

The Glowing of the GloFish

| Adapted from | Pets in the Classroom Lesson Plan (All About Fish) Standard(s): Materials: • Fish & Fish Tank • Magnifying Glass • Pa | | | |
|---|--|---------------|---|--|
| Pet: GloFlsh | | Class: 3-5 | | |
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| Brief Overview: In this lesson, students will explore the fascinating world of GloFish, genetically engineered zebrafish that emit fluorescent colors under different types of light. Through hands-on experimentation, students will investigate how different wavelengths of light affect the fluorescence of GloFish, examining the relationship between light and color perception. | | | Lesson Breakdown Lesson 1: Introduction to the GloFish Lesson 2: Experimenting with Different Types of Light Lesson 3: Effect of Distance on Fluorescence Analysis and Write a Claim | |
| Easily adapted to other grades | | | | |
| Essential Question How does the type of GloFish? | light affect the fluoresco | ence of | | |

| Subjects Science ELA Math STEM Art Other | Stem Connections Science: life science, adaptations of organisms Technology: different types of light Engineering: creation of a model of the light Math:measuring, data analysis, graphing |
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Performance Expectations/ Standards NGSS

4-LS1-1. From Molecules to Organisms: Structures and Functions a. Students investigate and understand that organisms have different structures that

serve different functions in support of the organism's survival.

CCSS Standards

Math:

4.MD.2.1 Measure and estimate lengths in centimeters and millimeters.

English:

ELA.4.W.2.2 Write an informative/explanatory text to examine and convey complex information.

I CAN statements

- investigate and explain how different structures in organisms serve specific functions that support the organism's survival.
- measure and estimate lengths in centimeters and millimeters with accuracy and precision.
- write a clear and informative report about a topic, showing that I understand it well. I can organize my thoughts in a logical way so that my writing is easy to follow.

Materials

The Glowing of the GloFish Student Worksheet GloFish tank with GloFish and other types of fish Hand lens/ magnifying glass Various flashlights (LED, halogen,etc. With a variety of lumens) Black light (or actinic (blue wavelength) light) Containers for water GloFish Rulers https://www.classhook.com/resources/1270-finding-nemo-anglerfish-chase?share_code= Osv2TkIQ (optional)



Teacher Background

GloFish, genetically engineered zebrafish, have captivated the hearts of many with their vibrant fluorescent colors that glow under different types of light. These unique organisms provide a fascinating opportunity to engage students in scientific inquiry and explore the relationship between light and color perception.

The Science Behind GloFish Fluorescence

GloFish exhibit fluorescence, a phenomenon where certain molecules absorb light energy and then emit light of a different wavelength, resulting in a visible glow. In GloFish, this process is mediated by a fluorescent protein, typically a green fluorescent protein (GFP), that has been introduced into their genetic makeup.

When GloFish are exposed to light of a specific wavelength, typically blue or ultraviolet light, the GFP molecules absorb the light energy. This energy excites the electrons within the GFP molecules, causing them to move to a higher energy state. As the electrons return to their ground state, they release the excess energy in the form of light, emitting a visible glow in the range of green, yellow, orange, or red, depending on the specific GFP variant.

Designing an Engaging Experiment

The GloFish lab activity invites students to investigate the effect of different types of light on GloFish fluorescence. By shining various colored flashlights on GloFish and measuring the fluorescence intensity, students can observe patterns and relationships related to light wavelength and fluorescence emission.

| Lesson 1: Introduction to the GloFish | | | |
|---------------------------------------|--|---|--|
| Time | Materials | Activity | |
| 5 mins | https://www.class hook.com/resourc es/1270-finding- nemo-anglerfish- chase?share_cod e=Osv2TkJQ (optional) | Show the students the fish tank and watch the short clip of Finding Nemo where the fish at the bottom of the ocean lights up to attract Marlin and Dory. Available at: <u>https://www.classhook.com/resources/1270-finding-nemo- anglerfish-chase?share_code=Osv2TkJQ</u> (optional) | |



| 15 mins | | Allow the students to observe the fish tank and have a class discussion about the similarities and differences of the fish in the tank. Create a Venn Diagram on the board and encourage all of the students to contribute. |
|---------|---|--|
| 15 mins | | Introduce the concept of fluorescence and explain how GloFish emit fluorescent colors under different types of light. |
| | | GloFish are zebrafish that have been genetically modified to glow brightly under certain types of light. This unique trait is the result of scientists introducing a fluorescent gene into the zebrafish's genetic code. The presence of this gene allows GloFish to absorb light and re-emit it as a visible glow, making them appear more vibrant and luminous as the intensity of the light increases. Initially, scientists developed fluorescent fish with the hope of using them to detect environmental pollutants in waterways. The goal was to create fish that would fluoresce specifically in the presence of certain pollutants, serving as a warning signal for potential contamination. While this goal was not fully realized, the development of fluorescent fish inadvertently led to the creation of GloFish, |
| | | |
| 10 mins | Various flashlights (LED, halogen,etc. With a variety of | Show the students the different types of light they will be using in the experiment. Explain the safety precautions(eg. not shining it into their own or another's eyes) |
| | lumens) Black light (or actinic (blue wavelength) light) Containers for water Rulers | Review how to measure, focusing on using precision and accuracy.Demonstrate the proper way to carry or handle the cup containing the fish to avoid an accident. Show them how they will carry the fish containers. |



