UFSO

SCIENCE OLYMPIAD
AT THE
UNIVERSITY OF FLORIDA

Northern Regional: January 19th, 2019

Water Quality C Answer Key

Name(s): _____

Team Name: _____

School Name: _____

Team Number: _____

Rank: _____

Score: _____

Section 1

Station 1 (20)
1. B (1)
2. Floc (2)
3. A, E, B, D, C (5)
4. Possible answers include, but are not limited to (one point per each correct response): pet waste, salt, fertilizer, pesticides (nitrates, phosphates), oil and grease, litter, excess soil and other pollutants. (4)
5. C (1)
6. Eutrophication (2)
7. Possible answers include, but are not limited to (one point per each correct response): algae, water lilies, cattails, duckweed, and phytoplankton. (4)
8. D (1)

Station 2 (25)
1. Flow of the water, amount of light, temperature or climate, and chemistry of the river (4)
2. Chondrichthyes,Chondrichthyes,Osteichthyes,Osteichthyes,Agnatha (5)
3. True (1)
4. C (1)
5. Tolerate a wide range of environmental conditions, reproduce early, often, in large numbers, and in multiple ways,grow rapidly, resist management control efforts (4)
6. A,C,E (3)
7. Ephemeroptera,plecoptera,odonata,trichoptera (4)
8. Lentic, Lotic (2)
9. D (1)

Station 3 (20)
1.
a. Iteroparous (1)
b. See image below; optimal RE is when the difference between offspring produced and offspring forgone is at a maximum. (3)
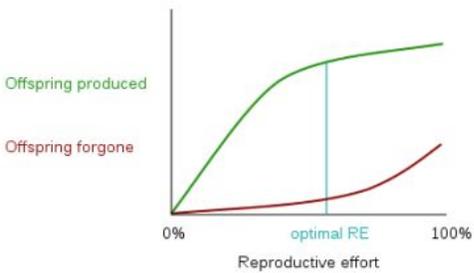
c. False (1)

d. K (1)

2. (see below)

a. Sorensen's coefficient is 2a/(b + c) where a is the number of species in common between x and y, b is the number of species in x, and c is the number of species in y. Thus, Sorenson's coefficient is 0.57. (2)

b. The minimum value is 0, indicating no similarity; the maximum value is 1, indicating maximum similarity. (2)

c. Simpson's index (D) is the sum of pi 2 , and Simpson's index of diversity is 1 - D. For x this is 0.64 (1 point) and for y this is 0.71 (1 point). It is not appropriate to compare the two values due to the small sample size and because not all of the species in each community are represented in the table (explanation must be provided for 1 point to be awarded) (3)

3. (see below)

a. Blackwater river (as opposed to whitewater) (1)

b. In slow-moving water, as vegetation decays, tannins leach into the water, making the water darkly stained and acidic (3)

c. Lower; less; lower (3)

Station 4 (15)

1. (see below)

a. Limestone (calcium carbonate, $CaCO_3$) in lake beds forms bicarbonate (HCO_3^-) ions in the reaction $CaCO_3 \rightleftharpoons Ca^{2+} + CO_3^{2-}$.

Note: if an equilibrium arrow is not present, subtract 0.5 points. State symbols are not required. (2)

b. $CO_3^{2-} + H^+ \rightarrow HCO_3^-$; $HCO_3^- + H^+ \rightarrow H_2CO_3$. Note: accept H_3O^+ instead of H^+ if H_2O is added on the product side. If an equilibrium arrow is present, no points. Both reactions must be present for any credit to be received. (1)

c. $CO_2 + H_2O \rightleftharpoons H_2CO_3$. Note: if the equilibrium arrow is not present, no points. (1)

d. Because Ka_2 is so much smaller than Ka_1 , we can safely ignore the equilibrium calculation for Ka_2 . If x = final concentration of H^+ = final concentration of HCO_3^- , then 4.3e-7 = x^2 /(1 - x). If we substitute 0 for x in the denominator because x is miniscule in comparison to 1M, then 4.3e-7 = x^2 and x = 6.6e-4M. pH = $-\log[H^+]$ = 3.18 or thereabouts (accept anything between 2.5 and 3.5). Note: if no work is shown, give no credit. If pH = -log(1) is shown, give one point (although it is incorrect). For each correct equilibrium equation shown, give one point. (5)

