Answer ALL questions

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 Read the passage below. Use the information in the passage and your own knowledge to answer the questions that follow.

When the Oceans Glow

In some areas of the world the oceans around the coast sometimes glow with a blue light. The photograph shows an area of coast that is glowing. This blue light is produced by the presence of thousands of microscopic, living organisms called dinoflagellates. These dinoflagellates are protoctists. The production of light by living organisms is called bioluminescence, a process that has evolved many times in different species of organism.

(Source: © AMIRREZA KAMKAR/SCIENCE PHOTO LIBRARY)

To generate light, dinoflagellates use special proteins and the ATP produced within their cells. Many species of dinoflagellate contain chlorophyll and are able to photosynthesize. The appearance of glowing dinoflagellates in the sea used to be a rare event but this now occurs much more frequently. Many of the events occur in the sea around river estuaries and scientists think that intensive farming and deforestation could be to blame. Due to overpopulation of dinoflagellates in these areas, other species of animal are often harmed. After a series of glowing events, large numbers of dinoflagellates die causing oxygen levels in the water to decrease.

People have often wondered why dinoflagellates glow. They only glow in areas where the water moves around, such as when waves hit a beach. Scientists now think that the production of light is a type of warning to stop predators eating the dinoflagellates. If an animal eats dinoflagellates, the dinoflagellates in the area glow making the animal obvious to its own predators. To test this, scientists placed dinoflagellates into a tank along with 15 copepods, which are predators of dinoflagellates. When the dinoflagellates glowed, the copepods ate 1200 dinoflagellates in two hours. When the dinoflagellates did not glow, the copepods ate 2100 dinoflagellates in two hours.

Some scientists think that we could make use of the dinoflagellates to provide sustainable street lighting. Tanks of dinoflagellates could be placed on top of lamp posts. The dinoflagellates would photosynthesise during the day when it is light. A stirrer powered by a small battery would then move them at night so that they would glow. These sustainable lamps could be carbon neutral and help to reduce pollution.