

## THE ART AND SCIENCE OF NATURAL DYES

Grades 4-6

### *This Packet Includes:*

|   |           |
|---|-----------|
| <b>How to Prepare Your Class for the Distance Learning Presentation .....</b> | <b>2</b>  |
| <b>Teacher Information Guide .....</b>  | <b>3</b>  |
| Program Objectives:.....  | 3         |
| Common Core Standards:.....   | 3         |
| National Education Standards:.....  | 4         |
| Program Overview:.....  | 4         |
| Prior to the Program:.....  | 4         |
| Bookmark Project to conduct during Videoconference.....                       | 5         |
| Prerequisite for Videoconference: Kool-Aid Dyeing Activity .....              | 5         |
| Selected Vocabulary: .....  | 6         |
| Teaching Extension: Making Flower Petal Pictures .....                        | 7         |
| Resource List: .....  | 8         |
| Selected Images: .....  | 9         |
| <b>VIEWING GUIDE.....</b>   | <b>11</b> |
| <b>The Cleveland Museum of Art Distance Learning Evaluation Form.....</b>     | <b>13</b> |

### *The following items will be sent by mail:*

- 1 pair disposable gloves
- Wool Yarn
- Kool-Aid packet
- Bookmark Blanks
- Cochineal
- Mineral powder

### *You will need to provide:*

- Disposable gloves
- Plastic plates or small plastic cups
- Plastic spoons
- Bag of fresh baby spinach leaves

### **Teacher Note:**

Please have students bring pencils, copies of the **Viewing Guide**, and kit materials to the distance learning program. Students will be involved with activities requiring these materials during the videoconference.

## **How to Prepare Your Class for the Distance Learning Presentation**

Teacher Information will be sent or made available to you prior to Distance Learning Lesson.

Please familiarize yourself with the materials and discuss them with your class.

Have Teacher Information Packet materials on hand in classroom, ready for the Distance Learning Lesson. These materials will often be used during the videoconference.

Be prepared to facilitate by calling on students yourself during the lesson. Students are sometimes initially shy about responding to questions during a distance learning lesson.

Explain to students that this is an interactive medium and encourage questions to Cleveland Museum of Art presenters.

Follow-up the Distance Learning Lesson with some of the suggested activities in the Teacher Information Packet to reinforce the information.

Provide evaluation as directed and return information to The Cleveland Museum of Art.

Thank You!

Distance Program at the Cleveland Museum of Art  
*In cooperation with The Cleveland Botanical Garden*

## **THE ART AND SCIENCE OF NATURAL DYES**

*Grades 4-6*

### **Teacher Information Guide**

#### **Program Objectives:**

*Students will learn and understand....*

1. That dyes can be classified as natural or synthetic.
2. That natural dyes come from sources such as plants, animals, and minerals.

#### **Common Core Standards:**

*English Language Art & Literacy in History/Social Studies, Science, and Technical Subjects-*

##### **4<sup>th</sup> Grade:**

##### **CCSS.ELA-Literacy.SL.4.1**

Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners on *grade 4 topics and texts*, building on others' ideas and expressing their own clearly.

##### **CCSS.ELA-Literacy.SL.4.3**

Identify the reasons and evidence a speaker provides to support particular points.

##### **5<sup>th</sup> Grade:**

##### **CCSS.ELA-Literacy.SL.5.1**

Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners on *grade 5 topics and texts*, building on others' ideas and expressing their own clearly.

##### **CCSS.ELA-Literacy.SL.5.3**

Summarize the points a speaker makes and explain how each claim is supported by reasons and evidence.

##### **6<sup>th</sup> Grade:**

##### **CCSS.ELA-Literacy.RI.6.7**

Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue.

##### **CCSS.ELA-Literacy.SL.6.1**

Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners on *grade 6 topics, texts, and issues*, building on others' ideas and expressing their own clearly.

