

# Science of Art

## Residency Overview

**Residency Overview:** A science/visual arts hybrid curriculum focused on understanding optical perception, the physical properties of light and color, and the physical and chemical properties of a variety of art media.

**Residency Product:** Students will act as docents for an interactive gallery display of:

- **Dual Image Self-Portraits:** Silhouette self-portraits which can be viewed through either a red filter, revealing a design created with stylized words the student believes to describe themselves, or a blue filter, revealing a separate design using words others have used to describe them.
- **Change Coasters:** A series of 4 clay coasters, designed to express the student artists' experience of 'change' in their own life.
- **Monogram sun prints:** An artists' signature created by each student using a combination of their own initials and simple symbols they feel represent their artistic brand.

**Duration/Frequency:**

- Minimum nine (9) one-hour (1hr) classes. *May be adjusted for more and/or longer class sessions.*
- May meet once per week or more frequently.
- one (1) "gallery installation" session (2-3 hours)
- one (1) "gallery opening" event.

**Facilitation:** Two (2) Teaching artists for a maximum of 35 students (space permitting).

**Students will be able to**

- **Science:**
  - Use a color filter to isolate an image of a contrasting color
  - Distinguish between translucent and transparent materials.
  - Identify which colors of light are being reflected/absorbed by a pigment.
  - Identify which colors of light are being filtered out by a filter.
  - Identify the differences between a physical and chemical state changes.
  - Identify whether a substance has undergone a physical or a chemical state change.
  - Identify factors (force, heat, light, water) that trigger a change.
  - Use opaque and translucent filters to control light levels.
- **Visual Arts:**
  - Use a mirror to create a self-portrait
  - Use tracing paper to transfer an image
  - Re-imagine written language as visual art
  - Knead, roll, cut, and stamp wet clay
  - Use "slip and score" method to join two pieces of clay
  - Apply glaze to clay
  - Prepare clay work for gallery presentation
  - Translate an idea in to a visual representation
  - Create and execute a design plan.
  - Create a silhouette from a sketched design.
  - Correctly use and develop SunPrint paper.
  - Use found objects to create collaged images.

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### Students will know

- **Science:**
  - That light consists of photons which can bounce off of some materials (reflection) and be stopped by others (filtration).
  - That pigments reflect only the colors of light that they appear to be to the viewer (ie. blue pigment reflects blue light) and absorb all other colors of light.
  - That transparent filters block all colors except the color they appear to be to the viewer (ie. blue filters allow only blue light to pass through).
  - That when light passes through a prism, different colors exit the prism at different angles, creating a rainbow.
  - That a chemical change alters matter at a molecular level.
  - That a physical change affects only the size, shape, or state (solid, liquid, gas) of matter.
  - That physical and chemical changes are both caused when an object is acted on by one or more source of energy.
  - Light is a form of energy.
  - Chemical changes require a stimulus in order to take place (ie. heat, light, water)
  - A chemical change can be identified by observing a change in the color of a substance.
  - Translucent substances allow some light to pass through, opaque substances allow no light to pass through.
- **Visual Art:**
  - That art can have interactive elements.
  - That a design may change throughout the creative process.
  - That one idea may be represented differently by different artists.
  - That the environment surrounding the presentation of a work of art can change the audience's understanding of the piece.
  - Proportions of the face.
  - Artists often design their signature as a means of personal expression.
  - The arrangement of objects in the frame (composition) can direct the observer's focus.
  - Symbols can be used to communicate information to an observer.

### Key Vocabulary:

- **Science:**
  - Photon: a particle (or "packet") of light energy
  - Reflection: When a particle bounces off of a surface
  - Refraction: The bending of light.
  - Filtration: When some particles but not others are stopped by a transparent material.
  - Rods: The part of the eye which perceives light and dark.
  - Cones: The part of the eye which perceives color.
  - States of Matter: Solid, liquid, and gas.
  - State Change: The physical transformation of a substance from one state to another.
  - Physical Change: A change affecting the size, shape, or state of matter, but not its molecular composition.
  - Chemical Change: A change affecting matter at the molecular level resulting in the production of a new substance.
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## Science of Art Residency Overview

- **Art:**
  - Self-Portrait: a portrait of an artist produced or created by the artist.
  - Trace: copy a design by drawing over its lines on a superimposed piece of transparent paper.
  - Sketch: a rough or unfinished drawing or painting, often made to assist in making a more finished picture.
  - Knead: to work clay with one's hands until it has a uniform consistency.
  - Slip: a thick liquid mixture of clay and water used as an adhesive to hold one piece of clay to another.
  - Score: to use a tool to scrape fine lines in to the surface of the clay to create a textured surface to which slip will adhere.
  - Kiln: A specialized oven in which clay is baked to create pottery
  - Silhouette: an image of an object or living creature represented as a solid shape or single color, its edges matching the outline of the subject.
  - Shade: how light or dark a color is.
  - Monogram: a motif created by overlapping or combining two or more letters to form one symbol.
  - Motif: a decorative design or pattern.

