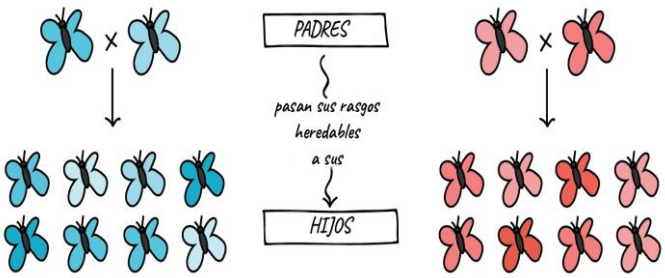

LESSON #5:

WHO DO I LOOK LIKE?

SCIENCE

K- 5TH GRADE

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INTRODUCTION

The *Genomic Logic for Underlying Morphological Divergence (EPSCoR)* project aims to bring science-related learning experiences to schools. This lesson is the last of six, designed to facilitate learning the concepts of biodiversity (lesson 1), adaptation (lesson 2), evolution (lesson 3), plant and animal structures (lesson 4), heredity (lesson 5), and the care of butterflies (lesson 6). These lessons will serve as a tool for the trainer or professional in charge of teaching (teacher, professor, among others). For participants, they can be teachers (as part of their professional development) or students.[1]

In this fifth lesson, the instructors or teachers of the elementary level, and their students, will actively participate in some activities where they will understand the principles of inheritance. Emphasis will be placed on the focus on color and size of butterfly wings and genetic variability.

This lesson includes:

- ✓ Scientific background of the concepts
- ✓ Glossary
- ✓ Alignment of the content to the standards, expectations, and specificities of the Department of Education of Puerto Rico (DEPR)
- ✓ Educational Process
- ✓ Detailed activities to carry out in the classroom.

[1] Unless otherwise stated, the neutral term will be used with nouns such as teacher/s, participant/s, professor/s, instructor/s, and/or student/s.

TEACHER'S GUIDE

MATERIA: Ciencia **NIVEL:** Elemental (K-5)

CONCEPTO PRINCIPAL: herencia (enfoque en color y tamaño de las alas de las mariposas), variabilidad genética

CONCEPTOS SECUNDARIOS: biodiversidad, especie, adaptación, evolución, estructuras de plantas y animales

CONOCIMIENTO PREVIO: semejanzas y diferencias, características de los seres vivos

OBJETIVOS ESPECÍFICOS DE APRENDIZAJE

Objetivos conceptuales:

- Identificar semejanzas y diferencias entre algunas especies dadas.
- Interpretar información relacionada con los conceptos especie y biodiversidad.
- Distinguir que progenie (crías) surge de dos progenitores (padres) dados.
- Identificar y mencionar las características que se transmiten y conservan de padres a crías.
- Mencionar como la intervención humana puede contribuir o afectar la disponibilidad de una especie.

Objetivos procedimentales:

- Observar e identificar organismos que comparten características semejantes y diferentes, y que pertenecen a la misma especie.
- Utilizar dibujos o diagramas para explicar las similitudes estructurales entre las especies.
- Investigar cómo surgió la mariposa (su historia evolutiva).

Objetivos actitudinales:

- Valorar y mostrar aprecio por la naturaleza y la diversidad de la vida
- Reconocer la importancia de cuidar la biodiversidad.
- Reflexionar sobre la fragilidad de una especie para crecer y cómo podemos cuidarla.
- Aceptar, respetar y reconocer los trabajos e ideas de otros.

ESTÁNDARES, EXPECTATIVAS Y ESPECIFICIDADES:

Grado: 1-3ro (Indicadores según los estándares de contenido)

Estándar: Estructura y niveles de organización de la materia

- Reconocer las similitudes estructurales y las diferencias entre los humanos, las plantas y los animales (puede usar dibujos, esculturas o representaciones teatrales).
- Hacer observaciones con el propósito de describir las estructuras que necesitan las plantas y los animales para sobrevivir y crecer.
- Desarrollar argumentos lógicos sobre el hecho de que las plantas y las crías se parecen mucho a sus progenitores, pero no son exactamente iguales a ellos.

Estándar: Conservación y cambio

- Interpretar información relacionada con el concepto de biodiversidad haciendo énfasis en el aprecio por la naturaleza y la diversidad de la vida.
- Reconocer que la materia (seres vivientes y no vivientes) cambian a través del tiempo.
- Describir los patrones de cambio en la materia.
- Reconocer que la reproducción es una forma de conservación de los seres vivientes.
- Deducir que los seres vivos cambian a través del tiempo.
- Identificar las características que se transmiten y se conservan de generación en generación

Estándar: Interacciones y energía

- Explicar cómo las variaciones en características entre individuos de la misma especie ofrecen ventajas para sobrevivir, encontrar pareja y reproducirse.
- Describir el ciclo de vida de los organismos (nacimiento, crecimiento, reproducción y muerte).
- Analizar e interpretar datos para proporcionar evidencia de que las plantas y los animales tienen características heredadas de sus progenitores, las cuales varían dentro de los organismos que pertenecen a un mismo grupo.
- Explicar cómo las variaciones en características entre individuos de la misma especie ofrecen ventajas para sobrevivir, encontrar pareja y reproducirse.
- Observar plantas y animales para comparar la diversidad de la vida en una variedad de hábitats.

