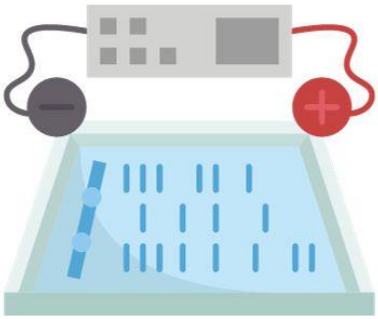
Materials

- Small container
- Stainless steel wire
- 9-volt batteries (5)
- Crocodile clip leads (2)
- Styrofoam™ tray
- Scissors
- Flasks
- Spatulas
- Weighing scale
- Dropper pipette
- Ruler
- Butter knife
- Deionized water
- Agar powder
- Corn syrup
- Food colouring dyes



Steps

Setting up electrophoresis chamber

To start this science project, you will first need to build your gel electrophoresis chamber. The plastic box will be the actual gel chamber, the stainless-steel wire will be the electrodes, the batteries will be the power source, and you'll use the Styrofoam to make a comb for creating wells in your gel.

1. Cut two pieces of the wire with your scissors. The wire should be slightly longer than the width of the plastic box.
2. Bend the wires so that they hook over the sides of the plastic box and run the width of the box. Place one wire at the top of the box; this will be your negative electrode. Place the other wire at the bottom of your box; this will be your positive electrode.

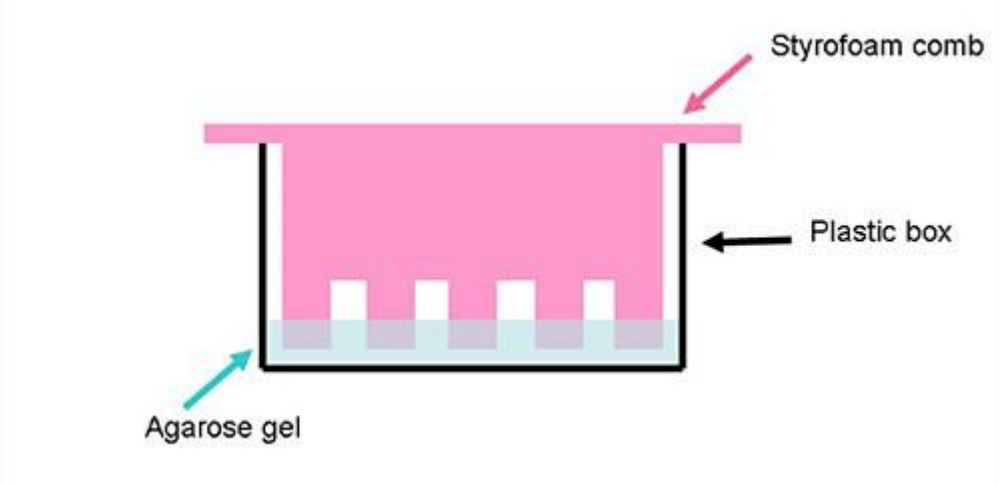
3. Connect your five 9-volt batteries together in series by snapping the positive (+) terminal of one into the negative (-) terminal of another until you've formed a battery pack with all five batteries. There should be one positive and one negative terminal left exposed.

When you're ready to begin the experiment, connect one crocodile clip lead to each of the exposed terminals in the battery pack. Complete the circuit by attaching the lead from the negative terminal to the negative electrode, and the lead from the positive terminal to the positive electrode. Now your gel electrophoresis chamber should be fully powered. Remember, don't complete the circuit until your experiment is set up.

4. Using a pair of scissors, cut out a comb out of the Styrofoam.
    a. The comb will be placed vertically into the plastic box and need to stand upright, so it should be wider at the top so that the comb can rest on the edges of the plastic box.

b. The teeth should be evenly spaced and there should be at least 2 millimeters of space between the bottom of the teeth and the bottom of the plastic box.

5. Make the buffer solution that you will use for both making the agar gel and running the samples. The buffer should be a 1% solution of baking soda. To make this, combine 2g of baking soda with 200 mL of deionized water in one of your bowls and stir well.
6. Make a 1% agar gel solution by combining 1 g of agar powder with 100 mL of your buffer solution in a microwave-safe bowl.
    a. Heat the agar solution in a microwave to dissolve the powder. Stop the microwave every 10-15 seconds to stir the solution.
    b. When you see that the solution is starting to bubble, remove it from the microwave. The solution should be translucent. Make sure to watch the agar solution carefully and remove it promptly from the microwave; when it gets hot it will easily bubble over.
7. Remove the stainless steel wire electrodes from the gel chamber.
8. Insert the Styrofoam comb into either end of the gel chamber, leaving approximately 0.5 cm between the end of the box and the comb. Gently pour the agar solution into the gel chamber. Add just enough solution to the box so that the comb teeth are submerged approximately 0.5 cm. If the gel is too thick, it will be difficult to observe good separation of the food colouring dyes.