### Social/Emotional Skills:

- **Self Exploration** through selection of symbols, words, and motifs to represent oneself in art.
- **Confidently present** prepared artistic content to an audience.
- **Build Trust** among classmates through discussion and shared experiences of self-discovery.

### Residency Schedule Overview:

Class meeting once per week, 1 hour per class for 9 class sessions plus Gallery Installation and Reception.

*NOTE the length of classes and number of total classes may vary. The following represents the minimum number of sessions required for engagement of this program.*

### Pre-Program Meeting:

- Discuss classroom procedures (pick-up, drop off, snacks, breaks, etc.)
- Discuss emergency procedures
- Plan integration with school classroom management procedures (schedule additional training if necessary)
- **Identify correlating curricular concepts which will be addressed.**
- Discuss product (ie. gallery display and reception) expectations.
  - Location of display
  - Procedure for installation of artwork
  - Approvals for methods of installation
  - Schedule date/time for installation
  - Schedule date/time for Opening Reception/Culminating Event
  - Schedule date/time for de-installation.
- Visit and approve classroom space
- Visit performance space and review technical support resources

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## Residency Overview

### Class 1:

- Establish behavior expectations and introduce incentive program.
- Provide overview of class goals.
- Explore classroom space as it will be used in the context of this course.
- Arts Pre-Assessment (**Sample assessment on page 19**)
- Science Pre-Assessment (**Sample assessment on page 21**)

### Class 2:

- Revisit behavior expectations
- Introduce Unit 1—Light and Color/Perception Filters.
- **See Sample Unit Plan: Light and Color Perception Filters on page 6** for detailed lesson plans for this unit.

### Class 3:

- Revisit behavior expectations
- Continue Unit 1—Light and Color/Perception Filters

### Class 4:

- Revisit behavior expectations
- Conclude Unit 1—Light and Color/Perception Filters
- Mid Point Evaluation

### Mid-Point Meeting:

- Review progress toward expectations set at Pre-Program meeting
- Confirm or make adjustments to plan for Gallery Opening event
- Confirm that space and resources are reserved for gallery display
- Address any classroom management issues which need support from the school (may also take place outside of designated meeting times)

### Class 5:

- Begin Unit 2—**Physical and Chemical Change/Glazed Clay Coasters**
- **See Sample Unit Plan: Physical and Chemical Change Glazed Clay Coasters on page 11** for detailed lesson plans for this unit.

### Class 6:

- Continue Unit 2—Physical and Chemical Change Glazed Clay Coasters

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### Class 7:

- Conclude Unit 2—Physical and Chemical Change Glazed Clay Coasters

### Class 8:

- Unit 3-- Art Smarts Sunprint Monograms (one-day unit) **See Sample Unit Plan: Sunprint Monograms on page 16.**

GALLERY INSTALLATION: *2-3 hours in length, ideally involves students.*

- Hang or otherwise display artwork and signage as planned with students in class.
- When possible, prepare and test other elements (lighting, music, etc.) to transform the space in to the desired environment for viewing art.
- Have student “docents” practice giving tours to guests.

### GALLERY OPENING:

- Teaching Artist remains on-site and actively engaged with students a minimum of 30 minutes prior to and following the event.
- Guests are introduced to artwork by student docents.
- Light refreshments served (as approved by school)

### Class 9:

- Warm-up game or activity
- Verbal review of gallery display
- Self-critique and/or reflection.
- Sharing of future personal artistic goals
- Science Post-Assessment (**See page 19**)
- Arts Post-Assessment (**See page 21**)
- Awards and accolades

### Post-Program Meeting:

- Discuss program successes and challenges
- Share results of student assessments
- Make plans for future programming if applicable.

## Unit Plan for Science of Art

### Unit 1: Dual-Image Drawings: Colors of Light and Pigment

**Unit Description:** Through the design and creation of dual-image drawings with color filters students will both A) learn properties of light and pigment colors B) explore and express the idea of “perception filter” as it applies to their personal life experience.

**Unit Product:** Each student will design and create a “dual-image” self-portrait. which changes when viewed through a red filter, blue filter, or no filter at all. Each filter will reveal a different viewpoint—the artist as described by themselves, or the artist as described by others.

#### Students will be able to:

- **Science:**
  - Use a color filter to isolate an image of a contrasting color
  - Distinguish between translucent and transparent materials.
  - Identify which colors of light are being reflected/absorbed by a pigment.
  - Identify which colors of light are being filtered out by a filter.
- **Visual Arts**
  - Use tracing paper to transfer an image
  - Use a mirror to create a self-portrait
  - Re-imagine written language as visual art

#### Students will know:

- **Science:**
  - That light consists of photons which can bounce off of some materials (reflection) and be stopped by others (filtration).
  - That pigments reflect only the colors of light that they appear to be to the viewer (ie. blue pigment reflects blue light) and absorb all other colors of light.
  - That transparent filters block all colors except the color they appear to be to the viewer (ie. blue filters allow only blue light to pass through).
  - That when light passes through a prism, different colors exit the prism at different angles, creating a rainbow.
- **Visual Art:**
  - That art can have interactive elements.
  - That one idea may be represented differently by different artists.
  - That the environment surrounding the presentation of a work of art can change the audience’s understanding of the piece.
  - Proportions of the face.

