Chromatography Lab

Name __________________________________
Date ___________________________________
Hour ______________

Definitions:

Chromatography

Mobile Phase

Stationary Phase

Ds_______________________________________

Df _________________________________________

Rf___________________________________________________________________________

Paper Chromatography

Capillary Action

Independent variable

Dependent Variable

Hypothesis

Null Hypothesis

Questions:

A student wanted to find out if some food colorings contained a banned food dye.

He put a drop of each food coloring and the banned food dye onto some filter paper. He hung the paper in a beaker of water.

After 10 minutes, the banned food dye and some of the dyes from the food coloring had moved up the paper.
The results are shown below.

1. In this particular scenario, what is the mobile phase? ________________________________
2. In this particular scenario, what is the stationary phase? ________________________________
3. The student wrote the labels on the paper in pencil. Why should he not write them in ink?
   _______________________________________________________________________________  _______________________________________________________________________________

Looking at the student’s results. The different dyes in some of the food colorings had moved up the paper.

4. Which food coloring contained the banned food dye? ___________________________ How can you tell?
   ____________________________________________________________________________  

5. Which food coloring contained the most dyes? ____________________________ How can you tell?
   ____________________________________________________________________________  

6. Which food coloring did not dissolve in the water? ___________________________ How can you tell?
   ____________________________________________________________________________  

A different student carried out an experiment to separate out the components of a black marker. She used a 0.1 M KNO₃ solution as her mobile phase.

She needed 50 mL of 0.1 M KNO₃ solution. Describe how she will make the solution including specific amounts of KNO₃ (in grams) and specific glassware.

1. Which of the dyes in the black marker is most attracted to the mobile phase? ________________
2. Which of the dyes in the black marker is most attracted to the stationary phase? ________________
Complete the data table for her chromatogram:

<table>
<thead>
<tr>
<th>Marker Color</th>
<th>Dye Color</th>
<th>( D_s ) (cm)</th>
<th>( D_f ) (cm)</th>
<th>( R_f )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>Red</td>
<td>5.5</td>
<td>6.0</td>
<td></td>
</tr>
</tbody>
</table>

Calculate the \( R_f \) value for each dye showing all set-up work below. Record final \( R_f \) answers in the data table.

\( R_f \) for the red dye. \( R_f \) for the green dye.

\( R_f \) for the yellow dye. \( R_f \) for the blue dye.

**Now your turn:**

**The rules:**

- You will need your own question and hypothesis. You will not have a partner.
- You will need to test at least one colored agent.
  - You may use up to 4 colored agents.
  - I have available many types/brands/colors of markers and food dye that you are welcome to use.
  - You may bring your own water soluble colored agents.
- One of your mobile phases must be a molar solution of salt (NaCl) or isopropyl Alcohol (\( C_3H_8O \)).
  - You may have up to 4 solutions.
  - You will need to make the molarity of your solution(s) fall between 0.010 to 0.10 M. The molarity of the solution must have 2 significant figures and end in a 5 or 0.
  - Solutions will be made in a 100 mL volumetric flask.
  - If you make multiple solutions, the secondary solutions may be made by using the dilution formula.
  - All solutions will be stored in labeled re-used water bottles; you will create the label.
- You may conduct your experiment by suspending your paper in a test tube or beaker, or forming your paper in to a cylinder. See the chromatography lab for pictures.
  - If necessary, you may conduct your experiment at home.
- You must get clearance from me first if you plan to deviate from any of the rules.

**Final caveat: More is not better.**

**Your report:**

You will need to use the steps of the scientific method to report your information. You may do your report in most any media that you decide; some examples that don’t need approval: paper display board (made of file folders), PowerPoint (slides) or video. The scientific method handout is located at the end of the chromatography lab. Regardless of the method you use, you will need to turn in your chromatogram along with a data table of all \( D_s \), \( D_f \), and \( R_f \) values (with calculation samples) and your calculations of molarity.
**Your Experiment:**

What is your experimental question that you will study using chromatography (be creative)?

_______________________________________________________________________________________________

What is your hypothesis? (you may use a null hypothesis if you have no educated bases to make a decision.)

_______________________________________________________________________________________________

What solution(s) will you be using? (include Molarities)  

_______________________________________________________________________________________________

What other non-chemical supplies will you need in addition to filter paper?

_______________________________________________________________________________________________

**Chromatography Check List**

<table>
<thead>
<tr>
<th>Item</th>
<th>Your check</th>
<th>My check (before experimenting)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completed Worksheet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valid Question Pre-check</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valid Hypothesis Pre-check</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Molarity Calculation Pre-check</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Pre-check Complete and I’m ready to experiment!*  

**Report Components**

<table>
<thead>
<tr>
<th>Item</th>
<th>Your check</th>
<th>My check (after submitted)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypothesis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detailed Procedure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Molarity Calculation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chromatogram</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data Table</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rf Calculation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conclusion</td>
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</tbody>
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