

Oceanography 320  
Mid-term Examination  
March 10, 2004

Name: \_\_\_\_\_

Social Security Number: \_\_\_\_\_

- 1) The ecological efficiency in a food chain is 15%. Pollutant X is transferred from one trophic level to the next with an efficiency of 60%. If the concentration of X on trophic level 2 is 8 parts per million (ppm), what would you expect the concentration of X to be
  - a) On trophic level 1?
  - b) On trophic level 4?
  
- 2) Which of the following is evidence that over geologic time photosynthesis has exceeded respiration?
  - a) Oxygen in the atmosphere
  - b) Coal deposits
  - c) Oil deposits
  - d) All of the above
  - e) None of the above
  
- 3) Ecological pyramids reflect the fact that
  - a) Respiration and excretion are in balance
  - b) Ecological efficiencies are less than 1
  - c) The ratio of photosynthesis to respiration is greater than 1
  - d) Substantial amounts of organic matter are produced by chemosynthesis
  
- 4) Which of the following kinds of organisms carries out secondary production?
  - a) Herbivores
  - b) Primary carnivores
  - c) Secondary carnivores
  - d) All of the above
  - e) None of the above
  
- 5) Which of the following would increase the critical depth?
  - a) Photoperiod (time from sunrise to sunset) becomes shorter
  - b) Depth of the mixed layer increases
  - c) Water becomes murky due to presence of suspended sediment
  - d) All of the above
  - e) None of the above

- 6) The depth of the euphotic zone is
- a) Deeper in the winter than in the summer
  - b) Shallower than the critical depth
  - c) Deeper in murky water than in clear water
  - d) All of the above
  - e) None of the above

Wastewater with a N:P ratio of 3 is being discharged into a lake. The N:P ratio of the algae in the lake is 15. What will happen to the algae in the lake if

- 7) The N in the wastewater is reduced by a factor of 10?
- a) Decreased by a factor of 10
  - b) Decreased by a factor of 5
  - c) Decreased by a factor of 2
  - d) No change
- 8) The P in the wastewater is reduced by a factor of 10?
- a) Decreased by a factor of 10
  - b) Decreased by a factor of 5
  - c) Decreased by a factor of 2
  - d) No change
- 9) The N in the wastewater is increased by a factor of 10?
- a) Increased by a factor of 10
  - b) Increased by a factor of 5
  - c) Increased by a factor of 2
  - d) No change
- 10) The P in the wastewater is increased by a factor of 10?
- a) Increased by a factor of 10
  - b) Increased by a factor of 5
  - c) Increased by a factor of 2
  - d) No change
- 11) Which of the following factors contribute to the fact that phosphorus tends to be more limiting to primary production in lakes and nitrogen tends to be more limiting in the ocean?
- a) The concentration of iron is higher in freshwater systems than in the ocean
  - b) P is recycled more efficiently than N from decomposing organic matter
  - c) The long residence time of bottom waters in the ocean allows denitrification, which is a slow process, to occur more efficiently than in lakes
  - d) All of the above
  - e) None of the above

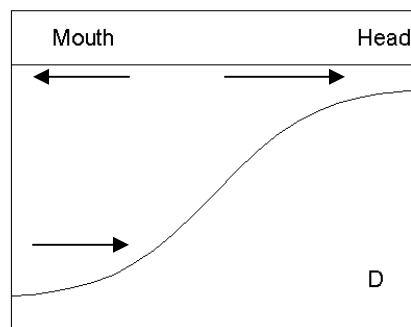
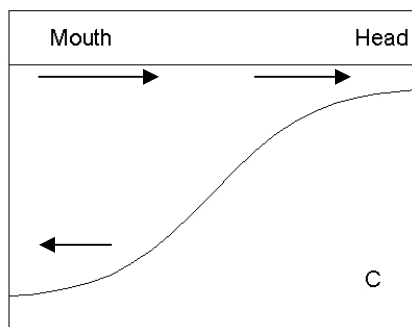
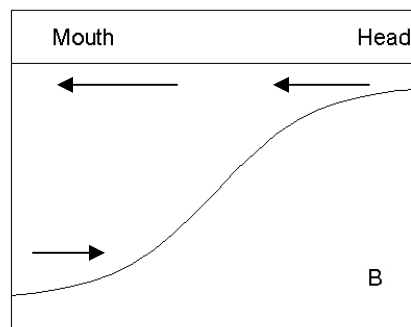
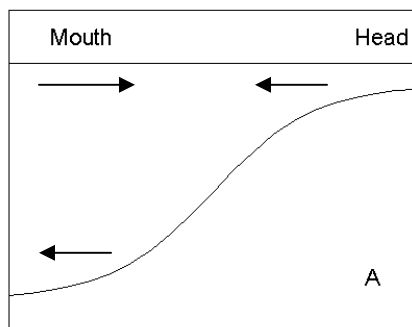
12) Overturning performs which **two** of the following important functions?