#### Vocabulary:

- **Science:**
  - Photon: a particle (or “packet”) of light energy
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  - Rods: The part of the eye which perceives light and dark.
  - Cones: The part of the eye which perceives color.
- **Art:**
  - Self-Portrait: a portrait of an artist produced or created by the artist.
  - Trace: copy a design by drawing over its lines on a superimposed piece of transparent paper.

## Unit Plan for Science of Art

### Unit 1: Dual-Image Drawings: Colors of Light and Pigment

- Sketch: a rough or unfinished drawing or painting, often made to assist in making a more finished picture.

#### Day 1: Reflection

- Materials: Mirrors, drawing paper, pencils, prism.
- 10 min: What is light made of?
  - Discuss the idea that light consists of photons which travel through space to our eyes, which have rods (for perceiving light and dark) and cones (which perceive color).
  - Demonstrate that light consists of many colors by refracting light through a prism. Have students identify the colors in the resulting rainbow.
  - Discuss that photons can bounce off of a smooth, shiny surface, causing a reflection.
  - Introduce mirrors for self portrait.
- 5 min: Discuss the idea of perception.
  - What do you see first when you look at your face in the mirror?
  - Why is that the first thing you focus on?
  - Do you have a strong feeling about what you see?
- 5 min: Introduce the self-portrait
  - Demonstrate how to sketch a self portrait based on what the artist sees in the mirror.
  - Distribute hand-out showing proportions of the human face to use as an additional reference.
- 20 min: Self portrait sketch
  - Students are given a large sheet of drawing paper and pencils to use in creating their own self-portrait.
  - Students are given 20 minutes to create a self-portrait based on what they see in the mirror.
    - Remind students that the portrait does not have to be perfect or even accurate
    - Encourage students to focus more deeply on their favorite features and spend less time on the parts of their face they feel are less important to communicating who they are as a person.
- 10 min: Perception of others
  - Students are given another piece of paper and asked to list the names of the other students in the room, as well as the Teaching Artist.
  - Ask students to write 1 to 3 words to describe the personality of each of their classmates and the teaching artist.
    - Stress that only positive language is to be used in this exercise
    - Stress that the words must describe the student's personality, and not their physical appearance.
    - Consider providing a word bank to prompt more specific language use.
    - Consider disallowing certain "weak" descriptors such as "nice, fine, ok."
  - Students hand in their observation sheets to the Teaching Artist.
  - Prior to the next class, the teaching artist will compile the list of descriptive words to give them to the student they describe. During this process, any inappropriate or unhelpful language may be edited from the list.
- 5 min: Journal—
  - How did it feel to examine your face closely in order to create a self portrait?
  - What did you notice in your close observation of your own face?
  - How did it feel to know others are writing words that describe you?
- 5 min: clean-up

## Unit Plan for Science of Art

### Unit 1: Dual-Image Drawings: Colors of Light and Pigment

#### Day 2: Pigment and Filtration

- Materials: red and blue lighting gels (filters), tracing paper, red and blue colored pencils, other color filters (for demonstration), red and blue paint samples cards, blue painter's tape
- 15 min: Introduction of how the colors of light are reflected by pigments and filtered by gels.
  - Discuss that a pigment only reflects the colors of light that are perceived by your eye.
    - If we draw a line with a blue crayon, the pigment absorbs the red, orange, yellow, green, and purple colors of light, reflecting back only the blue that our eyes perceive.
    - White pigment reflects all colors of light
    - Black pigment absorbs all colors of light.
  - Discuss that filters only allow some colors of light to pass through, which is the color our eyes perceive when we look at the filter.
    - If we look at a red filter, it is stopping the orange, yellow, green, blue, and purple photons from passing through.
  - Demonstrate using red and blue filtered flashlights and red and blue paint sample cards.
    - When we shine a red light on a red paint sample, we still see the color red—the filter allows red through, and the pigment reflects red back to our eyes.
    - When we shine a blue light on a red paint sample, the paint appears black. The filter is not allowing any red light through, so there is no red light available to bounce off the pigment and be perceived by our eyes. Instead, our eyes see black (which absorbs all colors of light). On the other hand, the white spaces between the samples will appear blue, because the white pigment is reflecting the blue light that the filter allows to pass through.
  - Have students look at the red and blue paint samples *through* the red and blue filters.
    - What do you see?
    - Why?
- 5 min: Introduce the Tracing project
  - Demonstrate how to place the *translucent* tracing paper over the previous week's self-portrait and tape it in place.
    - Ask the students to use observation to identify the difference between how light passes through *transparent* and *translucent* objects.
  - Demonstrate how to trace the outline of the self-portrait on to the translucent paper.
- 10 min: Tracing project
  - Each student receives a piece of tracing paper and a blue colored pencil
  - Students trace their previous week's self portrait on to the tracing paper in blue colored pencil.
  - Encourage students to draw lightly
  - Encourage students to only transfer the parts of the self-portrait they are happiest with, provided the finished product is still somewhat recognizable as a face.
- 5 min: Introduce the Words project
  - Teaching Artist shares the list of list of words collected from students the previous week to describe themselves.
  - Demonstrate how to add the words to the portrait using RED colored pencil and following the lines of the self-portrait created by the artist.
  - Encourage students to give words more or less weight by making them larger or smaller.
  - Encourage students to consider the placement of the words on the face.
  - Empower students to leave out any words they do not want to include in their project.
- 15 min: Add Words to portrait
  - Students add words to their portrait using red colored pencil.
  - Remind students to write lightly with the colored pencil.



