**Peppered Moth Simulation**

Name:

**Objective**: Simulate changes in moth population due to pollution and predation, and observe how species can change over time.

**Introduction:**

Charles Darwin accumulated a tremendous collection of facts to support the theory of evolution by natural selection. One of his difficulties in demonstrating the theory, however, was the lack of an example of evolution over a short period of time, which could be observed as it was taking place in nature. Although Darwin was unaware of it, remarkable examples of evolution, which might have helped to persuade people of his theory, were in the countryside of his native England. One such example is the evolution of the peppered moth *Biston betularia*.

The economic changes known as the industrial revolution began in the middle of the eighteenth century. Since then, tons of soot have been deposited on the country side around industrial areas. The soot discoloured and generally darkened the surfaces of trees and rocks. In 1848, a dark-coloured moth was first recorded. Today, in some areas, 90% or more of the-peppered moths are dark in colour. More than 70 species of moth in England have undergone a change from light to dark. Similar observations have been made in other industrial nations, including the United States.

**Instructions:**

Go to the Peppered Moth Simulation at [**peppermoths.weebly.com**](http://peppermoths.weebly.com/)

Read information on Kettlewell's study of moths. At the end, you will run four simulations (2 times in a light forest, 2 times in a dark forest for one minutes each, during this time you will play the part of a bluejay that eats moths.

After each simulation, record the percentage of dark moths and light moths. Switch with your partner after each trial.

**Data and Analysis**

Read the background information and answer the questions as you go.

*Life Cycle of the Peppered Moth*

1. Why are these moths called "peppered moths?"

2. What animals eat the peppered moth?

3. Moths that have more dark spots than the average moth are called what?

*Impact of Pollution*

4. Where was the first black form of the moth found?

5. By 1900, what percentage of moths around English cities were dark coloured?

6. What happened to the colour of the trees during the Industrial Revolution?

**7. What was causing the different colours in the moths?**

**8. What is natural selection?**

9. Who suggested that peppered moths were an example of natural selection?

**10. What is industrial melanism?**

*Kettlewell's Experiments*

11. What is an entomologist?

12. How do scientists test theories?

13. Write down ONE of Kettlewell's predictions.

14. How did Kettlewell directly study the moths?

**15. Why did dark moths have a survival advantage?**

**Birdseye View**

Open the simulation and play the role of the bird in both the dark and the light forest. Try to behave as a bird would behave, choosing the moths that are the most obvious. Switch with your partner after each trial. At the end of each simulation, record the percent of moths captured in the table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Light Forest** | | | |
|  | Starting Population | | Final Populations | |
| Trial | Dark | Light | Dark | Light |
| 1 | 50% | 50% |  |  |
| 2 | 50% | 50% |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Dark Forest** | | | |
|  | Starting Population | | Final Populations | |
| Trial | Dark | Light | Dark | Light |
| 1 | 50% | 50% |  |  |
| 2 | 50% | 50% |  |  |

**Final Analysis – You must write in detailed, clear and concise full sentences that completely answer the question!**

16. Explain how the color of the moths increases or decreases their chances of survival.

 17. Explain the concept of "natural selection" using your moths as an example.

 18. What would happen if there were no predators in the forest? Would the colors of the moths change over time? Defend your answer.

19. You are a scientist capturing moths to study their changes over time. Examine the table and construct a graph. Plot the years of the study on the X-axis, and the number of moths captured on the Y axis. You should have 2 lines on your graph - one for light moths, and one for dark moths.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| graph  20. Explain in your own words what the graph shows. What type of environment do you think these moths live in? | |  |  |  | | --- | --- | --- | | Year | # of Light Moths Captured | # of Dark Moths Captured | | 1 | 537 | 112 | | 2 | 484 | 198 | | 3 | 392 | 210 | | 4 | 246 | 281 | | 5 | 225 | 337 | | 6 | 193 | 412 | | 7 | 147 | 503 | | 8 | 84 | 550 | | 9 | 56 | 599 | |