

**Paper Reference(s) 4BI1/2B**  
**Pearson Edexcel International GCSE (9–1)**

**Biology**  
**UNIT: 4BI1**  
**PAPER: 2B**

**Friday 9 June 2023 – Afternoon**

**Text Booklet**

**DO NOT RETURN THIS BOOKLET  
WITH THE QUESTION PAPER.**

## Question 1

**The black and white photograph shows a sandy coastline with exposed rock along the shoreline. Waves are lapping the shore against a starry night sky.**



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**Turn over**

**1 continued.**

## **When the Oceans Glow**

**5 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**  
**10 organisms is called bioluminescence, a process that has evolved many times in different species of organism.**

**15 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**  
**20 this now occurs much more frequently.**

**Turn over**

Many of the events occur in the sea around river estuaries and scientists think that intensive farming and deforestation could be to blame.

- 25 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  
30 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.

- 35 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  
40 dinoflagellates in the area glow making the animal obvious to its own predators.

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**1 continued.**

**45 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.**

**50 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  
55 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  
60 could be carbon neutral and help to  
reduce pollution.**

**Turn over**



Question 1

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