##### **CCSS.ELA-Literacy.SL.6.2**

Interpret information presented in diverse media and formats (e.g., visually, quantitatively, and orally) and explain how it contributes to a topic, text, or issue under study.

**CCSS.ELA-Literacy.RH.6.3**

Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

**CCSS.ELA-Literacy.RH.6.4**

Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6–8 texts and topics*.

**National Education Standards:**

*For Fine Arts - Visual Arts (grades K-4, 5-8):*

- Understanding and applying media, techniques, and processes.
- Understanding the visual arts in relation to history and cultures.
- Making connections between visual arts and other disciplines.

*For Science (grades K-4, 5-8):*

- Physical Science
- Science and technology
- Personal and social perspectives
- History and nature of science

**Program Overview:**

Students discover how textiles from many cultures and historical periods acquire their color. Topics include an introduction to natural and synthetic dyes and a brief look at the way our eyes perceive color from pigment. Throughout the videoconference students participate in interactivities, such as experimenting with color application from plant, animal, and mineral sources, discussion, and embedded evaluation using a Viewing Guide.

**Prior to the Program:**

One-two weeks in advance: Please conduct the Kool-Aid dyeing project (described below) with your class. Most of the materials are available in the materials packet sent to you. Allow time for yarn to dry.

Two days prior to videoconference: Read through directions below for bookmark project, gather supplies and plan on how you will make the dyes that students will need for the on-camera interactivity. Copy the Viewing Guides for the students.

## **Bookmark Project to conduct during Videoconference**

On the day of the videoconference: Please bring the following materials to the videoconference site:

- One Viewing Guide for each student (please copy template included in this packet)
- Pencils for students (or have them bring their own)
- One small bag of fresh spinach (sold in grocery store salad departments, one “baby spinach” leaf per student)
- Small (3-5 oz.) plastic cups for mixing dyes (2 cups for every group of 4-5 students in the class)
- Plastic spoons for mixing dyes with water
- Materials in kit: dried cochineal, colored mineral powder, book mark blanks (one per student), one piece of dyed yarn for each student
- Have a pitcher of water available for mixing dyes, paper towels for drying hands.

About 10 minutes before videoconference starts, make a set of 2 dyes for every group of 4-5 students. Each set will consist of 1 small cup of mineral dye and 1 small cup of cochineal dye. Each student will only need a few drops of dye to complete the bookmark project.

Mix approx. ½ tsp (a visual estimate of the amount is fine) of dyestuff (cochineal or colored clay) with approx. 2 tablespoons of water. The presenter will let you know when during the videoconference to give out the 2 cups of dye to each small group of students.

### **Prerequisite for Videoconference: Kool-Aid Dyeing Activity**

The dyeing should be done with the class watching so that they can understand the concept of a mordant setting the color and also see the ability of certain fibers to absorb the color. The heat setting part of the process can be done either at the school (depending on the availability of a microwave) or after the school-day at your home.

Materials: (\* = included in kit)

Plastic beverage cup for mixing Kool-Aid dye

\*1 package Kool-Aid without sweetener—but not sugar free + approx. 4 oz. of water)

¼ cup of white vinegar

Plastic bowl or shallow tray

Access to sink and microwave

Dish detergent—one quick squirt

2 cups warm water (can use from sink or have filled pitcher)

Apron and paper towels

Disposable gloves

Plasticized plate

\*White wool yarn

1 gallon Ziploc bag for transporting Kool-Aid dyed wool.

**Note:** Color is set by use of heat (microwave) in combination with the vinegar mordant. After dyeing, wool can be microwaved either at school or the wet wool can be taken home with you in the Ziploc bag.

### Procedure:

- Put on disposable gloves.
- Make the mordant: put warm water in shallow plastic tray or bowl, mix in white vinegar.
- Soak wool skein in mordant for 30 seconds or longer.
- Mix ½ cup of water (can be cool) in cup with the Kool-Aid powder.
- Wring out wool skein and place on a plasticized paper plate.
- With a plastic spoon, sprinkle Kool-Aid mixture on wool.
- Squeeze the wool with your hands until the fibers absorb the Kool-Aid color.
- Make sure backside of skein also absorbs the color.
- More Kool-Aid can be added to the yarn if desired.

