EDVOTEK® INQUIRY GUIDE:

ELECTROPHORESIS

TEACHERS:

For the answer key, please contact us at **info@edvotek.com**

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Key Terms

DEFINE the following terms before you begin the guide then refer to them as needed. Use any resources you want!

Electrophoresis:

Matrix:

Agarose:

DNA:

RNA:

Protein:

Electrical Field:

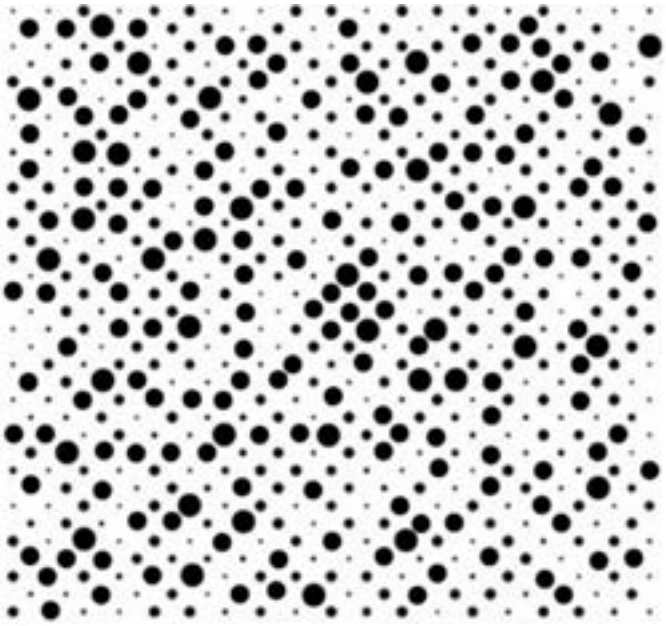
Gel:

PCR:

Restriction Enzyme:

Ladder:

1. This question requires a pencil and a thicker marker. **TRAVERSE** the matrix below with your pencil, moving exclusively through the white areas and steering clear of the black dots. Start from the left and proceeding to the right. **REPEAT** with your marker. Finally, **ANSWER** the four question on the right.

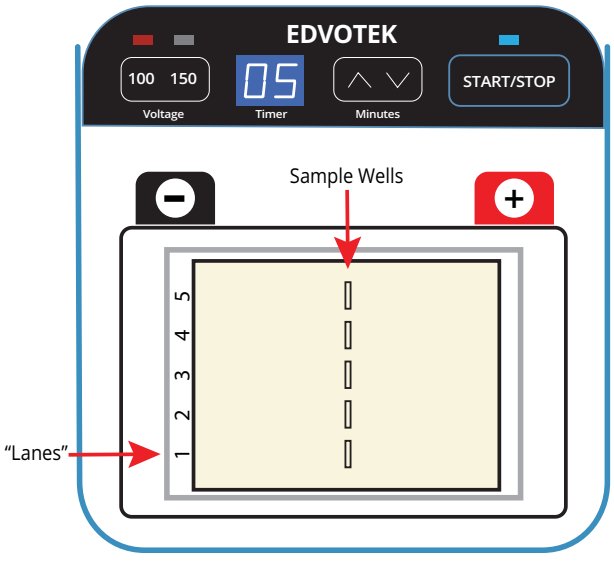


- Which run was faster?
- How does this relate to electrophoresis?
- What does the pencil represent in this simulation?
- What does the marker represent in this simulation?

2. **CIRCLE** the molecules below that would work on the electrophoresis apparatus below.

Molecule:	DNA (- charge) (Lane 1)	RNA (- charge) (Lane 2)	Protein (neutral) (Lane 3)	Protein (+ charge) (Lane 4)	Protein (- charge) (Lane 5)

3. In the illustration below, **DRAW** an arrow (<— or —>) in each molecule's corresponding "lane" to indicate which direction (if any) each molecule will move.



