

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

- (a) Based on the information in the diagram, **identify** the zone with the lowest level of dissolved oxygen. **1 point**
- Zone C/C
- (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.
- (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
- (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
- (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.

- (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

- (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.

---

**Total for question 1 10 points**