## Unit Plan for Science of Art

### Unit 1: Dual-Image Drawings: Colors of Light and Pigment

- *Optional* add a step in which students use a separate piece of tracing paper and graphite pencil to create a plan for the placement of the words, the transfer the words to the red/blue portrait using the same method as above.
- 5 min: Journaling
  - How did you feel when you read the list of descriptive words your classmates submitted about you?
  - Did you feel like their perception of you was accurate?
  - Did you have a positive or negative response to the list of words you received?
- 5 min: Clean-up

#### Day 3: Perception Filters

- Materials: Red and blue filters, red and blue colored pencils, previously completed red/blue “dual portraits,” additional materials (cardboard, dowel rods, tape, scissors, etc.) which students can use to manipulate filters.
- 5 min: Review of Reflection/Pigment/Filtration
- 10 min: Introduce portrait filters
  - Demonstrate how the portraits change when viewed through the Red filter, then through the Blue filter.
  - Demonstrate a few options for providing the observer with ways of interacting with the portrait and the filters.
    - Flaps which can be folded over the portrait from different directions
    - Hand-held filters which the observer holds in front of their own eyes
    - Have students brainstorm additional ways the filters can be applied by the viewing audience.
- 20 min: Adding filters to portraits, adding finishing touches to portraits
  - Have each student select their own method of adding the filter to their portrait
  - During this time students may also make final changes and additions to their portraits.
- 5 min: Discuss how portraits will be presented in the gallery display.
  - How will the observer know how to use your filters?
  - Will you provide written signs?
  - Instructional imagery?
  - Verbal or audio instruction?
  - Will it be possible to view your portrait with no filter, or only with the red or blue filter in place?
  - Brainstorm additional possibilities with students.
- 10 min: Preparation of portraits for display
  - Students select and create their preferred method of instructing the observer in the use of filters.
- 5 min: Journals: Which of the three images (blue portrait, red words, or both together) do you feel represents you best? Why?

#### Science Standards Addressed:

- 12.C.2a Describe and compare types of energy including light, heat, sound, electrical and mechanical.
- 12.A.1a Identify and describe the component parts of living things (e.g., birds have feathers; people have bones, blood, hair, skin) and their major functions.
- 11.A.1a Describe an observed event.

## Unit Plan for Science of Art

### *Unit 1: Dual-Image Drawings: Colors of Light and Pigment*

#### **Visual Arts Standards Addressed:**

- 25.A.1d Identify the elements of line, shape, space, color, and texture; the principles of repetition and pattern; and the expressive qualities of mood, emotion, and pictorial representation.
- 25.A.2d Identify and describe the elements of 2- and 3-dimensional space, figure ground, value, and form; the principles of rhythm, size, proportion, and composition; and the expressive qualities of symbol and story.
- 25.B.2 Understand how elements and principles combine within an art form to express ideas.
- 26.A. Understand the processes, traditional tools, and modern technologies used in the arts.
- 26.A.1e Identify media and tools and how to use them in a safe and responsible manner when painting, drawing, and constructing
- 26.B. Apply the skills and knowledge necessary to create and perform in one or more of the arts.
- 26.B.2d Demonstrate knowledge and skills to create works of visual art using problem solving, observing, designing, sketching, and constructing.
- 27.A. Analyze how the arts function in history, society, and everyday life.
- 27.A.2a Identify and describe the relationship between the arts and various environments (home, school, workplace, theater, gallery, etc.).

## Unit Plan for Science of Art

### *Glazed Clay Coasters: Chemical and Physical Changes*

**Unit Description:** Through the design and production of glazed clay coasters, students will both A) learn about physical and chemical changes in matter and B) explore and express the idea of “change” as it applies to their personal life experience.

**Unit Product:** Each student will design, create, and glaze four clay coasters, representing their personal experience of “change,” then conceptualize the gallery environment that will support the presentation of their work to their intended audience.

#### Students will be able to:

- **Science:**
  - Identify the difference between a Physical and Chemical State Change
  - Identify factors (force, heat) that instigate a change.
- **Visual Arts**
  - Knead, roll, cut, and stamp wet clay
  - Use “slip and score” method to join two pieces of clay
  - Apply glaze to clay
  - Prepare clay work for gallery presentation
  - Translate an idea in to a visual representation
  - Create and execute a design plan.

#### Students will know:

- **Science:**
  - That a chemical change alters matter at a molecular level.
  - That a physical change affects only the size, shape, or state (solid, liquid, gas) of matter.
  - That physical and chemical changes are both caused when an object is acted on by one or more source of energy.
- **Visual Art:**
  - That a design may change throughout the creative process.
  - That one idea may be represented differently by different artists.
  - That the environment surrounding the presentation of a work of art can change the audience’s understanding of the piece.