Grado 4to y 5to (Indicadores según los estándares de contenido)

Estándar: Estructura y niveles de organización de la materia

- Mencionar y argumentar sobre las ventajas funcionales de las adaptaciones estructurales en los seres vivos.

Estándar: Conservación y cambio

- Reconocer que la reproducción es necesaria para perpetuar la especie.
- Inferir en que la reproducción permite conservar o cambiar algunas características de las especies.
- Explicar los cambios relacionados con la forma, estructura y funciones vitales en los organismos.
- Reconocer que los organismos tienen ciclos de vida y cambian a través del tiempo.
- Reconocer que la forma, la estructura y las funciones vitales de los organismos pueden cambiar a través de sus etapas de desarrollo.

BACKGROUND

When we talk about **adaptation**, we refer to the characteristics that a species possesses that gives it the capability of survival in the environment it inhabits. A **species** is a group of organisms that share the same characteristics that can cross and produce a fertile descendance. However, individuals of one same species can show mild variations. These variations may be favorable or unfavorable. This lets the species survive in a particular environment. Depending on environmental factors, after many generations, a population can look very different. Adaptations can be **structural** or **physiological**. Butterflies are a particularly strong example of structural adaptations. These adaptations in butterflies include the way in which they use **mimicry**, **camouflage**, and even their capability to fly. Some examples of adaptations that butterflies possess are:

Camouflage = The principal structural adaptation of butterflies is in their wings and how they use them to hide. The wings of many species have evolved to imitate its surroundings, with the common green as a particularly good example. These butterflies have wings that have a color and shape that match exactly to the leaves in which they are found, which makes it more difficult for predators to find them.

Disguise and subterfuge = Many butterflies have developed “eye spots” on their wings. When their wings are open, these spots give the butterfly the appearance of a much larger creature, terrifying possible predators. In that same way, viceroy butterflies deliberately imitate the appearance of a monarch butterfly, which has evolved to be toxic upon consumption. As a result, predators avoid hunting both species. Another example that we can mention are the colors of *Heliconius*, who have red because animals associate it with a bitter taste.

Delight = Butterflies are cold-blooded creatures, which means that they need to heat their wings before taking off. That is where they are more vulnerable to predators, but it is a vital part in the progress of the butterfly. Butterflies may simply fold their wings if they overheat.

Sensibility to light = Every fourth generation of monarch butterflies migrates 2,000 miles (3,220 kilometers), traveling from as North as Canada to places to hibernate in Mexico. Monarch butterflies use their antennae to detect the basic level of light around them. This lets them know the time of the day depending on the amount of light that they can see, which also lets them stay alert.

Examples of adaptation in living beings

Species	Adaptation	How can adaptation help it survive in the environment?
Crocodiles	Digestive apparatus	Adapted to ingest a large variety of preys
Fish	Travel	It is favored by the wavelike movements of its body
Horse	Growth in size	To face prairie predators
Wolves	Development of muscles for chewing	It makes it easier to chew their prey
Anteater	Tail	It works as a coat
Mollusks	Large muscular foot	It allows them to set themselves on the sand to travel
Primates	Fingers	To collect tree branches
Butterflies	Camouflage	It allows them to imitate its surroundings with makes it harder for predators to find them

GLOSSARY

1. **Similarity** – relation among people, animals or things that have common traits.
2. **Difference** – quality that lets something distinguish itself from another thing.
3. **Species** – a group of organisms that can interbreed to produce fertile descendants.
4. **Biodiversity** – variety of organisms in our Planet.
5. **Adaptation** – traits form an animal that helps it survive in a specific environment.
6. **Structural adaptations** – adaptations that include changes in structure of some parts of the species' body.
7. **Mimicry** – structural adaptation that provides protection to an individual, letting it copy the appearance of other species.
8. **Camouflage** – structural adaptation that lets the individual blend into its surroundings. It involves the individual's change in color.
9. **Physiological adaptations** – changes in metabolic processes of an organism.

Evolution – change in inheritable traits of a population through time.

EDUCATIONAL PROCESS

BEGINNING

This activity reviews the previous knowledge that participants have about how parents (parents, progenitors) can pass their characteristics to their offspring (progeny). The lesson can be referenced #2: And I manage to survive!

