

Worksheet 2

Task:

PHOTOPHORES

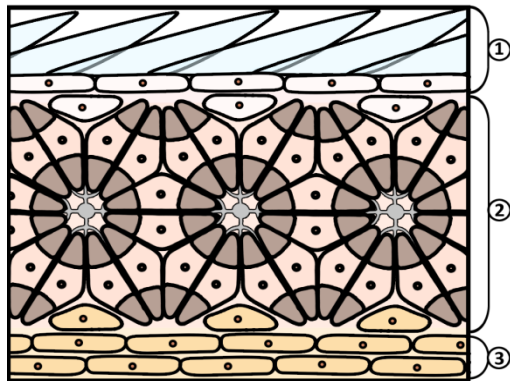
The lantern of fireflies is called a photophore. It is located underneath the abdomen and surrounded by a chitin shell. The light-generating layer consists of large cells called photocytes, below which is an opaque, light-reflecting layer of cells. Photocytes are cylindrically arranged around tracheae, which transport air.

Numerous mitochondria and granules can be found in a photocyte. Granules, in turn, contain the enzyme luciferase and the substrate luciferin. Glowing is monitored by nerve impulses and depends on the oxygen levels in the photocyte. Whenever oxygen levels rise, cells start to glow. Since many mitochondria are located at the outer part of the cell, only a little oxygen can get to the photocytes, because mitochondria use all incoming oxygen to generate adenosine triphosphate (ATP) in cellular respiration. A nerve impulse leads to nitrogen monoxide release, which inhibits oxygen uptake by mitochondria, thus leading to rising levels of oxygen in the photocytes. This enables the enzymatically catalysed oxidation of luciferin.

During this reaction, luciferin is oxidized by the enzyme luciferase, resulting in the emission of light, carbon dioxide, and oxyluciferin. This reaction is highly efficient: 90% of the energy is emitted as light and only 10% as heat.

- 1) Formulate the equation for this bioluminescence reaction:

- 2) Name the individual layers of the photophore:



1)

2)

3)