#### Vocabulary:

- **Science:**
  - States of Matter: Solid, liquid, and gas.
  - State Change: The physical transformation of a substance from one state to another.
  - Physical Change: A change affecting the size, shape, or state of matter, but not its molecular composition.
  - Chemical Change: A change affecting matter at the molecular level resulting in the production of a new substance.
- **Visual Art:**
  - Knead: to work clay with one’s hands until it has a uniform consistency.
  - Slip: a thick liquid mixture of clay and water used as an adhesive to hold one piece of clay to another.
  - Score: to use a tool to scrape fine lines in to the surface of the clay to create a textured surface to which slip will adhere.
  - Kiln: A specialized oven in which clay is baked to create pottery

## Unit Plan for Science of Art

### *Glazed Clay Coasters: Chemical and Physical Changes*

#### Day 1:

- Materials: Paper design templates, clay, cutting tools, rolling pins, stamping tools, table covers, drying trays, hypothesis worksheets, pencils, journals
- 5 min: Discuss the idea of Change. What does “change” mean to us personally? Share some ideas, which Teaching Artist records for the class to see.
- 5 min: Journal—what is a change you’d like to make in your life or in the world around you? Why?
- 5 min: Introduce the concepts of Physical and Chemical state change. Review the indicators of each type of change:
  - Physical: changes in size, shape, or state (liquid, solid, gas)
  - Chemical: the creation of a new substance, which may be indicated by unexpected changes in color or temperature, bubbles or fizz.
- 5 min: Introduce the project:
  - Each student will make a set of 4 coasters with an original design on the theme of “Change.”
  - Throughout the project, we will observe physical and chemical changes in the materials we use.
- 5 min: demonstration of the tools which will be available for their designs:
  - Stamping tools and how they can be used to make impressions on the clay
  - Cutting tools and slip, and how they can be used to add small dimensional details to the clay (remind students to think about how they want their finish project to function, and make sure that dimensional details will still allow a cup to sit evenly on the coaster if they are intended for use rather than display).
  - Show some examples of finish projects with simple designs highlighted by the glaze.
- 10 min: Design
  - Students are given a paper template of the size and shape of their coasters to sketch out their design ideas.
  - Remind students that they are not “married” to their initial sketch, and that the project will continue to evolve as they work on it.
  - Present some conceptual design options:
    - Each coaster is designed to represent a different unique idea on the theme of change
    - Each coaster tells one part of a story of change
    - The four coasters, when arranged in a square, create one image
    - The four coasters, when arranged in a straight line, create one image.
- 20 min: Roll, cut, and stamp/build coaster designs.
  - Students are given enough clay to make 4 coasters and are shown how to “work the clay” to get it ready to roll (*physical state change*)
  - Students are shown how to roll and cut the clay (*physical size and shape change*)
  - (*optional*) Students cut small shapes (*physical size and shape change*) and use scoring and slip (*physical state change*) to adhere the shapes to their coasters.
  - Students use stamping tools to impress their “change”-inspired design in to their coasters.
  - As the students work, have them hypothesize how they think their coasters will change as the clay dries. Fill out hypothesis/observation worksheet answering the following questions:
    - Appearance:
      - Will the clay have any change in its appearance as it dries?
      - How do you hypothesize the appearance will change? Why?
      - Is it a physical or chemical change? Why?
    - Weight:
      - Will the clay have any change in its weight as it dries?

## Unit Plan for Science of Art

### *Glazed Clay Coasters: Chemical and Physical Changes*

- How do you hypothesize the weight will change? Why?
- Is it a physical or chemical change? Why?
- 5 min: clean-up

#### Day 2:

- Materials: dry unfired coasters, glaze, brushes, table covers, drying trays, hypothesis worksheets, journals, pencils
- 5 min: Observe dry unfired coasters. Revisit hypothesis/observation worksheet:
  - Was there any change to the appearance of the coasters once they dried? If so, did the change meet or differ from your expectations?
- 5 min: Revisit the concepts of Physical and Chemical state changes.
  - Explain how the Clay and Glaze will undergo a chemical change when exposed to heat (fired). Level of detail provided on the changes at the molecular level varies by grade level.
- 5 min: Introduce and demonstrate the glazing process.
- 20 min: students glaze their work for firing, clean up.
- 5 min: Journaling—what is something I could do in the presentation of my work to support the theme of “change” in our gallery display?
- 5 min: Group discussion/idea sharing of how to best present the finished products for display. What other elements can be introduced to the gallery setting to support the theme of “change” and its meaning to the group?
- 10 min: Students break in to small groups and sketch their group’s vision for the gallery display of the finished work.