1. The teacher begins by asking the students:
    a. What do we remember about species?
    b. Are organisms of the same species similar (they look alike) or different?

    Answer: Students are expected to mention that organisms belonging to the same species share characteristics that allow them to cross paths to have young, although some show morphological differences (in appearance).

2. In cooperative groups, you are given the **Worksheet #1.**
    a. This activity should be done in a short time (almost immediate response), as it serves to explore what students know about the concept of heredity.
    b. The **Worksheet will #1** have variants:
        - Group #1: One will have blue butterflies.
        - Group #2: Another leaf will have the same butterfly, but the butterflies will be red.
        - Group #3: Another group will have a butterfly of different species and color.
    c. Discuss the **Worksheet #1**. You can paste the sheets colored by the students in a visible place in the classroom.
3. The teacher shows the illustration #1 (available in PowerPoint) to the students and asks the following questions:
    a. Do the offspring (the butterflies you colored) resemble the original butterflies (parents or progenitors)? The teacher asks each group separately, but in general discussion. Listen to all the answers.
    b. The butterflies from group #1, group #2, and group #3, do they belong to the same species? **Answer**: Butterflies from groups #1 and #2 belong to the same species but vary in color. Butterflies from group #3 belong to a different species. There are characteristics that they do not share with the butterflies from groups #1 and #2 (shape of the wings, coloration).
    c. The discussion is summarized according to what students have presented in their drawings, the butterflies that students colored (offspring) resemble the original butterflies (their parents) because they share characteristics that make them look similar. Students can comment.

DEVELOPMENT

1. The teacher begins by reminding the students that during the initial activity we found that the butterflies they painted looked like the ones the teacher had previously shown to them.
2. You can then present images of different species where parents (progenitors) appear with their children (offspring). The teacher asks, “Do children (offspring)

resemble their parents (progenitors)?" **Remind students that descendants** look like **their parents but are not exactly the same as them.**

3. The students are asked if they know why the butterflies and these organisms that were born resemble their initial parents (to their progenitors)? The answers of the students are heard. Probably, at the K-3 level, no students could mention the concept of heredity. If any students from levels K-3 and 4th to 5th mentioned the concept, their knowledge of it should be investigated.
4. If no one indicates the concept, the teacher could begin to explain the situation by telling students that every living organism, plant, animal, bacteria, etc., is made up of small structures called cells. These small structures cannot be seen with the naked eye, but we are all made up of them. In these small structures called cells there is a material that distinguishes each of us and allows each species to have characteristics that distinguish it from another.
5. The teacher can show a photo of a cell, but not abound in its parts, simply for students to see what a cell observed by a microscope, or the diagram of a cell would look like.
6. That material that is found in small structures is called DNA. DNA is like a code that each organism has that distinguishes us and makes us different from each other. **Care must be taken that the student does not think that plants and animals are the only organisms that have cells and DNA.**
7. The teacher asks the students to look at their classmates. Ask: "what can you say about the appearance of your companions? Do you share any characteristics with your classmates?" Answer: Yes, we all have two eyes, two ears, etc. "Do you physically look like your peers?" Answer: No. They can mention the differences.
8. The teacher summarizes what has been discussed so far. As we have seen even that we share some characteristics among ourselves, none of us are exactly the same. "Why don't you look like your peers?"
   Answer: that our parents are not the same.
9. "Do you physically look like your parents?" Listen to students' responses.
10. The teacher explains to the students "Do you remember that told you that all living organisms have small structures called cells and that those little structures have a material that is like a code that makes us different from each other? We are even physically different from our parents."
11. The teacher asks students to work on the **Worksheet #2.**
12. Once **Worksheet #2** is done, the teacher asks the students to place the pasted worksheets in a visible place.
13. The teacher asks the students if all the butterflies look the same.

    Answer: No. Although it is the same butterfly the colors look different. The teacher can point out to the students that the numbers work as a code to color, an event similar to what happens with the DNA of the cells when determining the colors of the cells of the wings of butterflies.

14. The teacher explains to the students that even though butterflies have the same shape, the material called DNA has a different code or information for the color of

these butterflies' wings. This allows that, although the butterflies are of the same species, there are varieties (differences) within the same species.

15. Every characteristic of all organisms is controlled by that material called DNA.
16. If you look at your parents you will see that you are not exactly the same as them, but your hair, the color of your eyes, the color of your skin may be present in you because the material that contains the code or the information called DNA allowed that characteristic to pass from your parents to you, that is, the DNA allowed you to inherit that characteristic.
17. The process of the characteristics that parents (parents) possess pass to their descendants (children) is called heredity.

