Separating a Mixture by Paper Chromatography

Name - _____

Partner - _____

Complete the reading at the back to give you background information for this lab.

<u>Pre-lab Questions</u> -

1.) In the separation technique of chromatography, how are the components of a mixture separated? (1)

2.) How is chromatography used in;

a.) urine analysis? _____ (1)

b.) pharmaceutical industry? _____ (1)

3.) In this lab, what is the;

a.) stationary phase?   _____ (1)

b.) moving carrier?   _____ (1)

4.) Define the term "ratio of fronts" (R_f). (1)

_____

_____

5.) If a substance has a high solubility (is strongly attracted to the solvent), what will its R_f value be close

to? _____ (1)

6.) If a substance has a very low solubility (is not attracted to the solvent), what will its R_f value be close

to? _____ (1)

7.) If the solvent in a chromatography experiment travels up the paper $8.2\ cm$ and a substance applied to

the paper travels up the paper $6.8\ cm$, what is its R_f value? (**show your work**). (2)

R_f value = _____

<u>Purpose</u> – to practice the technique of paper chromatography in separating out dye colours in a mixture and discover the identity and R_f values of an unknown dye.

<u>Materials</u> – (1)

<u>Procedure</u> –

<u>Part 1</u> – **Assembly of the Chromatography Apparatus**

a.) Gather 5 large test tubes and place each test tube in 1 large Erlenmeyer flask.

b.) To each test tube add <u>approximately</u> $2\ cm$ of distilled water.

c.) Cut a strip of chromatography paper that is $22.00\ cm$ in length. Use a pencil to draw a line across the strip $4.00\ cm$ from one end. Trim the $4.00\ cm$ end to a point making a cut from the pencil line to the center of the strip to make a point.

<u>Part 2</u> – **Conducting the Chromatography Experiment**

a.) Label the top of your paper strips with the following words, using a pencil;

green   red   blue   yellow   unknown

b.) Using a toothpick place a small (no bigger than $0.25\ cm$) dot of your colour of food dye at the base line (pencil line) of each piece of paper.

c.) Dip your labelled and spotted strip of paper into your test tube. The coloured dot of food dye will begin to move up the paper with the water solvent due to capillary action.

d.) Wait until the water (solvent) has moved up at least $10.00\ cm$ up the paper (this may take $20\ min$). The different spots of food dye will move up to various distances below the water front.

e.) Remove the paper strip from the test tube and draw a line with a pencil at the front. Set each strip on a paper towel to dry. Clean your lab area up.

<u>*Attach your strip to your lab for 2 marks*</u>

Part 3 – Calculations of R_f Values

a.) Fill in *Table 1* (including a title!!!!) for the red, blue and yellow strips of chromatography paper. Refer to page 27 of the handout for your measurements.

| Chromatogra |
| phy Strip |
| Here |

Table 1 -

	Red	Blue	Yellow
Distance moved by the water front (d_2)			
Distance to the front of the food dye (d_1)			
Calculated R_f value			

/3

/1

Ex. Calculation -

b.) Compare your calculated R_f values in *Table 1* to the established R_f values in *Table 2* to identify which dyes were tested.

Table 2 – Some R_f values for approved food colourings.

Dye	Red #2	Red #3	Red #4	Yellow #5	Yellow #6	Blue #1	Blue #2
R_f	0.8100	0.4100	0.6200	0.9500	0.7700	1.000	0.7900

Red dye = _____   Yellow dye = _____

Blue dye = _____

/3

c.) From the green strip, what appears to be the component colours of green food dye? (1)
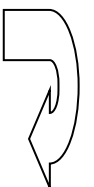
d.) From the unknown strip, what seems to be the component colours of this mixture? (1)

e.) Calculate the R_f value for the blue component in the green and unknown samples. (2)

Blue R_f value in the green sample = _____   <u>Calculation Work</u>

Blue R_f value in the unknown sample = _____

Post-lab Questions –

1.) What do you think would happen to the experiment as performed if ink, rather than pencil was used to mark the sample on the chromatography paper? (1)

2.) Why should green food dye be classified as a mixture, whereas yellow, blue or red should not? (1)

3.) Identify the dyes that appear on the chromatography on $page\ 29$ of the handout, $Figure\ 2D - 5$. Calculate the R_f values of each dark spot on the chromatogram and refer to $Table\ 2$ from the lab to identify the colour. The original spot of colour was <u>orange</u>. (3)

R_f value – lower spot = _____ R_f value – upper spot = _____

Colour identity =   _____   Colour identity =   _____

4.) If the R_f values of two spots on a chromatogram are 1.00 and 0.410 and the solvent front has moved $12.0\ cm$ from the beginning point, how far apart on the chromatogram are the two spots? Show your work. (2)

Separation distance - _____ cm

A chemist performs a R_f calculation, obtains a value of 1.2 and decides the answer is unacceptable. Why? (1)

Conclusion -