\*At this point you can put the wool and the plate in a Zip lock bag and take it home to microwave or you can transport the wool to a place in the school where this can be done.

- Put plate with wool in the microwave and cook at normal temperature for 2 minutes.
- Allow wool to cool thoroughly.
- Fill sink ½ way with water, add a few drops of dish detergent and “swish” wool through to remove any residual color.
- Wring out wool.
- Allow wool to dry.
- Bring wool back to classroom, so that students can complete their bookmark project.

### **Selected Vocabulary:**

**Analyze:** To break down, so as to understand the various parts of something.

**Astringent:** A bracing liquid that causes restriction or shrinkage.

**Cochineal:** A scale insect used to make a reddish dye.

**Ferment:** To cause the breakdown of certain parts of liquids which result in a chemical change.

**Lichen:** Moss-like plants.

**Metal Oxide:** Oxygen combined with metal in a compound.

**Mineral:** A naturally occurring substance which is not an animal or a plant.

**Mordant:** A substance which sets color in the dyeing process.

**Natural Dye:** A dye made only from a substance occurring in nature such as a plant, animal, or mineral.

**Petroleum Product:** Things made from fossil fuels. Some examples are gasoline, asphalt, and nylon.

**Resist:** A paste-like substance applied to fabric to block certain areas from absorbing dye.

**Synthetic Dye:** Dyes which are chemically “put together” by scientists.

**Textile:** Art works and artifacts made from cloth.

## **Teaching Extension: Making Flower Petal Pictures**

*(Post Videoconference Activity)*

### Overview:

Students create a picture using flower and plant parts. They then use simple chemicals to change the color of their picture, at the same time causing a change in the pH of their colorants.

### Objectives:

Students will:

- Understand the concept of pH.
- Learn how to use simple chemicals as indicators of pH change.
- Use flowers to color a picture.

### Material List

1. Lemon juice
2. Baking soda, mixed in a solution of 1 tablespoon per 2 cups of water
3. Blue flowers such as: delphinium, hydrangea, asters
4. Pink flowers such as: snap dragon, hydrangea, dianthus
5. White paper
6. Pencils

### Lesson Delivery:

1. Ask the students if they have ever heard of the term “pH”. If they have heard of it, ask for students’ definitions. When finished, write the following definitions on the board

- pH = concentration of H<sup>+</sup> (hydrogen ions)
- Measurement of acidity and alkalinity
- Scale ranges from 1-14, with 1-6 being acidic, 7 neutral, 8-14 alkaline

Explain that scientists use the pH scale to describe if a material is acidic or alkaline.

2. Ask the students if they can name some things that they think might be acidic or alkaline. Expect:

- Coke or Pepsi (acidic)
- Lemon juice (acidic)
- Baking soda (alkaline)
- Limestone (alkaline)

3. Tell them today they are going to color a picture using flower petals and plant parts. Hand out to each student a selection of flower petals and plant parts. Hand out a blank piece of paper to each student. Instruct them to draw a picture on their paper using a pencil. The picture should be simple like the pages in a coloring book.

4. After the picture is drawn, instruct them to rub their flower petals and plant parts on their paper to color it in. Make sure each student uses both pink and blue flower petals on their drawing.

5. When students have finished coloring, instruct them to carefully drip one drop of lemon juice on the pink and blue areas of their drawings. Repeat carefully with the baking soda solution.
6. Ask them if they noticed any changes in the color due to the lemon juice or baking soda.
7. Tell them that the color often changes to blue when it is treated with an alkaline chemical, such as baking soda. Blue often changes to pink when treated with an acidic chemical, such as lemon juice.
8. Let the drawings dry, and have students take home.

