

Question 1: Design an Investigation**10 points**

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- (a) Based on the information in the diagram, **identify** the zone with the lowest level of dissolved oxygen. **1 point**
- Zone C/C
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- (b) Based on the information in the diagram, **describe** the relationship between biological oxygen demand and dissolved oxygen. **1 point**
- Accept one of the following:
- As biological oxygen demand increases, dissolved oxygen decreases.
 - As biological oxygen demand decreases, dissolved oxygen increases.
 - As dissolved oxygen increases, biological oxygen demand decreases.
 - As dissolved oxygen decreases, biological oxygen demand increases.
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- (c) Based on the information in the diagram, **identify** the zone where there is likely point-source water pollution discharged into the stream. **1 point**
- Zone B/B
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- (d) **Identify** the dependent variable in the researchers' investigation. **1 point**
- Accept one of the following:
- The number of macroinvertebrate species
 - Macroinvertebrate diversity
 - Macroinvertebrate species richness
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- (e) **Identify** a testable hypothesis for the researchers' investigation. **1 point**
- Accept one of the following:
- As dissolved oxygen levels increase, the number of macroinvertebrate species increases.
 - As dissolved oxygen levels decrease, the number of macroinvertebrate species increases.
 - There is a direct/inverse relationship between dissolved oxygen levels and the number of macroinvertebrate species.
 - There is no relationship between biological oxygen demand and macroinvertebrate biodiversity.
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(f)	Describe the reason the researchers selected zone A to serve as the control in the investigation.	1 point
	Accept one of the following: • Zone A/A/It is upstream from the source of pollution/organic waste/discharge/change. • Zone A/A/It would not be affected by the source of pollution/organic waste/discharge/change. • Zone A/A/It has levels of dissolved oxygen that are not impacted by the source of pollution/organic waste/discharge/change.	
(g)	Explain how the modification to collect data in the winter months could alter the results of the investigation.	1 point
	Accept one of the following: • Cold water will have more dissolved oxygen, which could increase the number of species. • Colder water may be below the range of tolerance for some of the organisms, which could decrease the number of species. • Lower light levels in the winter decrease plant activity/photosynthesis, which lowers dissolved oxygen levels, which could decrease the number of species.	
(h)	Describe the effect that the introduction of raw sewage into the stream could have on the population of bacteria in the stream.	1 point
	Accept one of the following: • Raw sewage contains nutrients that could increase the population of bacteria. • Raw sewage contains bacteria that could increase the population size.	
(i)	Identify an abiotic factor other than dissolved oxygen and organic pollution that could also influence the population size of bacteria in the stream.	1 point
	Accept one of the following: • Temperature • pH • Light/Sunlight • Turbidity/Sediment • Salinity • Nitrate/Phosphate	

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- (j) **Explain** how persistent organic pollutants can affect higher trophic levels in an aquatic food web. **1 point**
- Accept one of the following:
- Persistent organic pollutants/Pollutants can bioaccumulate in the tissues of organisms at higher trophic levels because they consume prey that have accumulated the pollutants.
 - Persistent organic pollutants/Pollutants can accumulate/concentrate in the tissues of organisms at higher trophic levels because they consume prey that have accumulated the pollutants.
 - Persistent organic pollutants/Pollutants can bioaccumulate in organisms at higher trophic levels because of higher fat content in their tissues.
 - Organisms at higher trophic levels can experience neurological toxicity because persistent organic pollutants bioaccumulate.
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Total for question 1 10 points