilizers contain nitrogen that is made through _____ processes that fix atmospheric nitrogen.

7. When fertilizers are used, some of the excess _____ (in the form of ammonium or nitrate) washes from the soil. This is called leaching.

8. This run-off water, containing the excess nitrogen, enters _____ and _____.

9. Define eutrophication.

10. What happens to algae in a lake that is nitrogen-rich?

11. Why is excessive algae growth bad?

PART 6: SUMMARY OF THE NITROGEN CYCLE

In the space below, draw a simplified version of the nitrogen cycle. (see fig. 2.37, page 81)

PART H: THE PHOSPHOROUS CYCLE. (p.83-86)

1. Phosphorous is essential for a variety of life processes in both _____ and _____.
2. In plants, phosphorous is important for _____ development, _____ strength, and _____ production.
3. In humans, a large amount of phosphorous is in the _____.
4. Phosphorous is NOT found in the atmosphere... it is trapped in phosphate that makes up phosphate _____ and the sediments of ocean floors.
5. What is weathering?

6. Weathering releases _____ into the soil.
7. On land, plants quickly take up phosphate through their _____ and animals obtain phosphate by eating the _____.

8. Most phosphate from run-off settles on lake bottoms and ocean bottoms, forms sediments and eventually becomes _____ rock. In this way, the phosphorous will remain trapped for _____ of years.
9. What is geologic uplift?

10. Why is geologic uplift important to the phosphate cycle?

PART I: HUMAN ACTIVITIES AND THE PHOSPHOROUS CYCLE (p.85 - 86)

1. Why is phosphate rock mined in North America?

2. Commercial _____, phosphate-containing _____, animal _____ from livestock farming, some _____ waste, and untreated human _____ all enter waterways and contribute excess phosphate.
3. Why is too much phosphorous in an ecosystem bad?

4. Why is the "slash-and-burn" method of forest-clearing bad?

PART J: SUMMARY OF THE PHOSPHOROUS CYCLE

In the space below, draw a simplified version of the phosphorous cycle. (see fig. 2.46, page 85)

PART K: NUTRIENT CYCLES AND BIODIVERSITY (P. 86-87)

1. Changes in _____, _____, and _____ cycles can affect the health and variety of organisms in an ecosystem.
2. An _____ or a _____ ___ nutrients in an ecosystem can alter the conditions necessary for life.
3. Changes in the carbon cycle are contributing to _____ change. In B.C., changes in river temperature have a serious impact on Fraser River _____ populations. Warmer than normal river temperatures can reduce the ability of these salmon to _____. If fewer salmon are available, the entire food web will be impacted, and biodiversity will decrease.
4. Increased levels of nitrogen can also affect _____ diversity in both terrestrial and aquatic ecosystems. Plants that are adapted to increased nitrogen levels can _____ species that are not. For example, _____ grows well in nitrogen-rich environments, and can outgrow tree seedlings.