Name: _____

Separation of a Mixture Using Paper Chromatography

**Based on Experiment 2D in the Heath Lab Manual*

Objectives:

1) To assemble and operate a paper chromatography apparatus.

2) To study the meaning and significance of R_f values.

3) To test various food colourings and to calculate their R_f values.

4) To compare measured R_f values with standard R_f values.

5) To separate mixtures of food colouring into their component colours.

6) To identify the components of mixtures by means of their R_f values.

Materials:

Red food colouring	Blue food colouring	Yellow food colouring
Green food colouring	Unknown fd colouring	3 Erlenmeyer Flasks
3 glass test tubes	Chromatography Paper	Water
Scissors	Pencil	Ruler

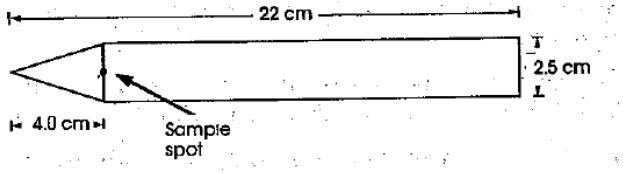
Procedure:

1) Put the three test tubes into the three Erlenmeyer flasks.

2) Using the scissors, pencil, and ruler, cut one 70 *cm* strip of chromatography paper.

3) From the 70 *cm* strip, cut three 22 *cm* strips. Four centimetres from the bottom of each strip, make a line with a ruler and then cut a triangle, as seen below:

Figure 1:

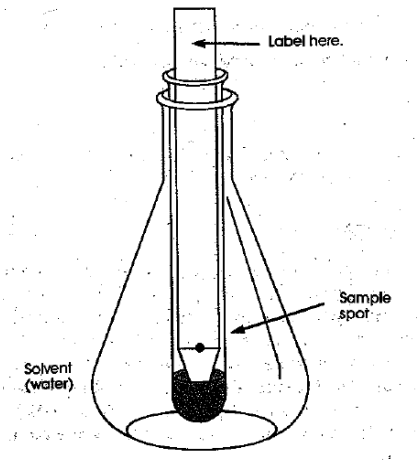


4) Place water in each test tube about 2 *cm* deep (half the triangle).

5) At the food colouring station, using a capillary tube or a toothpick (whichever is supplied), make a sample spot (as seen above) on each of the three chromatography strips. One sample is the unknown food colouring, one is the green, and the third is a choice of red, blue, or yellow. Label each strip at the top with a pencil.

6) Carefully put each strip into a test tube so that the point of the triangle just touches the bottom of the test tube. Make sure the strip is not bent or curved.

Figure 2:



7) Observe the water (solvent) carry the food colouring (solute(s)) up the strip. **Each component (primary) colour solute that makes up the food colouring will dissolve in the solvent and travel a different distance up the strip due to the capillary action of the solvent. Some solutes are more soluble in the solvent and so travel higher, while some solutes adsorb to the paper strip better and don't travel with the solvent front as far.*

8) When the solvent has reached two-thirds to three-quarters high on the strip, remove the strips and place them on paper towel to dry. Wait a few minutes for the water to stop moving, and then label the height of the water with a pencil before it dries out. Call this the '*solvent front*'.

9) Label each *solute front* with its primary colour name on the strip so that all three strips are fully labeled.

10) With a *centimeter* ruler, measure the solvent and solute(s) fronts on each strip from the pencil line where the sample spot was placed, and write the measurement neatly on the strip. Be sure to measure with correct significant figures.

11) Transfer all quantitative data to Table 1, and calculate the R_f value (with correct significant figures) for each solute in each strip. **Each primary colour is made up of an industry standard dye, and each different standard dye has its own specific R_f value, due to its unique properties.*

12) Clean up test tubes and flasks. Wash down the station and wash hands with soap.

13) Each member of the group will take one fully labeled chromatography strip to attach to lab report as an ***Appendix***, which is the last subheading in the report.

Data and Observations:

Table 1 – Chromatography Data and R_f Calculation and Analysis

Food Colouring	Component Colour	Solute Height (*cm*)	Solvent Height (*cm*)	R_f value (solute/solvent)	Industry Dye from Table 2

Table 2 – Industry Primary Dye R_f Values

Dye	Red #2	Red #3	Red #4	Yellow #5	Yellow #6	Blue #1	Blue #2
R_f	0.81	0.41	0.62	0.95	0.77	1.0	0.79

Sample Calculations:

**Pick one solute from any of the three samples, tell the reader which it is, then show one R_f calculation by giving the general formula, then substitute in the data (with units), then give the R_f with correct significant figures.*

Questions:

1) What is the lowest possible R_f value? What is the highest? Explain why for each.

2) Observe the experimental R_f values for each component colour and discuss the precision (clustering) of the results for each component colour. From the precision observed, does it seem that each component colour across all samples are the same industry dye? For example, can you conclude that the blue from the green mixture and the blue from the unknown mixture are the same blue industry dye? Discuss, using quantitative results as support.

3) Compare the experimental R_f values with the industry values for each component colour. Are there any primary colours that are certainly one of the industry dyes from Table 2? Are there any that don't seem to be? Discuss using quantitative results as support.

4) How come pencil was used for the sample line instead of pen?

Conclusion:

Restate and comment on Objective 6, and where the reader can view these results.

Appendix:

On a blank white sheet, affix the fully labeled chromatography strip.