Apply Teacher Instructions

Mission: Lighting Up Biomimicry

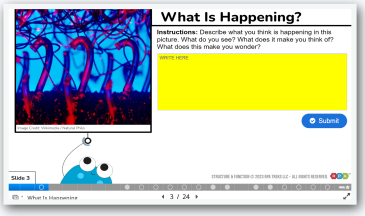
Objective: Each student will be able to explain how structure and function can be used by organisms to help it survive in its environment, and how humans use biomimicry in engineering.

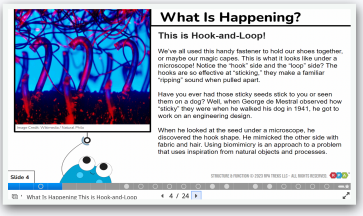
- "I can analyze how an organism's structure and function are studied to aid its survival."
- Students receive a task-based mission to design an efficient flashlight based on the fireflies of Texas.
- Academic Terms: bioluminescence, abdomen, biomimicry, visible light.

What is Happening?

Digital Student Journal Slides 3-4

Click slides to enlarge





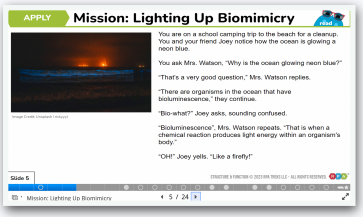
Description: Phenomenon-based approach for any classroom setting. This attention-getter can be used as either a cooperative learning strategy for engagement or as an individual reading opportunity to activate prior knowledge.

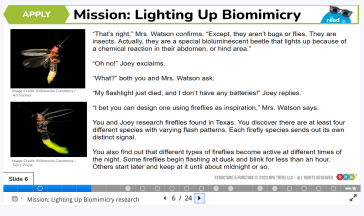
There is no correct or uniform answer for these connections. However, students should be able to relate information from 3rd, 4th, and possibly 5th grade to these terms using examples they have either directly observed or learned about previously. Be sure to provide time for students to make observations about the image before moving on to the description on previous slides. Encourage full sentences in the written descriptions.

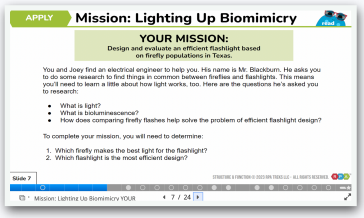
Mission: Lighting Up Biomimicry

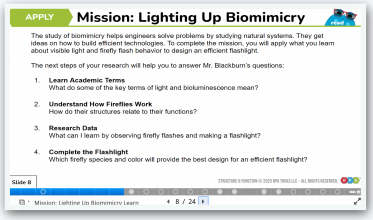
Digital Student Journal Slide 5-8— *Click slides to enlarge*

Description: This Real-World Scenario Instruction includes a brief background and reading to prepare students for their mission to design a flashlight based on fireflies. Terms: bioluminescence, abdomen, biomimicry, visible light.



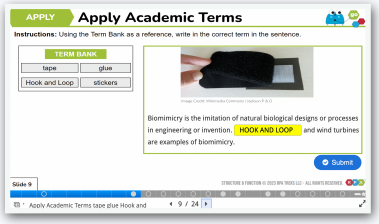




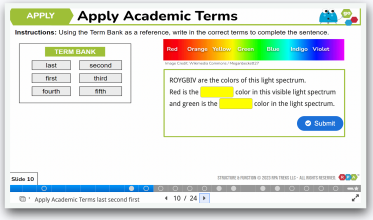


Academic Terms

Digital Student Journal Slides 9-13 - *Click slides to enlarge*

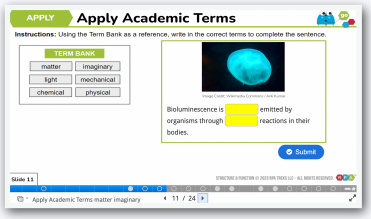


Description: Using information from the passage and the previous slide, student move academic terms into sentence stems to explain biomimicry.



Slide 9, Answer Key

Biomimicry is the imitation of natural biological designs or processes in engineering or invention. Hook and Loop and wind turbines are examples of biomimicry.