CLOSURE

1. The activity from Worksheet #1 is resumed. Students are told to look at the images and asked if they would make any changes to the work they did with the butterflies.
2. If a student replies no (that they would do the work just as it is), they are asked why they would not make changes. The student is asked to explain why they would leave work that way.
3. If a student claims that they would make changes, they are asked what colors they would change and why (they are asked to explain why they made the change and why they use those colors). The teacher gives them one or more silhouettes with the corresponding colors according to the student's explanation.
    a. Expected answer: The student indicates that the butterflies that are born have the characteristics inherited from the parents (progenitors). Relate the answer to the heredity concept.

K-5

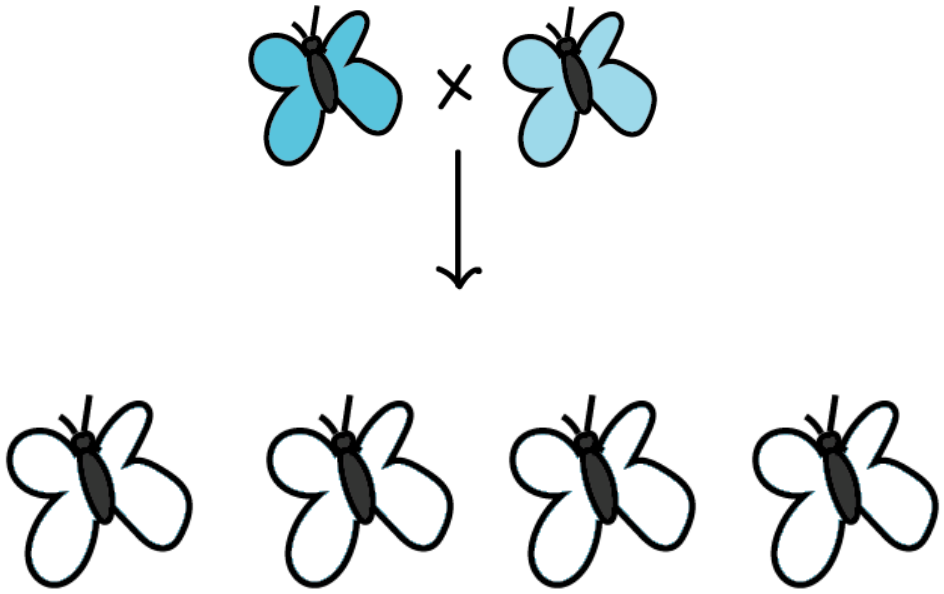
Worksheet #1

Lesson #5: Who do I look like?

Materials:

1) **crayons or coloring pencils**

Observe the butterflies that represent the parents and color the 4 butterflies (offspring) according to **the colors you think** they will inherit **from their parents.**



K-5

Worksheet #1

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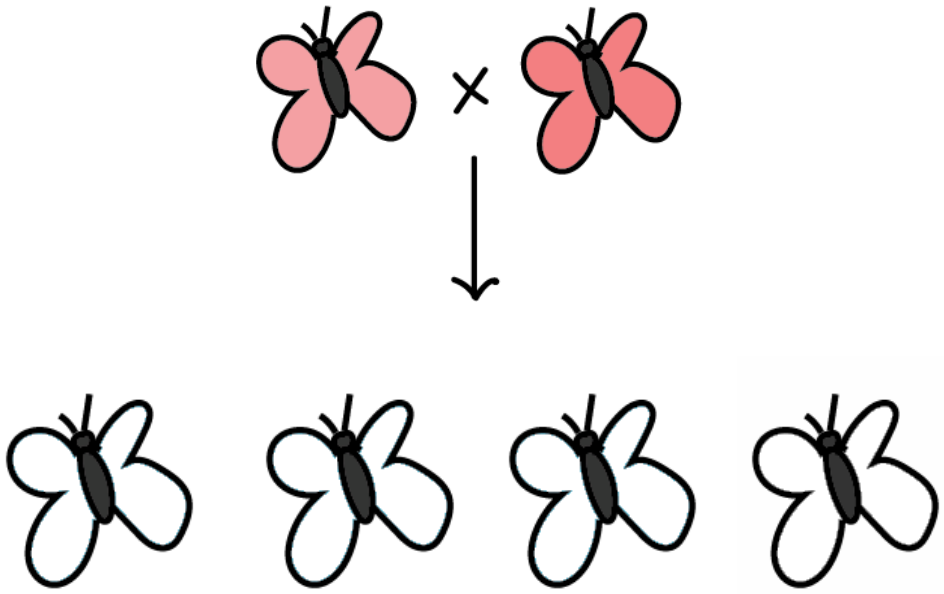

K-5

Worksheet #1

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Materials:

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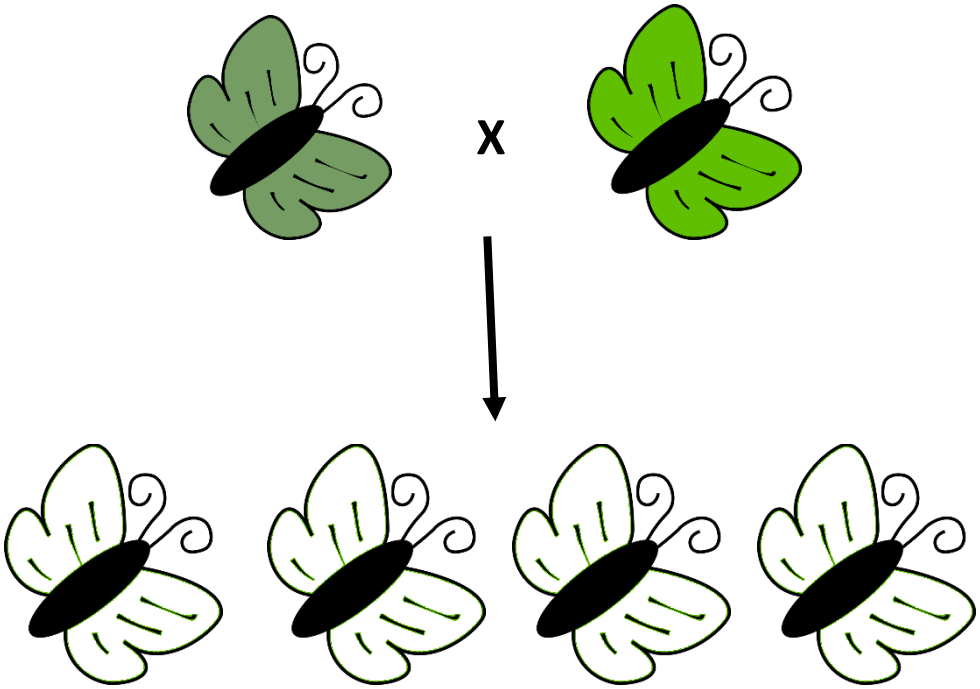
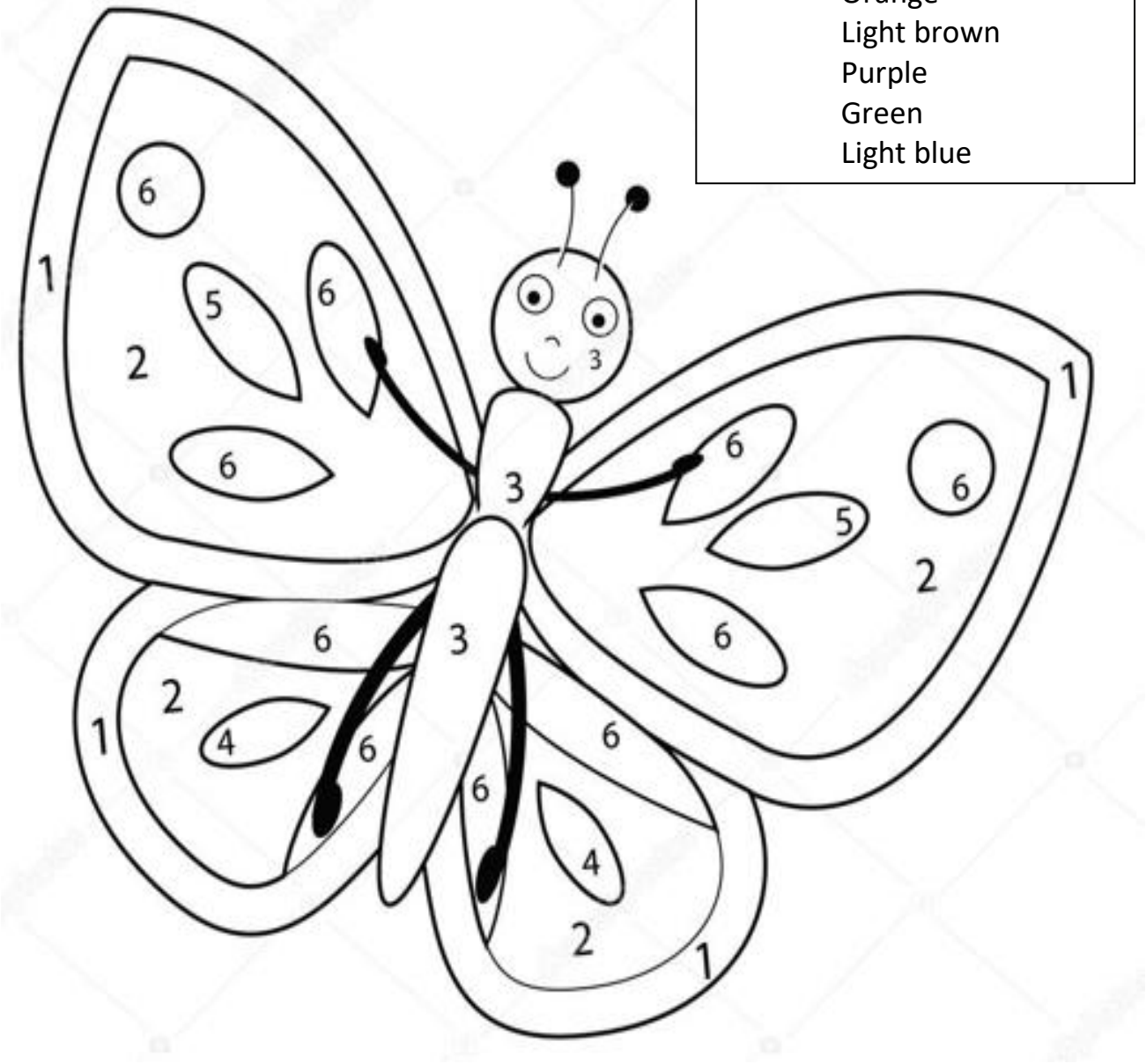