#### Day 3:

- Materials: Fired glazed clay coasters, felt “feet,” glue, journals, other display materials as brainstormed in class.
- 5 min: review the indicators of Physical and Chemical changes. (see above)
- 5 min: Journals: Observe the fired glazed clay coasters. What changes do you observe in the clay? In the glaze? Is each a physical or a chemical change? What evidence supports your claim?
- 5 min: Discussion of observations.
- 5 min: Demonstration of preparation of coasters for display.
  - How to glue felt “feet” to coasters
  - Any other display applications (ie. hangers, stands, framing, etc) as designed by the class in the previous session.
- 15 min: Preparation of coasters for display
- 15 min: preparation of supporting materials (labels, signage, other gallery decoration) for display
- 10 min: Journals: How did this project change your understanding of A) physical and chemical changes B) clay and glazes C) yourself? Be sure to include what you thought, felt or knew BEFORE the class, and what you think/feel/know NOW.

#### Physical Change:

- CLAY:
  - State change: Dissolving clay in water to make “slip” is a physical state change. The molecules of the clay do not change in to anything else, but the clay changes from a solid to liquid state.
  - State change: Wet clay dries. Water evaporates (liquid to gas state change) leaving behind the dry clay molecules (liquid to solid state change)

## Unit Plan for Science of Art

### *Glazed Clay Coasters: Chemical and Physical Changes*

- Shape change: Shaping the clay. Rolling the clay flat with a rolling pin, using tools to stamp a design in to the clay.
- Size change: Cutting a shape from the clay.
- GLAZE:
  - Size change: A small amount of liquid is separated from the larger amount of liquid in the container.
  - Shape change: Applying the glaze to the clay. The glaze goes from a thick liquid in its container to a thin layer of liquid on the clay.
  - State change: The glaze becomes dry to the touch as the water in the glaze evaporates in to the air and is absorbed in to the clay.

#### Chemical Change:

- CLAY: (when fired)
  - Change in color
  - A new substance is created (Pottery)—more durable than clay
  - Concepts for older/advanced students:
    - The process of firing a pot creates crosslinks between the hydroxyl groups in the clay, thereby strengthening the material and creating “pottery” or “ceramic.”
    - Oxides of the first row transition metals are the main sources of colour in pottery glazes
    - Earthen ware (water remains present) vs. stoneware (metakolinite becomes mullite, feldspar becomes glass--- greater hardness and strength.
- GLAZE: (when fired)—this class makes use of a Breaking glaze which changes color when fired and will pool in stamped areas on the clay to highlight the patterns.
  - Change in color
  - A new substance is created (a very thin layer of glass)
  - Concepts for older/advanced students:  
<http://www.rsc.org/education/eic/issues/2012July/chemistry-pottery-clay-glaze.asp>

For late secondary students, a Fused Glass element is added to the project.

- Glass is technically neither a solid or liquid due to the molecular structure (disorganized, like liquid, but stable, like a solid)
- When heated, the molecules gain enough energy to flow around one another and appear liquid.
- When cooled, at the “glass transition” phase, molecules form disorganized bonds (as opposed to organized crystals) and have insufficient energy to continue to flow.
- More information/photos: <http://math.ucr.edu/home/baez/physics/General/Glass/glass.html>

#### Science Standards Addressed:

- 12.C.2b Describe and explain the properties of solids, liquids and gases.
- 12.C.3a Explain interactions of energy with matter including changes of state and conservation of mass and energy.
- 12.C.2a Describe and compare types of energy including light, heat, sound, electrical and mechanical.

#### Visual Arts Standards Addressed:

- 25.A.1d Identify the elements of line, shape, space, color, and texture; the principles of repetition and pattern; and the expressive qualities of mood, emotion, and pictorial representation.

## Unit Plan for Science of Art

### *Glazed Clay Coasters: Chemical and Physical Changes*

- 25.A.2d Identify and describe the elements of 2- and 3-dimensional space, figure ground, value, and form; the principles of rhythm, size, proportion, and composition; and the expressive qualities of symbol and story.
- 25.B.2 Understand how elements and principles combine within an art form to express ideas.
- 26.A. Understand the processes, traditional tools, and modern technologies used in the arts.
- 26.A.1e Identify media and tools and how to use them in a safe and responsible manner when painting, drawing, and constructing
- 26.A.2f Understand the artistic processes of printmaking, weaving, photography, and sculpture.
- 26.B. Apply the skills and knowledge necessary to create and perform in one or more of the arts.
- 26.B.2d Demonstrate knowledge and skills to create works of visual art using problem solving, observing, designing, sketching, and constructing.
- 27.A. Analyze how the arts function in history, society, and everyday life.
- 27.A.2a Identify and describe the relationship between the arts and various environments (home, school, workplace, theater, gallery, etc.).

## Unit Plan for Art Smarts: Science of Art

### Unit 3: SunPrint Monograms

**Unit Description:** Through the design and creation of monogram panels using sunprint paper, students will both A) learn properties of light and chemical change B) explore and express the idea of self-representation through stylized text and symbolic images.

**Unit Product:** Each student will design and create a SunPrint image of their “Artist’s Signature” by stylizing their initials with 2-3 accompanying symbols they feel represent their personality and interests.

