



Exploring the World of Science

University of Michigan Science Olympiad
2021 Invitational Tournament

Water Quality C

Test length: 50 Minutes

Team name: _____ **Team number:** _____

Student names: _____

Instructions (shown before students start the test)

Welcome to the University of Michigan 2021 Invitational Division C Water Quality test! Make sure you have a stable internet connection and are ready to compete!

For this test, you are allowed the following resources:

A Google Meet/Zoom/Skype/Phone/Video call with your partner

A cheat sheet/binder, printed or in pdf format on your computer

Non-programmable calculator

Scratch paper

You MAY NOT take advantage of the following resources: ANY internet resource, help from any person other than your partner, a printed version of the test.

Introduction (shown after students start the test)

This test consists of 72 questions and you will have 50 minutes to complete it.

The Tiebreakers for this test will be:

#21

#22

#29

#36

#40

#47

#61

#62

#65

#71

If you experience technical difficulties during the test:

Immediately contact the event supervisor through the classroom feature on Scilympiad, stating clearly what issue you are having.

If your work is not saving/submitting, take screenshots of your answers on Scilympiad and submit them to this google form (<https://docs.google.com/forms/d/19cRQLafN7EARRS7tZHC-8HOCt4B1F-4fYOSiiON1kro/>)

Try to stay within your allotted 50 minutes.

1. (2.00 pts) In the water cycle, where are the two places the water goes once the precipitation reaches the ground?

2. (3.00 pts) List three factors that affect infiltration.

3. (1.00 pts)

In the potable water treatment process, the first steps are coagulation and flocculation. Positively charged chemicals are added to water to neutralize the negative charge of particles in the water. What is the name of the metal hydroxides produced when the positively charged chemicals bind with the particles?

4.(1.00 pts) How do impervious surfaces such as road and parking lots affect watersheds?

- ☐ A) Longer food chains
- ☐ B) Shorter food chains
- ☐ C) Inconsistency in dietary data
- ☐ D) Overfishing

6.(2.00 pts) Describe two different ways to help stop the spread of garbage patches.

7.(1.00 pts) Which of the following is a possible depth where a long-spined black sea urchin could live at in a coral reef?

- ☐ A) 0.5 meters
- ☐ B) 5 meters
- ☐ C) 20 meters
- ☐ D) 25 meters

8.(2.00 pts) Why does the Humphead Wrasse have a very slow breeding rate?

9.(1.00 pts) What is the common name of the following organism?



10. (1.00 pts) What is the most common food these organisms from #9 eat in the **spring**?

11. (1.00 pts) What is the most common food these organisms from #9 eat in the **winter**?

12. (1.00 pts) Identify the following organism by its common name.



13. (1.00 pts) In what months does this organism from #12 spawn in?

(Mark **ALL** correct answers)

- ☐ A) January
- ☐ B) March
- ☐ C) April
- ☐ D) May
- ☐ E) August
- ☐ F) December

14. (1.00 pts) Adults of the organism from #12 only eat fish.

☐ True ☐ False

15. (1.00 pts) The juveniles of this species below live rather solitary lives.



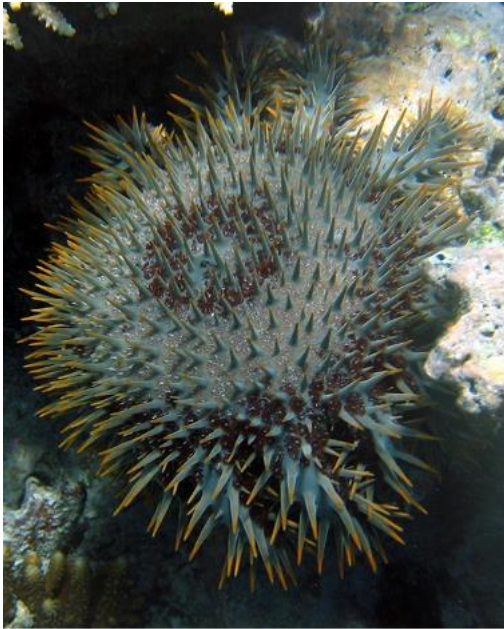
☐ True ☐ False

16. (1.00 pts) What is the common name of this species?



17. (1.00 pts) In regards to the species from question #16, describe the feeding behavior.

18. (1.00 pts) What is the common name of this species?



19. (1.00 pts) What is the primary sink for phosphorus in the ocean?

20. (1.00 pts) Why is phosphorus limiting in marine ecosystems?

21. (2.00 pts)

Suppose you obtain 200mg of dried residue from a 400mL sample. Calculate the number of total solids per liter that are in this sample. Units are mg. Show all work for full credit.

