

**MIDDLE SCHOOL**

**Biotechnology**

**Gelin’: Gel Electrophoresis Simulation**

**Background**: Scientists use a technique called gel electrophoresis to look at a DNA fingerprint. The DNA separates into bands and these bands form different lengths. Every organism, with the exception of identical twins, has a different DNA fingerprint.

**Goal**: To understand how DNA is separated into a fingerprint by using a chromatography activity to simulate gel electrophoresis.

**Learning Objectives**: Students will…

* Follow directions to complete a gel electrophoresis simulation
* Use a color-separation technique to separate individual colors from two sample solution
* Use the results of the separation to infer whether the sample solutions are identical or not

**Materials**: (per group)

* scissors
* white cone-style coffee filters
* clear containers, such as Mason jars or plastic cups
* water
* ruler
* pencils or dowels
* tape
* Solution 1- (yellow, green, blue)
* Solution 2- (red, yellow, blue)
  + Both solutions should appear green/black
* pipette
* paper towels
* Internet access

**Time Required**: 45 - 60 minute class period

**Standards Met:**

* Science and Technology Standards: Understanding about science & technology

**Prep:**

* Mix the solutions in beakers
* Place a pipette in each beaker and leave these in a central location
* Solution 1- 10 drops green, 8 drops blue, 18 drops yellow food coloring
* Solution 2- 16 drops blue, 12 drops yellow, 8 drops red food coloring

**Procedure:**

* Pass out DNA Fingerprint Activity Sheet to each group.
* Provide all the necessary materials.
* Monitor as the class completes the activity.
* Point out to students that they have just completed the same biotechnology lab as the technicians at Furry Friends.
* Furry Friends has sent over pictures of the results of the gel electrophoresis fingerprints for potential fathers.
* Have students get out medical file and turn to the medical expense sheet. The charge for receiving one DNA gel electrophoresis fingerprint is $30.00. Students should add the cost to their sheets.
* Give each group a copy of their first choice from yesterday’s Daddy Data Sheet. Also give a copy of the kitten’s DNA gel electrophoresis fingerprint.
* Students should compare the DNA gel electrophoresis fingerprints to determine if it is a match and reveal the identity of the father.
* If it is not a match, students are charged an additional $30.00 and will receive the 2nd choice DNA fingerprint.

**Assessment:**

* Participation in the lab activity
* Accurate completion of lab questions

Cells and Heredity, Evanston, Illinois: McDougal Littell, a Houghton Mifflin Company.



**Gelin’: Student Sheet**

**Problem**: How can similar substances be separated so that they can be identified?

**Materials**: Gather the following materials for your group

* 2 coffee filters
* 1 scissors
* 2 jars
* 2 pencils
* 1 graduated cylinder
* 1 ruler

**Procedure:**

1. Cut the seam off the coffee filters and open it flat. Cut a strip about 2cm wide from the widest part of the filter. You need two strips.

2. Write 1 on the top one strip and 2 on the top of the second strip

3. Fill the containers with 50 ml of water

4. Tape the top of each strip to the pencil

\*complete the “color of solution” column in the table below.

5. Place one small drop of Solution 1 about 2 cm from the bottom of the strip labeled 1.

6. Place 1 small drop of Solution 2 about 2 cm from the bottom of the strip labeled 2.

7. Fill out the observation and hypothesis chart.

8. Carefully lower the strip into the container so that 3to 5 mm of the end of the strip is in the water. Do not allow the part of the strip with the color drop to touch the water. If necessary, re-tape the strip on the pencil. Rest the pencil on the rim of the jar.

9. Repeat procedure # 8 for strip #2

10. Observe your setups for 15 to 20 minutes. Then remove the strips from the containers and lay them on a paper towel.

**Observation and Hypothesis Table**

|  |  |  |
| --- | --- | --- |
|  | Color of Solution | What colors are in the solution |
| Solution 1 |  |  |
| Solution 2 |  |  |

**Gelin’: Simulation Analysis**

1. What happened to the dots of solution on each of the strips as the water traveled up the strip? Draw and describe the color patterns on each strip.

2. Compare your test to actual gel electrophoresis steps you saw in the video. How are the tests similar and different?

**Gelin’: Gel Electrophoresis Simulation Analysis Teacher Key**

**Observation and Hypothesis Table**

|  |  |  |
| --- | --- | --- |
|  | Color of Solution | What colors are in the solution |
| Solution 1 | Blackish Green | Yellow  Green  Blue |
| Solution 2 | Blackish Green | Red  Yellow  Blue |

1. What happened to the dots of solution on each of the strips as the water traveled up the strip? Draw and describe the color patterns on each strip.

Answers will vary, but may include:

**As the water travels up the strips, the solution starts to separate. The lighter colors travel more quickly so they move farther up the strip. The darker colors form bands closer to the starting point.**

2. Compare your test to actual gel electrophoresis steps you saw in the video. How are the tests similar and different?

Answers will vary, but may include:

**They are similar that both the DNA and color solutions separate according to how quickly they move across the gel or paper strip.**

**You don’t need to stain the paper to see the results. No electric current was used.**