4th – 5th

Lesson #5: Who do I look like? **Worksheet #2**

Use the following numeric code to color the butterfly below.

1	Red
2	Orange
3	Light brown
4	Purple
5	Green
6	Light blue

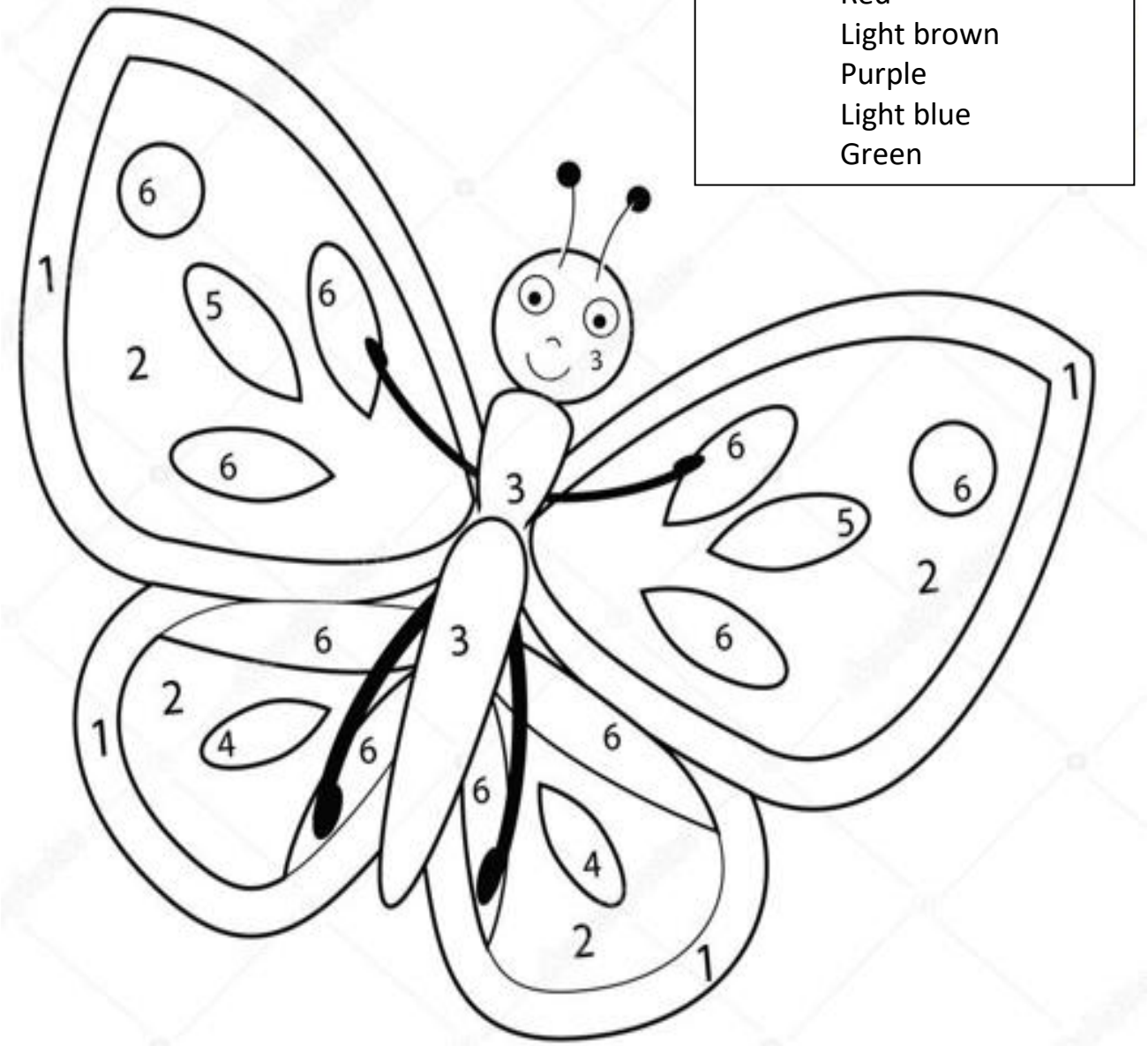


4th – 5th

Lesson #5: Who do I look like? **Worksheet #2**

Use the following numeric code to color the butterfly below.