22. (3.00 pts)

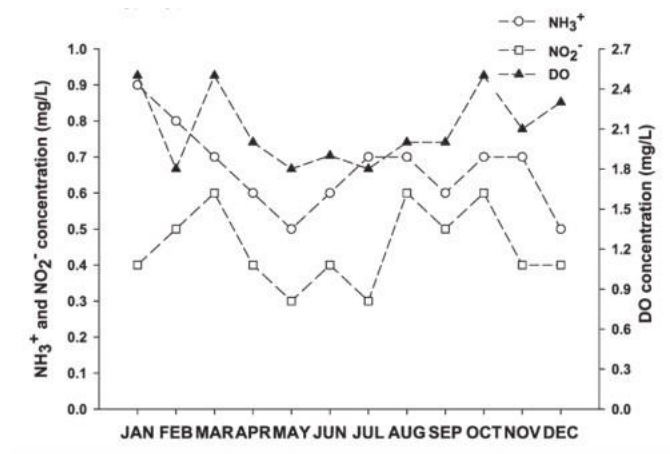
A Secchi disk is dropped into a turbid body of water at a depth of 5ft. In meters, approximately how deep will photosynthesis be able to occur. Explain your answer.

23. (4.00 pts) List and describe two different methods for measuring the turbidity of water.

24. (1.00 pts) What happens to the amount of phosphate ions when phosphorus is removed from sewage?

25. (1.00 pts) What is the term that describes the condition of water with dissolved oxygen levels lower than 1mg/L?

26. (2.00 pts) According to the graph below, is the DO concentration in February considered anoxic? Explain.



27. (1.00 pts) The sodium chloride content in the ocean is 5%.

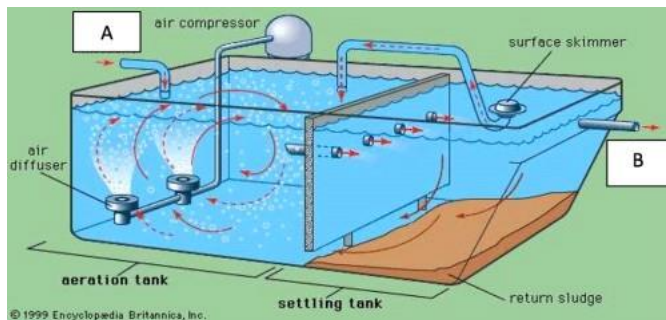
☐ True ☐ False

28. (1.00 pts) Are aeration and disinfection a part of the secondary or primary treatment process?

☐ A) Primary
☐ B) Secondary

29. (1.00 pts) In wastewater treatment, what is the name of the “tank” that is filled with a bed of stones where settled sewage is sprayed on top of?

30. (2.00 pts) The photo below is a diagram of a prefabricated package plant for the aeration treatment of small sewage flows. Label A and B.



31. (1.00 pts) The process of Nitrification-Dentrification involves the conversion of ammonia nitrogen into nitrites by macroorganisms.

☐ True ☐ False

32. (2.00 pts) Where does primary sludge come from?

33. (3.00 pts) List three places where autotrophs can get inorganic nutrients from to later convert them into organic compounds.

34. (1.00 pts) Interspecific competition occurs between members of the same species.

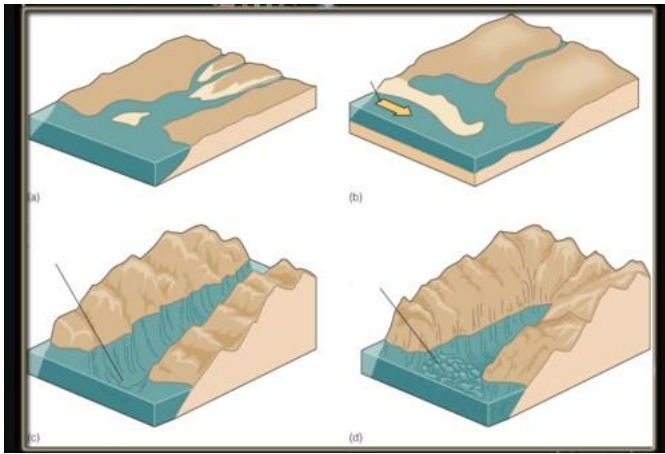
☐ True ☐ False

35. (1.00 pts) Combined sewage overflows is the greatest source of viral and bacterial contamination in estuaries.

☐ True ☐ False

36. (2.00 pts) Fjord and salt-wedge estuaries are classified differently based on their_____.

37. (4.00 pts) Name the 4 types of estuaries shown in the photo below.



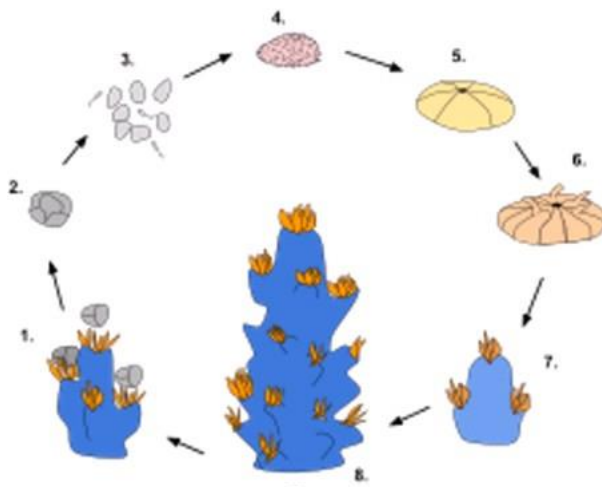
38. (1.00 pts) Anaerobic bacteria and fungi are present in anaerobic sludge digesters.