| Lesson 2: Experimenting with Different Types of Light | | | | |
|---|--|--|--|--|
| Time | Materials | Activity | | |
| 10 mins | GloFish tank with GloFish and other types of fish Hand lens/ magnifying glass <u>The Glowing of</u> <u>the GloFish</u> <u>Student</u> <u>Worksheet</u> | Guide the students as they collect their materials and conduct the first part of the experiment. They will be examining the fish through the cups with the magnifying glasses and then recording their observations. Review the directions with the students. | | |
| 5 mins | GloFish tank with GloFish and other types of fish Various flashlights (LED, halogen,etc. With a variety of lumens) Black light (or actinic (blue wavelength) light) Containers for water Rulers <u>The Glowing of the GloFish</u> <u>Student</u> <u>Worksheet</u> | Explain to the students they will be next testing how different types of light affect the way the fish glow. Review the directions with the students. Remind them of the safety guidelines and to only shine the light on the fish for a few seconds at a time to avoid fatiguing the fish. Be sure that the students are placing the light 20 cms away from the cup | | |
| 20 mins | <u>The Glowing of</u> <u>the GloFish</u> <u>Student</u> <u>Worksheet</u> | Support the students as they complete the experiment. | | |
| 10 mins | <u>The Glowing of</u> <u>the GloFish</u> | Work with the students as they complete the hypothesis and variables section of their worksheet. | | |



| Student | | |
|------------------|--|--|
| <u>Worksheet</u> | | |

| Lesson 3: Effect of Distance on Fluorescence | | | |
|--|--|--|--|
| Time | Materials | Activity | |
| 5 mins | | Review the directions for the final experiment In this project. This experiment only uses the GloFish. The other fish should be returned to the aquarium. In this experiment, the students will alter the distance that the lights are held away form the cup to determine if the distance makes a difference in the amount of fluorescence | |
| 25 mins | GloFish tank with GloFish and other types of fish Various flashlights (LED, halogen,etc. With a variety of lumens) Black light (or actinic (blue wavelength) light) Containers for water Rulers <u>The GloWing of the GloFish</u> <u>Student</u> <u>Worksheet</u> | Support the students as they complete the experiment. | |
| 15 mins | <u>The Glowing of</u> <u>the GloFish</u> <u>Student</u> <u>Worksheet</u> | Have the students construct a model / drawing of how the GloFish reacted to the light coming through the cup. | |



| Lesson 4: Analysis | | | |
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| Time | Materials | Activity | |
| 30 mins | <u>The Glowing of</u> <u>the GloFish</u> <u>Student</u> <u>Worksheet</u> | Allow the students time to complete the write up at the end of the worksheet. Encourage students to use their data tables and graphs to support their summary. Remind students to use clear and concise language, avoiding technical jargon. Emphasize the importance of organizing their ideas logically and presenting their summary in a cohesive manner. | |
| 15 mins | | Have the students share what they have learned and their models with the class. | |

Differentiation

For students who need additional support:

- provide additional visuals or diagrams to help them understand the concept of fluorescence.
- allow students to draw their observations instead of writing then
- Provide the students with prompts for their final write up.

For students who need additional challenges:

- have them create a model to explain how GloFish produce fluorescent colors under different types of light.
- Have the students experiment with other fish to see how they react to different types of light.

Assessment



| Criteria | 4 Points | 3 Points | 2 Points | 1 Point |
|--------------|--|---|---|--|
| Introduction | Clearly introduces the purpose of the experiment and identifies the organisms involved. | Introduces the purpose of the experiment but may not clearly identify the organisms involved. | Attempts to introduce the purpose of the experiment but lacks clarity. | Does not introduce the purpose of the experiment or identify the organisms involved. |
| Results | Provides a comprehensiv e summary of the key observations and findings, including quantitative data if applicable. | Summarizes the key observations and findings but may lack some details or quantitative data. | Attempts to summarize the observations and findings but lacks clarity or accuracy. | Does not provide a summary of the observations or findings. |
| Discussion | Demonstrates a clear understanding of the results, draws conclusions, and identifies limitations of the experiment. | Shows some understanding of the results, attempts to draw conclusions, and may identify some limitations of the experiment. | Attempts to explain the results but lacks clarity or depth, and limitations are not fully addressed. | Does not explain the results, draw conclusions, or identify limitations. |



| Conclusion | Restates the main findings and emphasizes the significance of the experiment. | Restates the main findings but may not fully emphasize the significance of the experiment. | Attempts to restate the main findings but lacks clarity or emphasis. | Does not restate the main findings or emphasize the significance of the experiment. |
|--|--|---|---|---|
| Overall Organization and Writing | The summary is well-organize d, with logical transitions between sections. The writing is clear, concise, and free of grammatical errors. | The summary is generally organized, with some transitional elements. The writing is mostly clear and concise, with few grammatical errors. | The summary is somewhat organized, with transitional elements lacking in some areas. The writing may lack clarity or conciseness, and some grammatical errors are present. | The summary is poorly organized and lacks transitional elements. The writing is unclear and grammatically incorrect. |

Extension

Encourage students to design and conduct experiments to investigate other factors that may affect the fluorescence of GloFish, such as temperature or pH.

Have students research other animals that absorb and re-admit light.

Have students research the differences between animals that absorb light and those that glow.

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