#### Students will be able to:

- **Science:**
  - Use opaque and translucent filters to control light levels.
  - Distinguish between translucent and transparent materials.
  - Identify whether a substance has undergone a physical or a chemical state change.
- **Visual Arts**
  - Create a silhouette from a sketched design.
  - Correctly use and develop SunPrint paper.
  - Use found objects to create collaged images.

#### Students will know:

- **Science:**
  - Light is a form of energy.
  - Chemical changes require a stimulus in order to take place (ie. heat, light, water)
  - A chemical change can be identified by observing a change in the color of a substance.
  - Translucent substances allow some light to pass through, opaque substances allow no light to pass through.
- **Visual Art:**
  - Artists often design their signature as a means of personal expression.
  - The arrangement of objects in the frame (composition) can direct the observer’s focus.
  - Symbols can be used to communicate information to an observer.

#### Vocabulary:

- **Science:**
  - **Photon:** a particle (or “packet”) of light energy
  - **Chemical Change:** A change affecting matter at the molecular level resulting in the production of a new substance.
  - **Filtration:** When some particles but not others are stopped by a transparent material.
- **Art:**
  - **Silhouette:** an image of an object or living creature represented as a solid shape or single color, its edges matching the outline of the subject.
  - **Shade:** how light or dark a color is.
  - **Monogram:** a motif created by overlapping or combining two or more letters to form one symbol.
  - **Motif:** a decorative design or pattern.

#### Day 1:

- **Materials:** white heavy cardstock, translucent lighting gel, stencils, scissors, several small tubs to hold water for developing sunprints
- **10 min:** Introduce Monogram design project



## Unit Plan for Art Smarts: Science of Art

### Unit 3: SunPrint Monograms

- Show several examples of Monograms.
- Have students share the adjectives each Monogram brings to mind.
  - Is it “clean?” “spicy?” “elegant?”
  - Have students identify the visual element of the monogram that inspired their description.
- Introduce materials (stencils, font samples, abstract and silhouette shapes, found objects) which students can use to design their own monograms.
- 10 min: Monogram design.
  - Students have 10 minutes to use the elements provided to create a monogram they feel best represents their style as an artist.
  - Monograms must contain 2 or 3 of the student’s initials
  - Monograms can also contain abstract and/or literal shapes (using the stencils and found objects provided).
- 10 min: Introduce SunPrint Paper and explain its light-reactive properties.
  - Light is an energy that can affect the objects upon which it shines.
  - Chemical reactions can be triggered by sunlight.
  - When sunlight shines on SunPrint paper, it triggers a chemical reaction that makes the blue substance experience a chemical change to a new, colorless substance.
  - Water can also act as a stimulus for chemical change.
  - When exposed SunPrint paper is placed in water:
    - A) any blue substance that was NOT exposed to light is simply washed away, leaving behind white paper.
    - B) any blue substance that experienced a chemical change to white experiences a *second* chemical change, turning the white substance to a dark blue color.
  - Any area on the paper that is completely covered by an opaque filter will remain white in the finished product.
  - Any area on the paper that is partially covered by a translucent filter will develop in to a light blue color.
  - Any area on the paper that is fully exposed to sun will develop in to a deep blue color.
- 10 min: Cut opaque and translucent sun-blockers
  - Students cut out the designs created on paper.
  - Students use the paper cut-outs as a stencil to trace the shapes on to either a) heavy cardstock or b) translucent lighting gel, or some combination of the two.
  - Students lay out designs and objects on the SunPrint pattern in the format they desire for the final product
- 5-10 min: expose SunPrints, Journal
  - Leave SunPrints undisturbed in direct sunlight.
  - While students wait for SunPrints to become exposed, Journal entry: What elements and images did you feel were most essential to communicating your style and personality? Why did you choose those elements/images?
  - Students are given 20 minutes to create a self-portrait based on what they see in the mirror.
    - Remind students that the portrait does not have to be perfect or even accurate
    - Encourage students to focus more deeply on their favorite features and spend less time on the parts of their face they feel are less important to communicating who they are as a person.
- 10 min: Develop Sun-Prints
  - Review the series of chemical reactions that turns the paper from blue to white and back to blue again.

## Unit Plan for Art Smarts: Science of Art

### Unit 3: SunPrint Monograms

- Allow each student to rinse their own sun-print
- Hang sun-prints to dry for the next class.

#### Science Standards Addressed:

- 12.C.2a Describe and compare types of energy including light, heat, sound, electrical and mechanical.
- 12.C.3a Explain interactions of energy with matter including changes of state and conservation of mass and energy.

#### Visual Arts Standards Addressed:

- 25.A.1d Identify the elements of line, shape, space, color, and texture; the principles of repetition and pattern; and the expressive qualities of mood, emotion, and pictorial representation.
- 25.A.2d Identify and describe the elements of 2- and 3-dimensional space, figure ground, value, and form; the principles of rhythm, size, proportion, and composition; and the expressive qualities of symbol and story.
- 25.B.2 Understand how elements and principles combine within an art form to express ideas.
- 26.A. Understand the processes, traditional tools, and modern technologies used in the arts.
- 26.A.1e Identify media and tools and how to use them in a safe and responsible manner when painting, drawing, and constructing
- 26.B. Apply the skills and knowledge necessary to create and perform in one or more of the arts.
- 26.B.2d Demonstrate knowledge and skills to create works of visual art using problem solving, observing, designing, sketching, and constructing.