☐ True ☐ False

39. (2.00 pts) What is wrong with the coral in the following image and why?



40. (2.00 pts) The following photo shows the life cycle of corals by sexual reproduction. Explain what is happening at #1.



41.(2.00 pts) In the same diagram from question #40, explain what is happening at step 6.

42.(1.00 pts) What is the common name of the species shown below?



43.(1.00 pts) What does the overabundance of the species from question #42 indicate?

44. (2.00 pts) Is the species from question #42 more abundant in tropical or temperate waters? Why?

45. (1.00 pts) What organism uses its three pairs of claws to remove parasites and fungi from fish?

46. (1.00 pts) The species from question #45 lives above the intertidal zone.

☐ True ☐ False

47. (1.00 pts) How many larval stages does the species from question #45 have?

48. (1.00 pts) Do dissolved oxygen levels in a body of water increase or decrease overnight?

☐ A) Increase
☐ B) Decrease

49. (1.00 pts) The species that are known to live for around 30 years and are protogynous hermaphrodites are called_____.

50. (1.00 pts) The addition of additional nitrogen and phosphorus to aquatic systems will

☐ A) Increase algae and decrease O₂.

- ☐ B) Increase O₂ and decrease algae
- ☐ C) Increase the number of fish
- ☐ D) Decrease productivity

51.(1.00 pts) Generally, daily pH cycles peak

- ☐ A) In the morning
- ☐ B) In the evening
- ☐ C) At Noon
- ☐ D) At night

52.(1.00 pts) Which holds the most dissolved oxygen?

- ☐ A) Water at 50°C
- ☐ B) Water at 0°C
- ☐ C) Water at 10.0°C
- ☐ D) Water at 7°C

53.(1.00 pts) The best pH sampling procedure is to collect the water sample a

- ☐ A) At the surface of the riverbank
- ☐ B) Just above the bottom of the river
- ☐ C) Away from the riverbank and below the surface
- ☐ D) It does not matter where you collect the sample

54.(1.00 pts) Which of the following is decreased by the breakdown of organic waste?

- ☐ A) Salinity
- ☐ B) Total Suspended Solids
- ☐ C) Acidity
- ☐ D) Dissolved Oxygen

55.(3.00 pts) List three other names for estuaries.

56.(1.00 pts) What trophic level contains secondary consumers?

57. (2.00 pts) Explain why linear food chains are rare in nature.

58. (2.00 pts) Describe what is happening in the photo below.



59. (2.00 pts) Describe the domino effect in a food web.

60. (1.00 pts) Which type(s) of organisms make up the first trophic level in a food web?

- ☐ A) Producers
- ☐ B) Autotrophs
- ☐ C) Primary Consumers
- ☐ D) A and B

61. (1.00 pts) What cells contain toxins which are used for catching prey?

- ☐ A) Nematocysts
- ☐ B) Mesoglea
- ☐ C) Coenosarcs

☐ D) Theca

62. (1.00 pts) What is the highest point of a reef?

63. (1.00 pts) The name of the chemical that is often used to stun live fish and can potentially kill coral reefs is _____.

64. (1.00 pts) Estuaries usually have lower levels of phosphorus compared to freshwater systems.

☐ True ☐ False

65. (1.00 pts) Algae can affect the pH of a body of water.

☐ True ☐ False

66. (1.00 pts) Water is sampled from some unknown location. The salinity was measured to be 20 ppt. What type of water is this sample taken from?

67. (1.00 pts) From the question above, what is an example of body of water that this type of water could be taken from?

68. (1.00 pts) Which of the following is caused by an excess amount of phosphates in water?

- ☐ A) High oxygen
- ☐ B) Cloudy water
- ☐ C) Overpopulation
- ☐ D) Domino effect

69. (1.00 pts) Which of the following regions would you expect to have the highest biomass productivity?

- ☐ A) Coral reefs
- ☐ B) Oceans
- ☐ C) Salts and marshes
- ☐ D) They all have equal biomass productivity

70.(1.00 pts) Which statement about wastewater treatment processes is correct?

- ☐ A) Aeration is used in the removal of dissolved iron when present with small amounts of manganese.
- ☐ B) Sedimentation is the process used for the separation of solids.
- ☐ C) Filtration is used to remove particles from the water.
- ☐ D) All of the above

71.(1.00 pts) What is the name for stable manmade chemicals that have properties which allow them to repel both water and oil?

72.(1.00 pts) List one common type of freshwater harmful algal bloom.

Congratulations on completing the University of Michigan 2021 Invitational Division C Water Quality test!