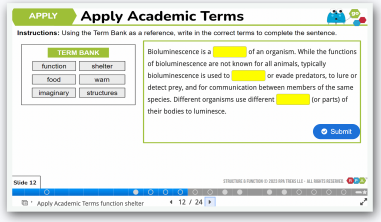


Slide 10, Answer Key

Red is the first color in the light spectrum and green is the fourth color in the light spectrum.

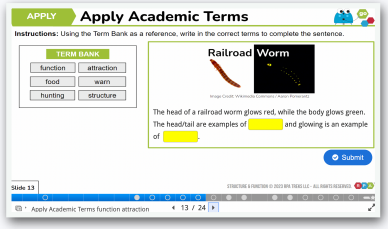
Slide 11, Answer Key

Bioluminescence is light emitted by organisms through chemical reactions in their bodies.



Slide 12, Answer Key

Bioluminescence is a function of an organism. While the functions of bioluminescence are not known for all animals, typically bioluminescence is used to warn or evade predators, to lure or detect prey, and for communication between members of the same species. Different organisms use different structures (or parts) of their bodies to luminesce.

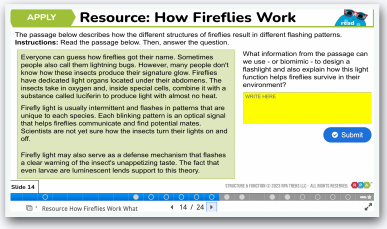


Slide 13, Answer Key

The head of a railroad worm glows red, while the body glows green. This is an example of structure and the glowing is an example of the function.

Resource: How Fireflies Work

Digital Student Journal Slides 14 - *Click slides to enlarge*

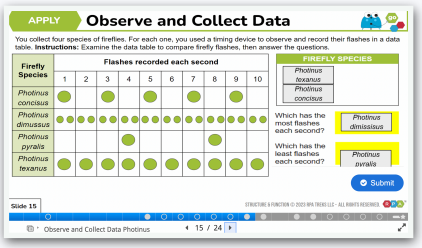


Description: Students read a brief passage and answer a question on biomimicry.

Answer Key

Student answers will vary but should include a description of the intermittent flashes and defense, communication, and mating.

Observe and Collect Data



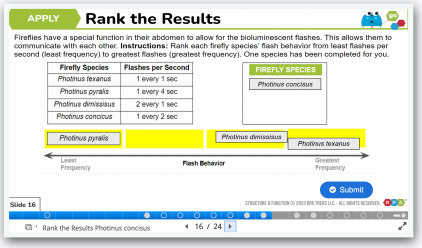
Digital Student Journal Slide 15 - *Click slides to enlarge*

Description: Students review a data table of the firefly flashes for each second and interpret the species with the most vs. least flashes per second.

Answer Key

Most flashes: *Photinus dismussus*. Least flashes: *Photinus pyralis.*

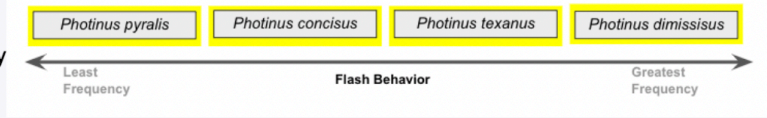
Rank the Results



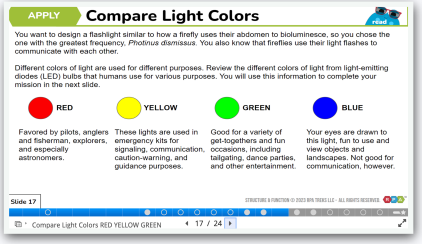
Digital Student Journal Slide 16 - *Click slides to enlarge*

Description: Students use a data table to interpret and rank the frequency of the firefly flashes.

Answer Key



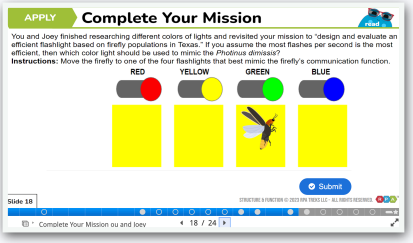
Compare Light Colors



Digital Student Journal Slide 17 - *Click slides to enlarge*

Description: Students read passages about different colors of light and move the correct firefly to each area.