## Science of Art Pre/Post Assessment—Science

NAME: \_\_\_\_\_

1- Light is a form of:

- a. Energy
- b. Matter
- c. Force
- d. None of these

2- Light consists of:

- a. Protons
- b. Photons
- c. Glowtrons
- d. Nothing

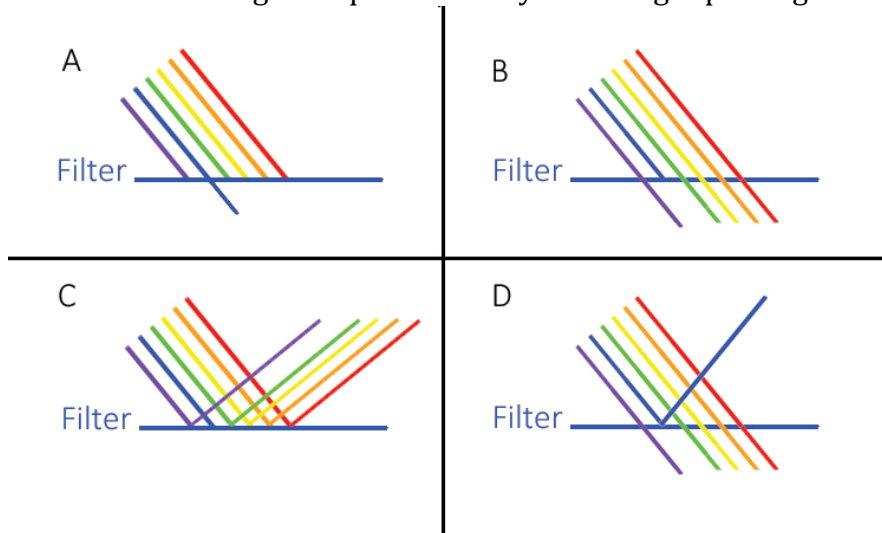
3- Which of the following is an example of a *physical* state change?

- a. Baked clay becomes pottery
- b. Heated glaze becomes glass
- c. Clay hardens as water evaporates
- d. Colored paper fades in sunlight

4- Which of the following is an example of a *chemical* state change?

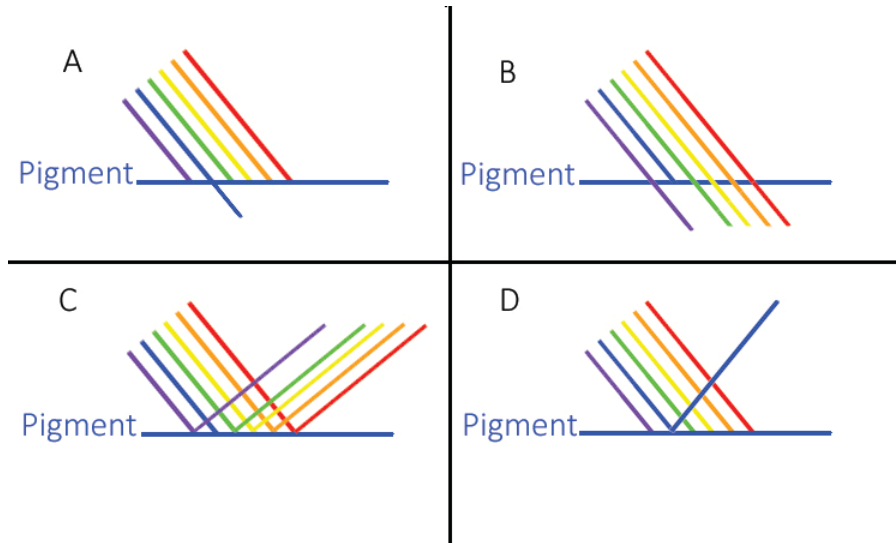
- a. Clay changes color when baked in to pottery
- b. Clay becomes a liquid when mixed with water to make slip.
- c. Wet glaze dries over time.
- d. Water washes blue dye off of a piece of paper.

5- Which of the following examples correctly shows light passing through a blue filter?



## Science of Art Pre/Post Assessment—Science

6- Which of the following images correctly shows light reflecting off a blue pigment?



7- The parts of the eye that perceive color are called:

- a. Rods
- b. Cones
- c. Cylinders
- d. Spheres

**Science of Art Pre/Post Assessment**  
**Visual Art**

- 1- **Practical Application with Clay:** Using the clay and tools provided, take the following steps:
  - a. Knead the clay
  - b. Create a clay slab
  - c. Cut a shape from the clay
  - d. Score both pieces of clay
  - e. Use slip to attach the two pieces of clay together
  
- 2- **Practical Application with Monogram Design:** Using the scissors, paper, pencil, and cardboard provided, take the following steps:
  - a. Sketch a monogram using your own initials
  - b. Transfer your design to the cardboard
  - c. Cut a silhouette of your monogram