

Worksheet 3

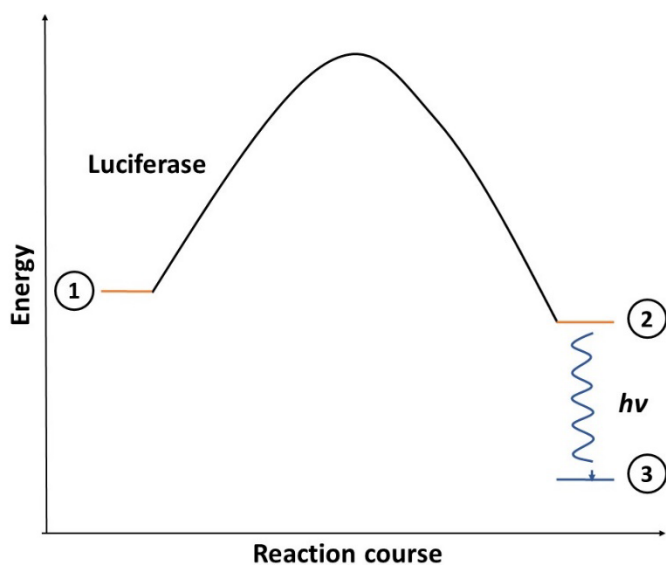
(BIO-)LUMINESCENCE

A chemical reaction is possible whenever the molecules involved in the reaction are in a higher energy state. In this state, stable atomic bonds of a molecule are loosened, so that new bonds can be established. To reach this high-energy state, molecules need to be exposed to a certain amount of energy, e.g., through light or heat. Essentially, a chemical reaction is a form of energy conversion. During the reaction, the energy levels of molecules involved are changed. An enzyme, which serves as a biological catalyst, lowers the activation energy of a chemical reaction, and thus, speeds up its course.

In the bioluminescence reaction of fireflies, an enzyme (luciferase) catalyzes the oxidation of the luminescence compound (luciferin) using ATP to provide energy. The oxyluciferin product of the reaction is not formed directly in its lowest-energy state (the 'ground state') but rather in an excited state. When the excited oxyluciferin drops down to the ground state, the surplus energy is emitted as light.

Task:

- 1) Look at the course of the reaction illustrated in the diagram below. Assign the numbered chemical states (luciferin, ground-state oxyluciferin, excited oxyluciferin).



1)

2)

3)

When is energy emitted as light?

- Transition to 1→2
- Transition to 2→3