4. In DNA electrophoresis, the matrix used to contain and separate molecules is called a gel. Typically, this gel is made from agarose. By adding more or less agarose, scientists can separate a wide range of DNA molecules from the very big (25,000 bp) to the very small (<10 bp).

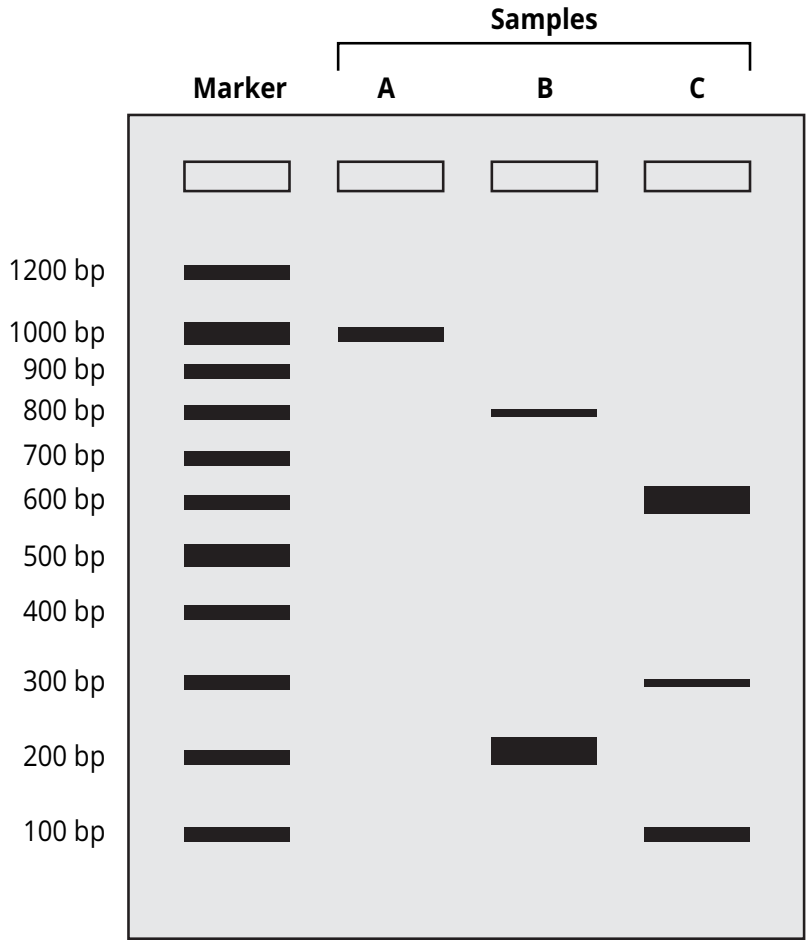
   a. **CALCULATE** how much agarose you'd need to create 50 mL of a 1% gel using the weight/volume formula below. (A 1% gel is optimal for separating DNA fragments 500-10,000 bp long.)

      Agarose (g) = Percentage (expressed as a decimal or fraction) x Gel Volume (mL)

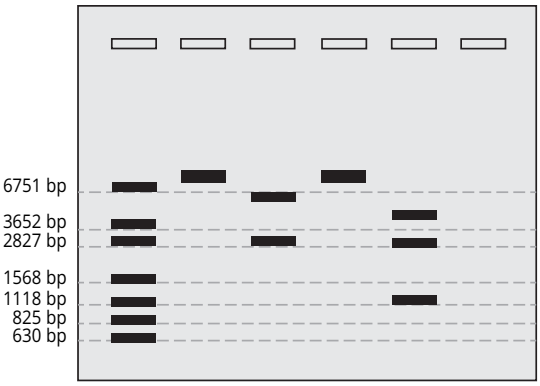
   b. If you were working with DNA fragments between 50-500 bp, would you make a lower or higher percentage gel (i.e. add less or more agarose)?

