



# DPTV's Digital Adventure

## DIA Virtual Field Trip: Science at the Museum

<b>Title of Lesson:</b> Black Ink Chromatography
<b>Grade Level/Content Area:</b> Grades 2+ Science and Art
<b>Created by:</b> Tiffany Stano
<b>School/District:</b> New Paradigm for Education-Detroit Edison Public School Academy

Objective (Students will be able to...)	Students will be able to determine what pigments are present in black markers.
Common Core State Standards	<p><u>CCSS.MATH.CONTENT.3.MD.B.4</u> Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch.</p> <p><u>CCSS.MATH.CONTENT.4.MD.B.4:</u> Make a line plot to display a data set of measurements in fractions of a unit (<math>\frac{1}{2}</math>, <math>\frac{1}{4}</math>, <math>\frac{1}{8}</math>).</p> <p><u>CCSS.MATH.CONTENT.5.MD.B.2:</u> Make a line plot to display a data set of measurements in fractions of a unit (<math>\frac{1}{2}</math>, <math>\frac{1}{4}</math>, <math>\frac{1}{8}</math>).</p>
Subject-Specific Standards	<p>Michigan Science Standards</p> <p>K-2-ETS1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.</p> <p>3-PS2-2 Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.</p> <p>3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.</p> <p>5-PS1-3 Make observations and measurements to identify materials based on their properties.</p> <p>3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.</p> <p>MS-PS1-2 Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.</p>

	<p>MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.</p> <p>Next Generation Science Standards:  HS-PS1-2: Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table and knowledge of the patterns of chemical properties.  HS-PS1-4: Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends on changes in total bond energy.</p> <p>Michigan Art Standards  ART.VA.II.2.3 Understand and recognize how artists create and construct multiple solutions to visual problems in artworks.  ART.VA.V.2.1 Describe how art is used in everyday life.  ART.VA.II.3.1 Apply materials and techniques to problem solve in the creation of art.  ART.VA.II.4.1 Synthesize the use of a variety of materials, techniques, and processes to problem solve in the creation of art.  ART.VA.II.5.1 Synthesize the knowledge of materials, techniques, and processes to create artwork.  ART.VA.II.6.1 Identify, design, and solve creative problems at a developing level.  ART.VA.II.7.1 Identify, design, and solve creative problems at an emerging level.  ART.VA.II.8.1 Effectively identify, design, and solve creative problems.</p>
Materials Required	<ol style="list-style-type: none"> <li>1. White coffee filters or paper towel cut into 1 inch strips</li> <li>2. 3-5 different types of black markers or felt tip pens (i.e. Expo, Sharpie, Pentel, Paper Mate)</li> <li>3. Cup with 1 inch of water</li> <li>4. Ruler</li> </ol>
Technology Integration	<p>Detecting Pigments in Cancer and Art:  <a href="http://dptv.pbslearningmedia.org/resource/6f19226f-9b94-4398-8e04-038b3e3ad950/detecting-pigments-in-cancer-art/">http://dptv.pbslearningmedia.org/resource/6f19226f-9b94-4398-8e04-038b3e3ad950/detecting-pigments-in-cancer-art/</a></p> <p>Pigments and Pixels:  <a href="http://dptv.pbslearningmedia.org/resource/ket09.sci.phys.energy.pixel/pixels-and-pigments/">http://dptv.pbslearningmedia.org/resource/ket09.sci.phys.energy.pixel/pixels-and-pigments/</a></p>
Lesson Introduction/Hook	<p>Is all black ink the same? Black ink may actually be made of a combination of many different dyes.</p>

	<p>Teacher: Prior to the lesson, write a “ransom” note to students on a piece of paper towel or coffee filter, leaving ink on one end of the piece of paper towel and no writing on the other. This will be cut into strips later in the lesson. Assign each of the black inks to a character or person in the building who only uses that kind of ink. Tell students they are going to determine who wrote the note by investigating the ink.</p>
Lesson	<ol style="list-style-type: none"> <li>1. Cut the coffee filter or paper towel into strips about 1 inch wide.</li> <li>2. Draw a large dot 1 inch from the bottom of the strip of paper. Label the strips so you know which pen you used. Do the same for all ink being investigated.</li> <li>3. Hang the strip over the cup of water, touching only the very end of the paper towel and not the ink.</li> <li>4. Tape the coffee filter paper towel in place. The water will creep up the strips and separate each of the inks into a dye pattern called chromatography.</li> <li>5. Measure how far each ink sample travelled using the ruler. Make a line plot to record the data.</li> <li>6. Cut off a strip from the ransom note in the hook. The strip should have ink on one end and no ink on the other.</li> <li>7. Put the strip of paper towel in the water as you did before, allowing it to creep up and separate the ink.</li> <li>8. Take the strip out and compare it to the ink samples you took at the beginning of the lesson to determine what pen was used.</li> </ol>
Lesson Modifications	<p>Flatten the coffee filter and make black dots on the filter. Make a 1-inch cut in the center of the filter. Take a blank one-inch strip of paper towel or coffee filter and stick it into the cut you made on the coffee filter to create a wick. Place the bottom of the wick just touching water cup. Watch the water creep up the wick to the coffee filter. Allow the coffee filter to dry and use the colored coffee filter as butterfly wings for an art project.</p>
Assessment/Check for Understanding	<p>Exit ticket</p>

## **Black Ink Chromatography Exit Ticket**

The ink that was used was sample \_\_\_\_\_.

The person who used this sample was \_\_\_\_\_.

I know it was this ink sample because \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_