- a) Recharges the surface water with nutrients
- b) Recharges the bottom waters with nutrients
- c) Recharges the surface waters with oxygen
- d) Recharges the bottom waters with oxygen

13) The hypolimnion of a monomictic freshwater lake in Antarctica never freezes, and the lake overturns continuously during the summer when the water is being warmed. This information is sufficient to tell us that

- a) The temperature of the hypolimnion never drops below 4°C
- b) The temperature of the hypolimnion rises above 4°C in the summer and drops below 4°C in the winter
- c) The temperature of the hypolimnion is between 0°C and 4°C throughout the year.
- d) The surface of the lake never freezes.

14) Which of the figures below correctly depicts the pattern of circulation in an estuary?



- a. A
- b. B
- c. C
- d. D

15) Seasonal oxygen depletion problems are most likely to occur in which of the following kinds of lakes

- a) A deep lake in which the hypolimnion lies within the aphotic zone and is very large compared to the epilimnion (mixed layer).
- b) A lake of intermediate depth in which the hypolimnion lies within the aphotic zone and is small compared to the epilimnion.
- c) A shallow lake in which the entire water column is the epilimnion (the lake is mixed from top to bottom).

16) The fact that the volume of anoxic bottom water during the summer in the Chesapeake Bay is positively correlated with the flow of the Susquehanna River during April and May is attributed to which of the following?

- a) The Susquehanna River is a major source of nutrients to the bay
- b) The water column in the bay is more thermally stratified (i.e., the temperature gradient is steeper) when there is more inflow from the Susquehanna River
- c) The salinity gradient in the bay is steeper and hence the water column more stratified when there is more inflow from the Susquehanna River
- d) The oxygen concentration in the Susquehanna River is low because of nonpoint source pollution in the river's watershed

17) The citizens of Seattle voted to spend more than \$100 million to divert sewage discharges from Lake Washington to Puget Sound for which of the following reasons

- a) The water in the lake was murky
- b) The water in the lake was contaminated with pathogens
- c) There was a series of large fish kills in the lake
- d) The hypolimnion of the lake was becoming anoxic in the late summer

18) If you were interested in documenting the extent of water quality problems in Lake Washington as a result of the discharges of sewage to the lake, which one of the following combinations would make the most sense?

- a) Measure Secchi depths and inorganic nutrient concentrations in the summer
- b) Measure Secchi depths and inorganic nutrient concentrations in the winter
- c) Measure Secchi depths in the summer and inorganic nutrient concentrations in the winter
- d) Measure Secchi depths in the winter and inorganic nutrient concentrations in the summer

- 19) Following diversion of wastewater, the external loading rates of phosphorus to Lake Washington and Lake Sammamish were almost identical. Lake Sammamish continued to experience serious water quality problems, but Lake Washington did not. The explanation for the different response of the two lakes is
- The post-diversion loading rate of nitrogen was much higher to lake Sammamish than Lake Washington
  - Lake Sammamish is monomictic, and Lake Washington is dimictic
  - Lake Sammamish has a bigger surface area than Lake Washington
  - Lake Sammamish is shallower and has a much smaller hypolimnion than Lake Washington
- 20) During the time that sewage was being discharged into Kaneohe Bay, studies of the metabolic characteristics of the perimeter zones of coral reefs in the southeastern sector of the bay revealed that
- Both photosynthetic rates and respiration rates were higher than normal
  - Both photosynthetic rates and respiration rates were lower than normal
  - Photosynthetic rates were higher and respiration rates were lower than normal
  - Photosynthetic rates were lower and respiration rates were higher than normal
- 21) Between 1983 and 1990 the abundance of bubble algae on the Kaneohe Bay barrier reef increased. The most likely explanation for this is
- Leaky sewer lines, which have been inadequately maintained by the City
  - Overfishing of herbivorous fish on the reef
  - Introduction of nutrients from land runoff due to developments in the central and northern watersheds of the bay
  - The clarity of the water has improved following diversion of sewage from the bay
- 22) Which of the following is found in typical urban runoff at a concentration as high or higher than the concentration of the same substance in sanitary sewage
- Fecal coliform bacteria
  - Suspended solids
  - Inorganic nitrogen and phosphorus
  - BOD
- 23) Stranded filth is
- Fecal material that is not scoured out of the pipes in a combined sewer system during dry weather
  - Organic waste left on city streets as a result of inadequate/infrequent street sweeping
  - Garbage that is not picked up by a city's refuse division because it was not set out in time for pickup
  - Garbage set out in an insecure container and scattered by the wind or feral cats and dogs before it can be picked up