## **Resource List:**

### ***Websites:***

<https://kbaxterpackwood.com/natural-dyeing-notes/>

Notes on Natural Dyeing.

[https://en.wikipedia.org/wiki/Natural\\_dye](https://en.wikipedia.org/wiki/Natural_dye)

Overview of natural dyes.

<http://www.dyesonline.net:8085/dyes/historyind.htm>

Overview and glossary of dye-related terms.

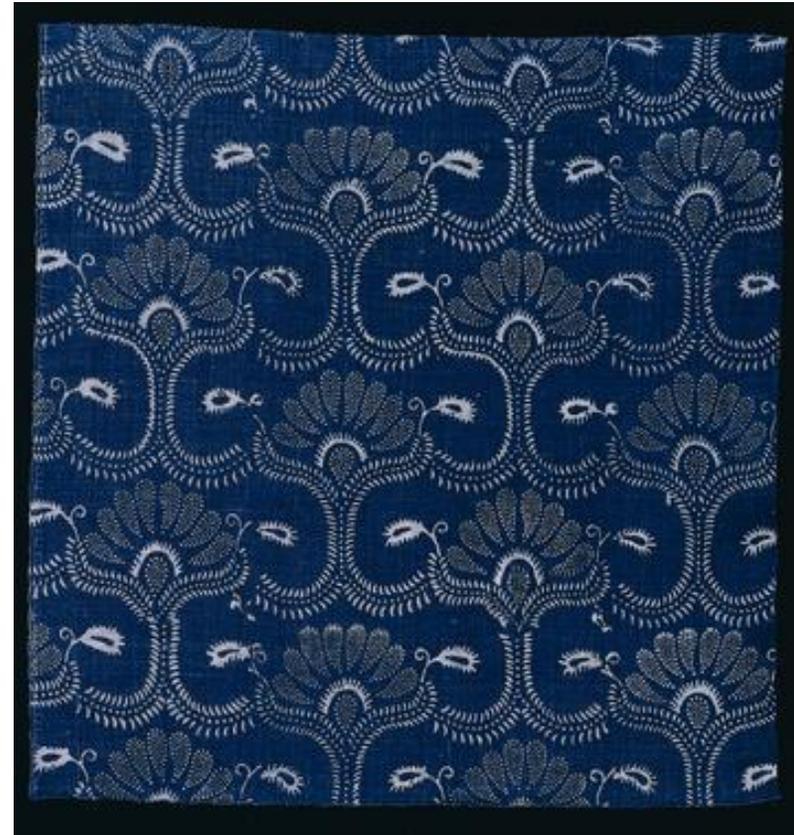
<http://www.allfiberarts.com/cs/dyesnatural.htm>

Compendium of information for artists working with textiles and fibers.

**Selected Images:**



***Curtain Fragment with Galloping Horse, 500s***  
Egypt, Antinoë, Byzantine period, 6th century  
Plain weave (tabby) with inwoven slit-tapestry weave; wool  
1948.27



***Blue Indigo Resist Print with Stylized Leaf Design, 1790***  
France, Alsace, Sain-Bel, late 18th century  
Wax-resist print, design printed by means of woodblock  
1935.113



*Tunic*, c. 700-1100

Peru, South Coast, Wari Culture, Middle Horizon, 8th-12th Century  
Tapestry; interlocked wefts and areas of eccentric weaving: wool and cotton  
1956.84

This Teacher Information Packet and Distance Learning lesson were developed by Jeremy Bishko and David Calco of the Cleveland Botanical Garden and Dale Hilton of the Cleveland Museum of Art.

