Water Quality - Division C Condensed Key

Boca Raton Placement Exam 2020

Written by Sophia Velasco, University of Florida

Instructions and Clarifications:

- You have **50** minutes to finish this exam.
- This exam will be worth **95%** of your overall score. There will be a dry lab involving a salinometer instead of a wetlab. The dry lab will be worth **5%** of your overall score.
- Anything written on the exam will **not** be graded. Only the **answer sheet** will be graded.
- If you have any questions or comments about this exam, feel free to email me at **velasco.scienceolympiad@gmail.com. Happy testing!**

Part I: Marine and Estuary

Multiple Choice

1. F
2. B
3. D
4. C
5. E
6. E
7. D
8. C
9. A
10. E
11. D
12. F
13. C
14. B
15. E
16. C
17. A
18. F
19. C
20. B
21. C
22. E
23. E
24. B
25. D
26. E
27. E
28. D
29. B
30. A

Identification

1. European green crab
2. Zebra mussels
3. Northern snakehead
4. Lionfish (Pterois volitans)
5. Sea lamprey
6. Asian carp

Short Answer

1.
    a. Amount of dissolved gas: cold water can hold more dissolved gas.
    b. Rate of photosynthesis by algae and aquatic plants
    c. Metabolic rates of aquatic organisms (increased respiration, digestion, etc.)
    d. Organisms becoming more sensitive (increased levels of stress, increased vulnerability to disease, parasites, pollution, etc.)
2.
    a. Atmosphere
    b. Photosynthesis by algae and plants
3. Diel is the 24-hour period that includes a day and adjoining night. Photosynthesis stops and respiration continues when the sun sets. Because of this, DO levels drop naturally overnight , reaching their lowest level just before dawn , when the sun rises and photosynthesis adds more DO into the water . Extensive algal growth could lead to large oxygen fluctuations from late afternoon to early morning. . Really low DO levels can lead to aquatic animal death.
4. PO_4
5. Phosphorus; it is less prevalent in surface water than nitrogen.
6. Give two points for any two of the following examples below.
    a. Septic systems
    b. Wastewater from sewage treatment plants
    c. Runoff from feedlots and from the application of animal wastes on fields
    d. Runoff of commercial fertilizer from crop fields, lawns, golf courses or parks.

7. Give 1 point for example. Give 1 point for description. There should be a maximum of 4 points in this question. Do not give credit for more than two examples and descriptions.

    a. Organic waste: includes human, animal, and plate waste. Comes from sewage treatment plants, malfunctioning septum systems, or manure runoff from animal operations. Organic wastes stimulate aquatic plant and algal growth. These plants and algae die eventually, contributing to more organic waste.
    b. Urban runoff: rain carries heat, salt, sediments and other pollutants into streams. As a result, water temperatures increases and the amount of total solids in the water increases. The amount of DO that the water can hold decreases.
    c. Dams: deceases oxygen level in water at damms. When water is released from the top of a dam or spillway, there can be an excessive air uptake from the atmosphere and result in water that has too much atmospheric gas.
    d. Removal of vegetation in the riparian corridor: Less shade leads to increased water temperature and a decreased protection from erosion. This also leads to increased suspended solids that contribute to decreased DO levels in the body of water affected.
8. NH_3 and NO_3 (ammonia and nitrate)
9. Give two points for the correct reactants. Give two points for the correct products. GIve one point for the arrow pointing to the right.

$$NH_3 + O_2 \rightarrow NO_2 + O_2 = NO_3$$

10. Give two points for any two of the following examples below.
    a. Poorly functioning septic systems
    b. Inadequately treated wastewater from sewage treatment plants
    c. Storm drains
    d. Runoff from feedlots
    a. Runoff from crop fields, parks, and lawns

Part II: Microflora and Fauna Identification

1. *Stenopus hispidus.* Global
2. *Diadema setosum.* Global
3. *Thelenota ananas.* Indo-Pacific
4. *Epinephelus striatus.* Atlantic
5. *Cyphoma gibbosum.* Atlantic
6. *Tridacna gigas.* Indo-Pacific
7. *Lutjanidae.* Global
8. *Scarus frenatus.* Global
9. *Charonia tritonis*. Global
10. *Acanthaster planci.* Global
11. *Haemulidae*. Global
12. *Lates calcarifer*. Indo-Pacific

Part III: Water Monitoring and Analysis

1. Give two points for each sentence answered. The maximum points in this section is 18 points. This section is the dry lab section of the exam, so when calculating the overall mark, use the formula listed to consider the weight of this section: 0.05 x points earned. After that, add this to the rest of the test: .95 x points earned in the rest of the exam. Add the points together for the adjusted overall score.

    1. Create a ball of modeling clay around one end of the straw.
    2. Make sure that the clay prevents water from leaking inside the straw.
    3. Do not form pits or voids inside the clay that can trap air.
    4. Fill the container with water and then place the straw (clay covered end submerged first).
    5. Add or remove clay until the straw floats at the maximum depth you wish.
    6. Use the permanent marker to mark the depth where the salinometer floats in the water (0% salt solution).
    7. Mix a saltwater solution to use for calibration (10% for example).
    8. Place the salinometer inside the saltwater solution and mark the level where it floats.
    9. Repeat this process for other concentrations to improve the accuracy of your salinometer.
2.
    a. As water flow increases, turbidity levels increase.
    b. Suspended
    c. Suspended
    d. Increase in rainfall will cause an increase in turbidity due to increased water flow and increased sediment from runoff.

3.
    a. 1
    b. 20 or less
    c. Dilution method (1) and manometric method (1)
    d. Give four points for each equation. No partial credit will be given.

- Unseeded: $\mathrm{BOD}_5 = \dfrac{(D_0 - D_5)}{P}$
- Seeded: $\mathrm{BOD}_5 = \dfrac{(D_0 - D_5) - (B_0 - B_5)f}{P}$

e. Give two points for any of the following: *Trichosporon cutaneum, Bacillus cereus, Klebsiella oxytoca, Pseudomonas sp*