2. (see below)
    a. Canopy interception (1)
    b. Advection (1)
    c. Subsurface flow (1)

3. A, E, F (3)

Section 2

Station 5 (27)
    1. A (1)
    2. B (1)
    3. D (1)
    4. D (1)
    5. A (1)
    6. B (1)

    7. D (1)
    8. A (1)
    9. A (1)
    10. D (1)

    11. B (1)
    12. B (1)
    13. A (1)
    14. A (1)
    15. B (1)

16. B (1)
17. A (1)
18. A (1)
19. B (1)
20. A (1)
21. B (1)
22. A (1)
23. B (1)

24. D (1)
25. C (1)
26. A (1)
27. B (1)

Station 6 (16)
1. Predation, parasitism, competition, introduction of new pathogens, genetic, habitat alterations. (1 point each, 6 points maximum)
2. Industrial water users, municipal water supplies, nuclear power plants, commercial fisheries, recreational fishing, shipping. (1 point each, 6 points maximum)
3. Disease epidemics, West Nile Virus, cholera risks, parasites. (1 point each, 4 points maximum)

Station 7 (31)
1.
   a. Dobsonfly (1)
   b. 7 days. (3 points for 7 days exactly, 2 points for 3 days - 2 weeks, 1 point for 1 day - 1 month)
   c. Largest (1)
2.
   a. Annelids (1)
   b. Eat large quantities of mud and filter organic matter from it. (2 points for both parts of answer
   c. Hermaphroditic. (1)
3.
   a. Mosquito (1)
   b. Wigglers, wrigglers (2)
   c. Males feed only on plants. Females bite animals and feed on blood. (2)

4.
    a. Bythotrephes longimanus (1)

    b. Secondary consumer (1)

    c. Daphina zooplankton (1)

    d. Can eliminate zooplankton species (1); zooplankton are the backbone of aquatic food chains (1). Note: discussion of how it competes with fish of the same trophic level is also acceptable for 1 point.

5.
    a. Dreissena polymorpha (1)

    b. Through byssal threads (that come out of their dorsal side; optional) (1)

    c. Any two of the following: damage harbors/waterways, ships/boats, water treatment plants; cling to pipes underwater and clog them (2)

    d. Filter feeding; can increase water clarity, but the increased penetration of sunlight results in the growth of submerged macrophytes, which causes water quality problems when the macrophytes decay (3)

6.
    a. *Psephenus* (also accept *Ectoparia*) (1)

    b. It cannot live in habitats where rocks acquire a thick layer of algae, fungi, or sediment (2)

    c. 6-10 mm (1)

Section 3
Station 8 (11)
1. More, increases, increases (3)
2. meter/probe/paper, 8-9, 4-6 (3)
3. Turbidity (1)
4.

a. Gas chromatography–mass spectrometry (1)
b. Atomic fluorescence spectroscopy (1)
c. Electrical conductivity meter (1)

5. A - magnesium (1)

Station 9 (20)
1. B- carp, catfish (1)
2. 1 point for saying run-off. Additional point for specifying agricultural/fertilizer, biodegradable waste, or chemical. (3 points maximum)

3. Seasonal temperature changes, dissolved or suspended solids, dry periods, amount of plant life/photosynthesis rate changes, rate of plant/animal respiration, rate of decomposition of organic matter, algal blooms, daily or seasonal light level change. (1 point each, 8 points maximum)
4. Dumping organic waste, urban runoff, dams, manipulating vegetation. (1 point each, 4 points maximum)
5. Adsorption, electrodialysis, ion exchange, reverse osmosis (1 point each, 4 points maximum)