5. Congratulations! You've successfully PCR amplified your DNA samples and run the results on a gel. Now it's time to analyze the results. Use the gel below to **ANSWER** the following questions. (You will need access to colored pens.)

   a. In RED circle the two largest DNA fragments in the three samples.
   b. In BLUE circle the two smallest DNA fragments in the three samples.
   c. In BLACK circle DNA fragments larger than 500 base pairs in the three samples.



6. Congratulations again! You've successfully amplified your DNA samples, completed a restriction enzyme reaction*, and run the results on a gel. Now it's time to analyze the results. Use the gel below to **COMPLETE** the table.



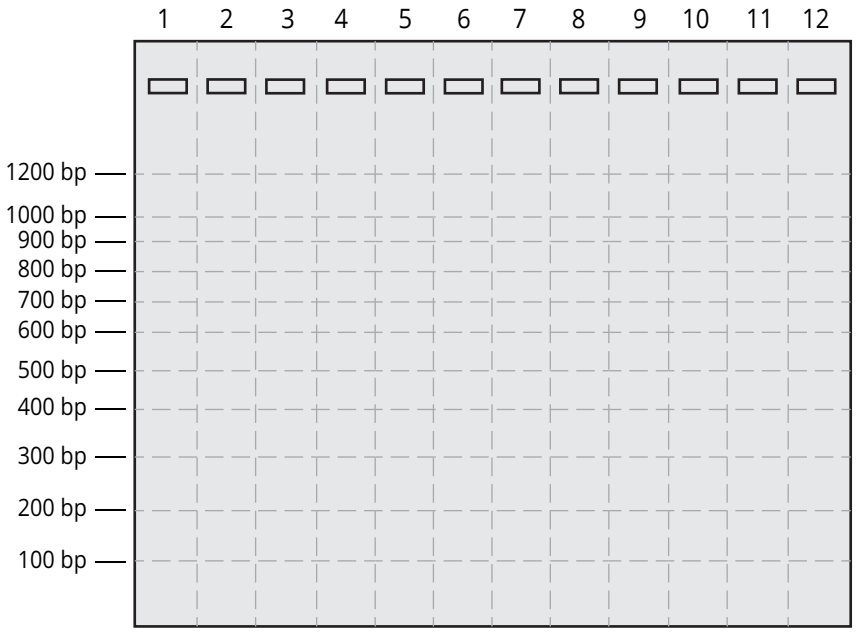
Lane	Number of Fragments	*Estimated* Size of Fragments	*Estimated* Sum of all Fragments
Marker	7	6751, 3652, 2827, 1568, 1118, 825, 630	---
Sample 1 (Undigested DNA)	1	7720	7720
Sample 2 (DNA digested with EcoRI)			7720
Sample 3 (DNA digested with BamHI)			7720
Sample 4 (DNA digested with EcoRI and BamHI)			7720

* *During a restriction enzyme reaction amplified DNA is mixed with enzymes that cut the DNA at specific DNA sequences resulting in smaller fragments. The more frequently a specific sequence appears the more often the DNA will be cut and the more fragments.*

7. Now do the reverse. Use the blank agarose canvas and table below to **DRAW** the results from a diagnosis experiment. The marker in Lane 1 is already filled in for you.

Lane	Number of Fragments	Estimated Size of Fragments
Marker *(already filled in)*	7	6751, 3652, 2827, 1568, 1118, 825, 630
Negative Control	1	4282
Positive Control	3	4282, 3000, 1282
Patient 1	3	4282, 3000, 1282
Patient 2	1	4282

8. Use this next agarose canvas to **DRAW** a simple shape out of bands (e.g. a circle, square, heart, emoji). What base pair bands would you need to make this shape in the lab?



Lane	Number of Fragments	Estimated Size of Fragments
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		

NOTE: Remember that in electrophoresis the key measurement is distance traveled from wells so feel free to use different colors, thicknesses, or textures for the bands.