Complete Your Mission



Digital Student Journal Slide 18 - *Click slides to enlarge*

Description: Using the information they have learned so far, students select the correct color of light and move the firefly to the area.

Answer Key

Yellow

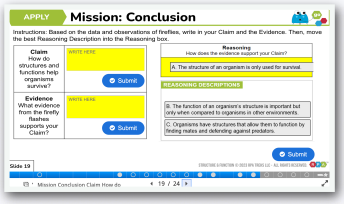
Scientific & Engineering Practices Spotlight

5.1B Use engineering practices to design solutions to problems.

Students read about a real life example of an organism's "engineering solutions" with their ability to bioluminesce. Inferences can be made on how we have copied nature.

Mission: Conclusion

Digital Student Journal Slide 19



Description: Students demonstrate their understanding of Claim-Evidence-Reasoning and move the correct Reasoning to support their Claim.

Answer Key

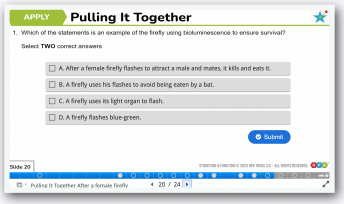
> Possible Claim: Different organisms use their structures to help them find mates, scare predators or find food.
>
> Possible Evidence: Fireflies use their flashes to find mates by timing the flashes differently from other fireflies of different species.
>
> Reasoning:
>
> *C. Organisms have structures that allow them to function by finding mates and defending against predators.*

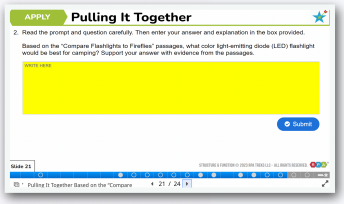
Pulling It Together

Digital Student Journal Slide 20-21

Description: Using the information they have learned so far, students answer the questions about biomimicry.

Students should provide evidence that supports their answer.





Slide 20, Answer Key

1. A and B

Slide 21, Answer Key

2. A red LED flashlight would be best for camping because it supports the eyes natural ability to see in the dark.

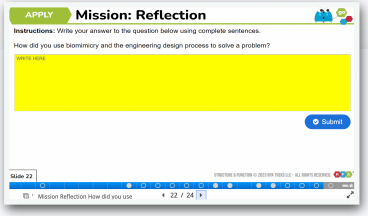
Mission Reflection

Digital Student Journal Slide 22

Description: Students write a brief reflection to answer, “How did you use biomimicry and the engineering design process to solve a problem?”

Answer Key

> Student answers will vary but should generally show understanding of how humans use the structures and functions of other organisms to solve human problems.



ELPS Spotlight

STRATEGY: Collaborative Learning

Debate: Students will be able to participate in a debate about a science topic using academic language.

Instructions:

1. Introduce the concept of debate and explain that it is a way to argue for or against a position on a topic.
2. Preview the topic and provide students with a text related to the topic.(Reading)
3. Divide students into two groups and assign each group a position (for or against) related to the science topic.
4. Provide students with a debate graphic organizer worksheet and model how to use it to organize their ideas by explaining their position, providing reasons, and providing supporting arguments.
5. Have students work in their groups to prepare their arguments and evidence for the debate.
6. Monitor student progress and provide feedback and support as needed.
7. Conduct the debate and encourage all students to participate by speaking and listening to their peers.(Listening and Speaking)
8. After the debate, have students reflect on their performance and write a summary of what they learned from the experience.(Writing)

ELPS Tips for Beginning EB students:

- Provide sentence frames or other support tools to help students express their ideas and arguments using academic language.
- Provide simplified texts or videos and use visuals and other graphic organizers to help students understand the science topic.
- Assign groups that have fewer members and provide more guidance and support to students.

ELPS Tips for Intermediate and Advanced EB students:

- Encourage students to use more complex sentence structures and academic language to express their ideas and arguments.
- Encourage students to use evidence from the text to support their arguments and explain their reasoning.
- Provide challenge activities, such as having students research and argue for a different position or having them present their arguments in a different format, such as a written essay or a presentation.