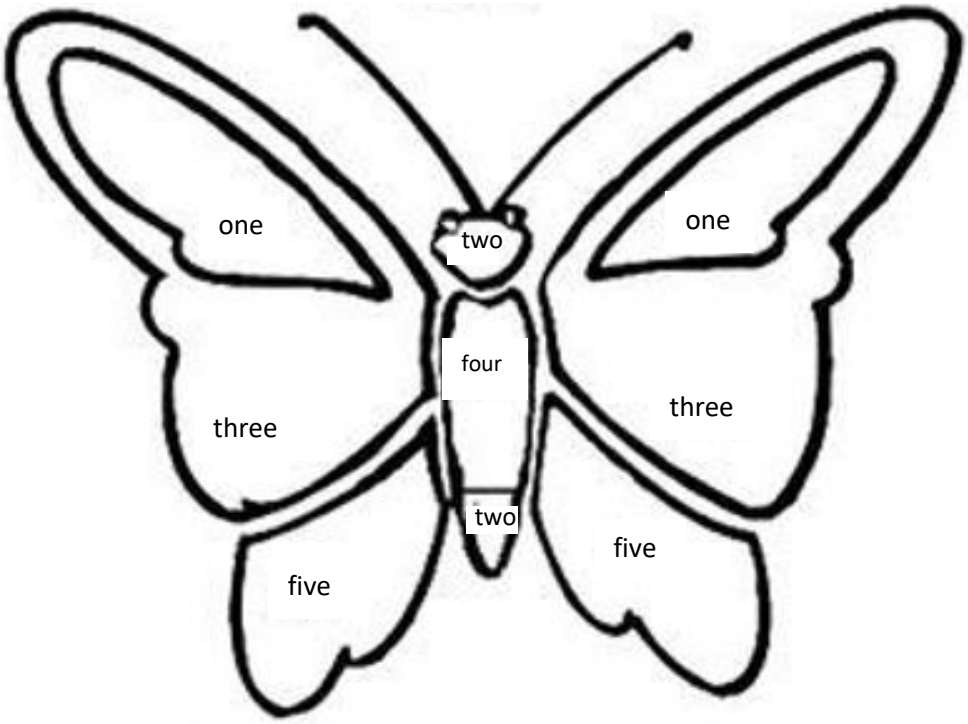
Orange
Red
Light brown
Purple
Light blue
Green



K-3

Lesson #5: Who do I look like? **Worksheet #2**

Use the following numeric code to color the butterfly below.

