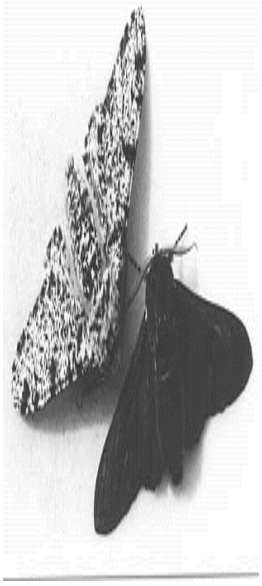
Kettlewell & the Peppered Moth

NAME _____



Background: Natural selection, the reproductive success of organisms best suited to their environment, is a driving force in evolution. Natural selection occurs within populations, which are interbreeding groups of individuals of the same species. Genetic variation, the alternative types of genes for inherited traits, is one factor in the reproductive success of certain members of a population. The result of natural selection is adaptation, the changing of a population so that it is better suited to its environment.

Industrial melanism is the term used to describe the adaptation of a population by the darkening of its individuals in response to industrial pollution. One example of rapid industrial melanism occurred in populations of peppered moths. *Biston betularia*, in the area of Manchester, England, from 1845 to 1890. Before the Industrial Revolution, the trunks of trees in the forest around Manchester were light grayish green due to the presence of lichens. Most of the peppered moths in the area were light colored with dark spots. As the Industrial Revolution progressed, the tree trunks became covered with soot and turned dark. Over a period of 45 years, a dark variety of the peppered moth became more common.

Procedure:

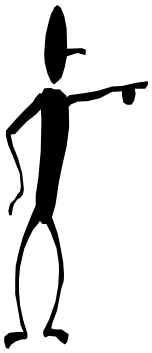
1. Work with a partner, and decide which of you will be the "predator" and which will be the timekeeper.
2. Place a sheet of white paper on your lab table. If you are the timekeeper, scatter 30 white paper disks and 30 black disks on the paper while your partner looks away. The disks represent a bird's prey. If you are the predator use a tweezers (which represent a bird's beak) to pick up as many disks as possible in 15 seconds while your lab partner watches the time.
3. Count the number of each type of disk picked up in 15 seconds. Record these numbers in the data table below. **How does the color of the paper and the color of the disks you captured compare?**

		Total # of Disks		# of Disks Picked Up		% of Available Prey Recovered = $\frac{\text{\# of disks picked up}}{30} \times 100$	
Trial	**Background**	**White**	**Black**	**Contrasting Background**	**Matching Background**	**Contrasting Background**	**Matching Background**
1	White	30	30				
2	White	30	30				
3	Black	30	30				
4	Black	30	30				

4. Take the white paper away and scatter the 60 disks used in #2 directly on the lab table (you must be at a black surfaced lab table for this part to work). If you are the predator, repeat the hunting procedure while your partner watches the time. Again, record the numbers in the data table above. **How does the color of the paper and the color of the disks you captured compare, this time?**

5. Change roles (timekeeper now predator, predator now timekeeper) and repeat steps 2-4.

Year	# of Light Moths Captured	# of Dark Moths Captured
1	537	112
2	484	198
3	392	210
4	246	281
5	225	357
6	193	412
7	147	503
8	84	594
9	56	638



6. Examine the table at the left, which represents data from a 10-year study of a population of peppered moths. The numbers represent moths captured in traps that were located in the same area each year.

7. Construct a graph, using the information from the table in #6, comparing the number of each color of peppered moth captured. Plot the years of the study on the x-axis (horizontal axis) and the number of moths captured on the y-axis (vertical axis). Use a different color of pencil or some other means to differentiate the color variation of the moths. Be sure to label each axis and to make a key for the graph

8. If you were a predator selecting from a field of an equal number of light and dark prey, you would expect to capture an approximately equal number of each color of prey. What did the experiment you conducted in the first part of the lab indicate?

9. Describe what is shown in your graph. What happened to the peppered moth population in that area?

10. Is coloration an important factor in successful predation? Why?

11. What is the relationship between the environment and the color of the peppered moth?

12. Explain why an increase in the number of dark-colored peppered moths occurred during the Industrial Revolution.

13. What effect do you think using cleaner-burning fuels had on the environment and the peppered moths near Manchester, England?