- 24) Sedimentation basins are **least** effective in retaining which one of the following kinds of particles
- a) silt
  - b) sand
  - c) pebbles
  - d) rocks
- 25) Eugene Dashiell argues that the cost of removing sediment from the Ala Wai Canal could be substantially reduced by widening and deepening the Manoa-Palolo drainage canal near its mouth so that it functioned as a sedimentation basin. The rationale behind this strategy is
- a) Erosion of the banks of the Manoa-Palolo drainage canal is responsible for most of the sediment that enters the Ala Wai Canal
  - b) The sedimentation basin could be an economic asset, because the City could charge admission to curious citizens who wanted to watch the sediment settle
  - c) Removing the sediment from the basin would not require a dredge mounted on a barge
  - d) The sediment would be less contaminated and could be disposed of safely in the ocean
- 26) A recent article in the Honolulu Advertiser concerned the unusually large amount of trash that washed into the Ala Wai Canal after a prolonged period of dry weather. This observation is an example of what phenomenon?
- 27) What percentage of suspended solids and BOD is primary sewage treatment required to remove?
- 28) What percentage of suspended solids and BOD is secondary sewage treatment required to remove?
- 29) If a primary sewage treatment plant is removing 60% of the suspended solids from the wastewater entering the plant, what percentage of the BOD is it probably removing?
- a) 10%
  - b) 30%
  - c) 60%
  - d) 80%

- 30) What are the two principal factors that limit land application of the liquid portion of sewage effluent to the land?
- 31) What is the principal factor that limits land application of sewage sludge?
- 32) Which one of the following genera of bacteria contains a species that causes typhoid fever?
- a) Vibrio
  - b) Salmonella
  - c) Shigella
  - d) Campylobacter
- 33) Which of the following pathogens is most easily killed by chlorination
- a) Salmonella
  - b) Giardia lamblia
  - c) Cryptosporidium parvum
  - d) Hepatitis A virus
- 34) Why do public health authorities feel that Enterococcus is not a useful indicator of fecal pollution in Hawaii
- 35) Chlorine can react with organic compounds in water to form chlorinated organics, some of which are carcinogenic. Given this fact, why are public water supplies (i.e., drinking water) disinfected with chlorine rather than ultraviolet light?
- a) Chlorine does a better job of penetrating particles
  - b) Ultraviolet light is more expensive
  - c) Chlorine does a better job of killing viruses
  - d) With chlorine one can maintain a residual of killing power in the distribution system

36) The following information is available for pollutant Y:

Final acute value 12 ppm

Final chronic value 5 ppm

Final plant value 3 ppm

Given this information, what would be the

- a) criterion maximum concentration for pollutant Y
- b) criterion continuous concentration for pollutant Y

37) Complete the table below

	concentration	96-hr TLM	Acute/chronic ratio	Acute toxicity units	Chronic toxicity units
X	10	40	5		
Y	20	200	6		
Z	30	150	4		

38) Based on your calculations in question 3, would you expect this water to exert a chronic stress if

- a. The interaction of X, Y, and Z is strictly additive
- b. There is no interaction between X, Y, and Z

39) Correct the grammar/punctuation/spelling errors in the following sentences:

- a) The disease is caused by a bacterium which is transmitted by mammal urine.
- b) Waikiki is a place of beauty where visitors and residence can stroll along walkways or sit and relax.
- c) If the Manoa-Palolo Canal was used as a sedimentation basin the maintenance cost of dredging would decrease.
- d) The dredge spoil was placed along side the canal.

40) Correct the grammar/punctuation/spelling errors in the following sentences:

- a) A reduction of metals can be obtained by installation of nonmetallic break pads.
- b) The water is not very deep in the Ala Wai yet one is not able to clearly see the bottom.
- c) The Kapahulu exit of the canal was continual blocked by sand.
- d) The odor of dying phytoplankton is admitted from the canal.