# The Dyes Have It

## Distance Learning The Cleveland Museum of Art

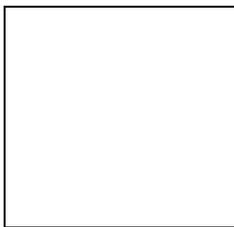
### VIEWING GUIDE

#### 1. Classification

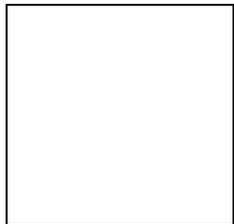
| <i>PLANT</i> | <i>ANIMAL</i> | <i>MINERAL</i> |
|--------------|---------------|----------------|
|              |               |                |
|              |               |                |
|              |               |                |
|              |               |                |

#### 2. Design Experiment:

Imagine a small square in the center of box A, do not draw the outline of the square. To make the square visible darken everything around it, so that you finish with a white rough edged square surrounded by a dark “background”



Box A



Box B

In Box B make a square by drawing one in the center and then darkening in the square. You will have a dark square on a white background. These 2 ways of producing a square represent a difference in approach between many western and African textile artists.

#### 3. Q & A

**A. If you were alive 200 years ago and wanted to dye the military uniforms for the British “Red Coats” a beautiful shade of red what could you use?**

**Circle the correct answer:**

**A pack of Cherry Jello   Madder   A vat of boiling ketchup   Cochineal**

**B. If you leave one piece of cloth in a dye bath for 10 min. and a second piece of cloth in for 25 minutes which one will be darker?**

\_\_\_\_\_

**C. If you want to make sure the color from a shirt you dyed will not run out in the washing machine, what would you use during the dyeing process to set the color?**

\_\_\_\_\_

# The Cleveland Museum of Art Distance Learning Evaluation Form

Your Name \_\_\_\_\_

Your School \_\_\_\_\_

School Address (with zip code) \_\_\_\_\_

E-mail Address \_\_\_\_\_

Grade/Class of students (e.g. 10<sup>th</sup> grade French) \_\_\_\_\_

Program Title \_\_\_\_\_

Program Date \_\_\_\_\_

**Thank you so much for your participation in our distance learning program. We would appreciate your response to these questions by circling the appropriate answer and returning the survey. Please Mail or Fax to Dale Hilton at 216-707-6679**

**5= Strongly Agree    4= Agree    3= Neither Agree nor Disagree  
2= Disagree    1= Strongly Disagree**

1. The teacher information packet was helpful for preparing my class and me for the distance learning lesson.

5                      4                      3                      2                      1

2. The teaching style of the on-camera instructor was interesting, engaging and fostered interaction.

5                      4                      3                      2                      1

3. The Teacher Information Packet was helpful in providing interdisciplinary extension activities that I did use or plan to use.

5                      4                      3                      2                      1

4. The distance learning lesson successfully taught its objectives.

5                      4                      3                      2                      1

5. The distance learning lesson was not interrupted by technical difficulties.

5                      4                      3                      2                      1

6. The pre-requisites in the distance learning lesson and extensions are aligned with The National Education standards.

5                      4                      3                      2                      1

7. I plan to register for another distance learning lesson.

*(circle one)*

Yes

No

*If no, why?* \_\_\_\_\_

8. I would like more information about The Cleveland Museum of Art's Teacher Resource Center.

*(circle one)*

Yes

No

9. Why did you choose The Cleveland Museum of Art Distance Learning?

*(circle one)*

- a.) Price Point
- b.) Quality of lessons
- c.) Selection of lessons
- d.) Ease of working with CMA
- e.) Other

10. How did you hear about The Cleveland Museum of Art Distance Learning program?

*(circle all that apply)*

- a.) CMA in service
- b.) CILC
- c.) TWICE
- d.) Conference
- e.) Brochure
- f.) The Cleveland Museum of Art website
- g.) The Teacher Resource Center
- h.) Other

11. Do you have any additional comments about the distance learning lesson?

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*Please return the completed teacher evaluation form to:*

**Dale Hilton/Distance Learning  
The Cleveland Museum of Art  
11150 East Boulevard  
Cleveland, OH 44106**

**Or fax to Dale Hilton at 216-707-6679**