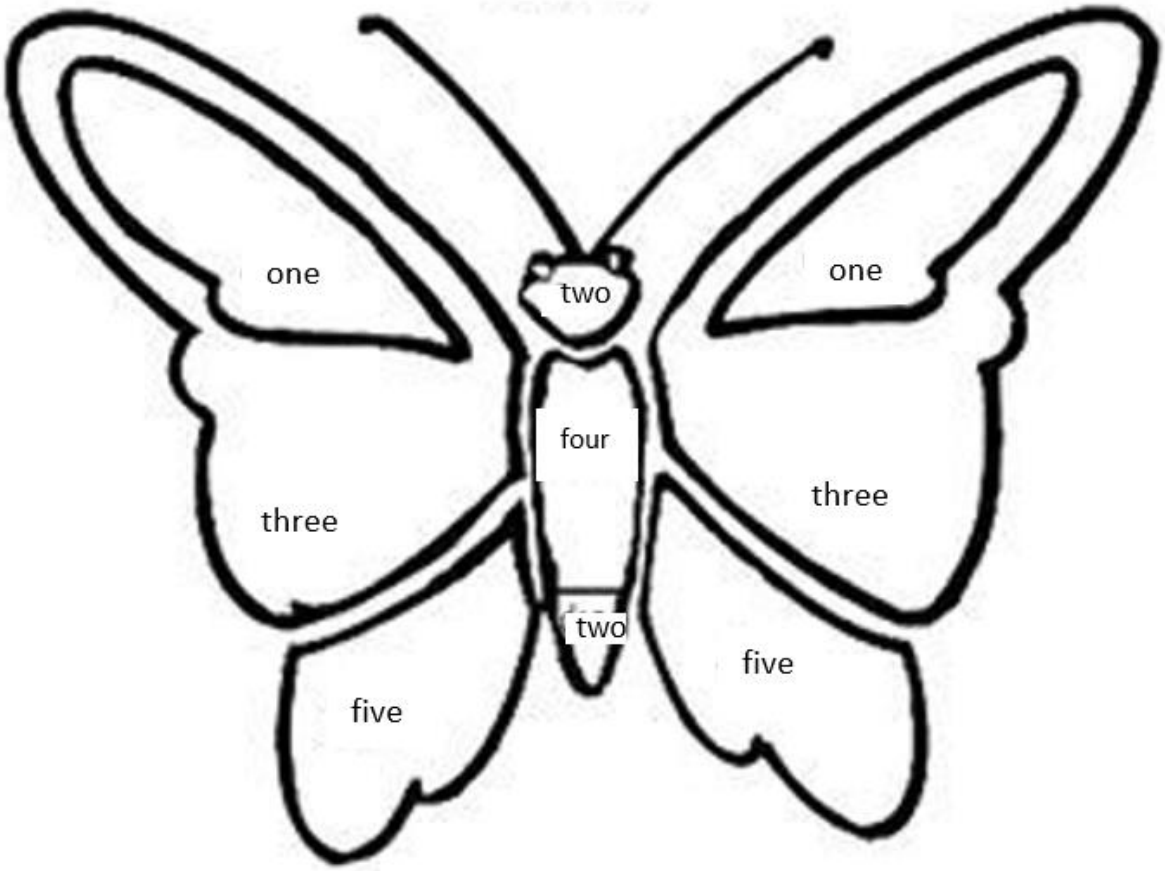


one – red
two – yellow
three – blue
four – orange
five - green

K-3

Lesson #5: Who do I look like? **Worksheet #2**

Use the following numeric code to color the butterfly below.



one – blue
two – yellow
three – green
four – orange
five - network

Material available in the PowerPoint Presentation

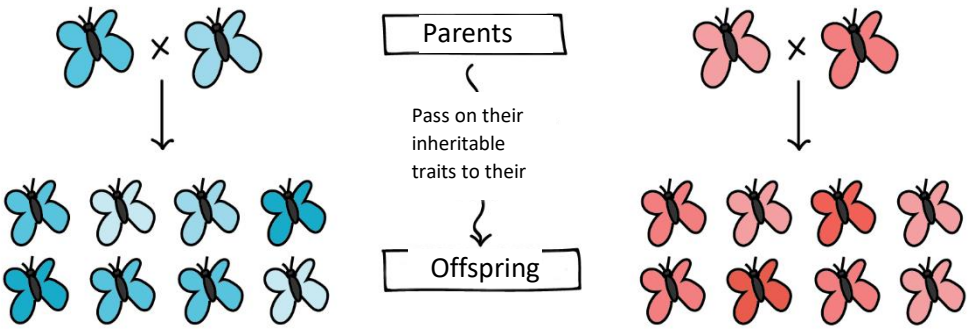


Illustration #1

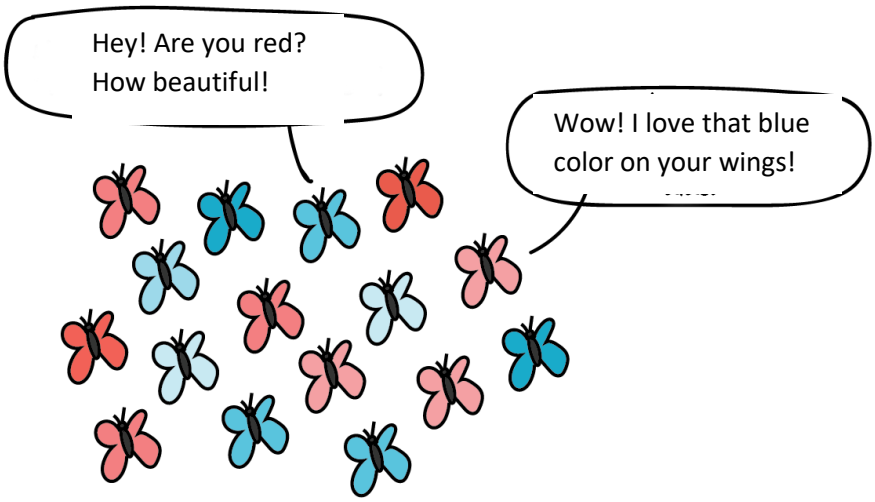


Illustration #2

Images taken from:

https://ka-perseus-images.s3.amazonaws.com/f987120ad4e1f24fbb9fd25991a260d4dbe287b4.png

https://es.khanacademy.org/science/biology/her/evolution-and-natural-selection/a/darwin-evolution-natural-selection