

**Exemplar exam question – Option E**

- 1 This question is about dissolved oxygen in water.
- a Explain what is meant by the term **biochemical oxygen demand**. [2]
  - b Explain the difference between aerobic and anaerobic decomposition of organic matter in water, giving examples of the different products formed. [3]
  - c State what is meant by the term **eutrophication** and explain why eutrophication may be more common in a region where there is a lot of agricultural land. [3]
  - d Explain the effect on the oxygen content of water and the fish population of a power station discharging coolant water into the sea. [2]

**Commentary**

- a Biochemical oxygen demand (BOD) is the amount of oxygen used by the aerobic microorganisms in water to decompose the organic matter in the water [1]  
over a fixed period of time (usually 5 days) at a fixed temperature (usually 20 °C). [1]
- b Aerobic decomposition occurs in the presence of oxygen but anaerobic decomposition occurs in the absence of oxygen/when the oxygen has been used up. [1]  
Aerobic decomposition results in oxidation of the organic matter so that elements are in their highest oxidation state but anaerobic decomposition produces elements in low oxidation states. [1]  
Carbon in organic matter is decomposed under aerobic conditions to CO<sub>2</sub> but to CH<sub>4</sub> under anaerobic conditions. [1]  
Sulfur is decomposed to sulfates under aerobic conditions but to hydrogen sulfide under anaerobic conditions. [1]

maximum of 3 marks

Note that the question for part **b** doesn't say how many differences need to be given. With three marks available it is important that at least three points are given; however, it is always worth giving more than three points as it is usually difficult to predict what points the marks will be given for in a particular question and this can also change from year to year.

The question also requires a comparison. It is important in the answers to distinguish between the products of aerobic and anaerobic decomposition. For instance, stating that carbon is decomposed to CO<sub>2</sub> or CH<sub>4</sub> may not get marks as you haven't stated which product results from which type of decomposition.

**c** Eutrophication is the enrichment of a body of water, such as a lake, with nutrients. [1]

The question uses the word 'state' so this should be sufficient, but with three marks available in total it is difficult to know whether more detail is required here or in the description of the effect of agricultural land on eutrophication. The rest of the answer could include the following:

This causes excessive growth of algae. The algae then die and are broken down aerobically, dramatically reducing the oxygen content of the water. [1]

Further algae are then broken down anaerobically, which produces toxic and foul smelling substances. [1]

Artificial fertilisers run off agricultural land into bodies of water, these provide the nutrients for eutrophication. [1]

maximum of 2 marks

As with part **b** above, it is always safer to include extra correct points to try to match the points that are on the mark scheme.

**d** The oxygen content of the body of water decreases as oxygen is less soluble in warmer water. [1]

Fish can die as there is less oxygen available and they also use up the oxygen more quickly at higher temperatures. [1]