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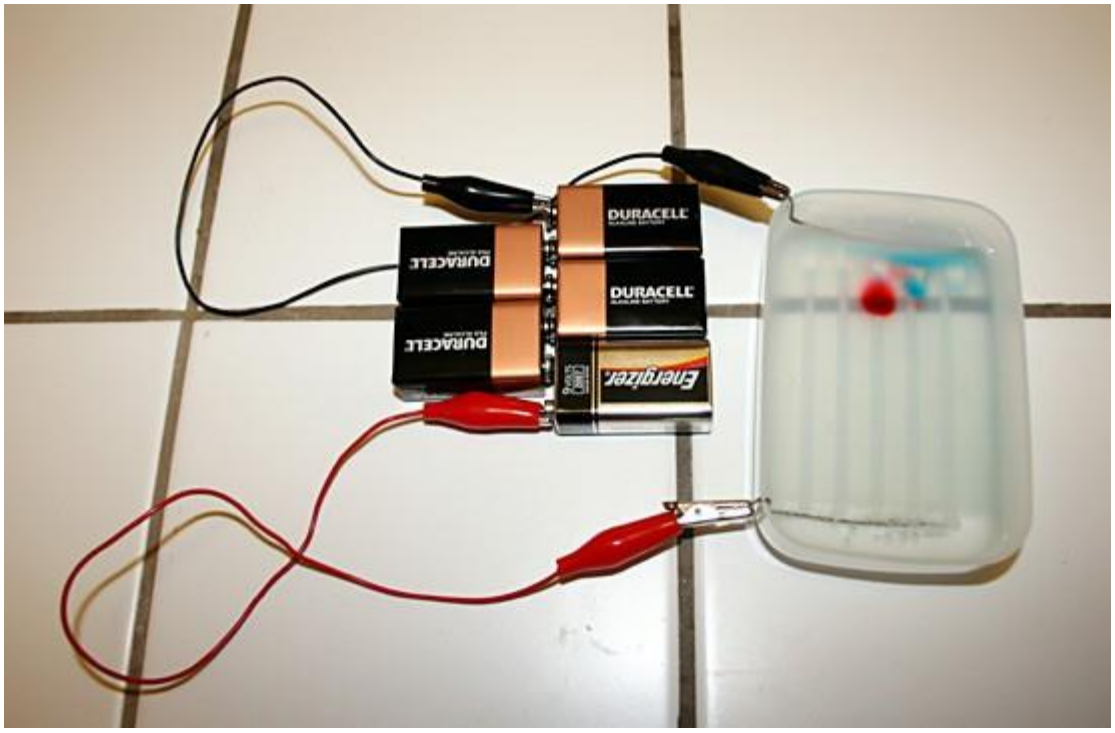
Wait until the gel solidifies, which may take at least 30 minutes at room temperature. *Tip:* When the gel is set, it should be firm to the touch and wiggle like solid jelly. While waiting we may perform an online interactive lab of electrophoresis that closer resembles electrophoresis in a research lab.

Running gel

9. Pour the remaining 100 mL of your buffer solution over the solidified gel. Add enough buffer to submerge the gel.
10. Gently pull the comb out of the gel. Be sure not to remove thec comb until you are sure that the agar gel is completely set. The resulting wells will be used as reservoirs for your samples.
11. Using the butter knife, carefully cut a thin slice of the gel from the top and the bottom to make room for the electrodes.
12. Re-attach the electrodes.
13. Using a dropper pipette, fill each well in the gel with a different colour of food dye. A small drop of food colouring dye is sufficient.
14. Using the crocodile clip leads, attach the battery pack to the wires resting on the gel chamber. The positive terminal of the battery pack should be connected to the positive electrode; this is the electrode toward which you want the food colouring dye to migrate as it separates. You should see bubbles forming around the electrodes in the buffer as the current passes through them.
    a. If you don't see bubbles, recheck all your electrical connections. Make sure the batteries are properly placed in *series,* and that the batteries are fresh and fully charged.



15. Check the progress of your gel every 10-15 minutes. Run the gel until you see good migration and separation of the food colouring dyes.
16. Compare each food colouring dye sample. How many bands do you see for each colour? Which one ran the farthest? Using a ruler, measure how far from the wells each band migrated. Make a data table, like the one below, for all your observations.

Food Dye Colour	Number of Bands	Migration Distance of Each Band (cm)
Red		
Blue		

Reference

Buddies, S. and Buddies, S. (2023) *Forensic Science: Building your Own Tool for Identifying DNA | Science Project*. https://www.sciencebuddies.org/science-fair-projects/project-ideas/BioChem_p028/biotechnology-techniques/forensic-science-building-your-own-tool-for-identifying-dna.