CERAMICS

4-H Project Manual

COLORADO STATE UNIVERSITY
EXTENSION

Acknowledgements

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Photos of 4-H Ceramics club members courtesy of Jaci Wagner, 4-H Youth Development / Family & Consumer Science, Logan County, Colorado State University Extension

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Lois Helgeland, 4-H Volunteer Leader, Delta County

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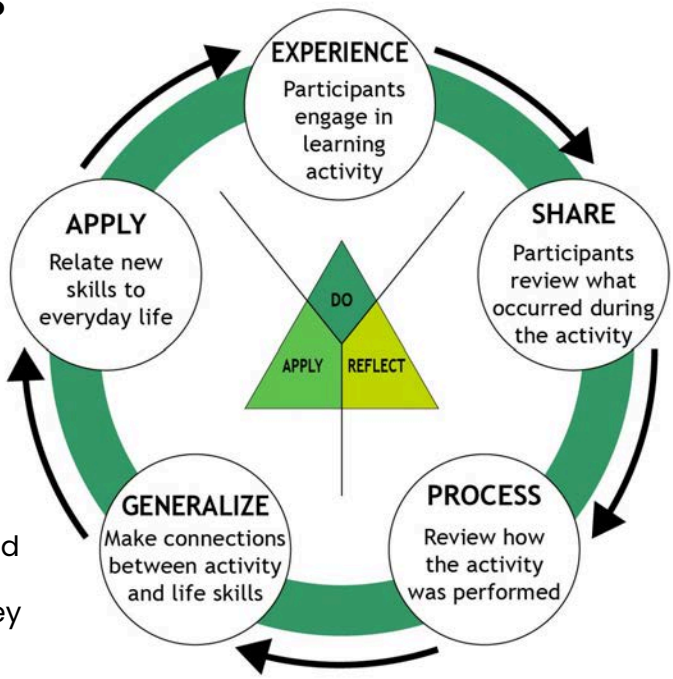
Experiential Learning Process



The 4-H program utilizes a process where adult leaders ask open-ended questions that challenge youth to think. Through this inquiry, youth can propose hypotheses and determine their own solutions. The Experiential Learning Model developed by Pfieffer and Jones (1985) and modified by 4-H includes five specific steps that can be summarized into three main processes: Do, Reflect, and Apply.

The Experiential Learning Model encourages discovery with minimal guidance from others. A situation, project or activity is undertaken for individual thought and problem solving. Minimum outside assistance is provided, but support is offered to the individual by questioning at each stage. The youth participating in an activity reflect on what they did and then assess how what they learned can be applied to a life situation. Below are questions that might help during each stage of learning.

1) Experience (Doing)
Questions: What sources of information are available? What is possible? What do you expect to see? How is it working? What else might you try?

2) Share (Reflecting on what occurred)
Questions: What was your goal for this project/activity when you began? What happened? What were the results? What was most difficult? How do you know? What did you learn? What surprised you? How did you share this project/activity with others?

3) Process (Reflecting on what's important)
Questions: What problems seemed to reoccur? How did you solve them? What similar experiences have you had? How was the experience like or unlike experiences others had? Would you do anything differently? What did you learn about making decisions? What suggestions would you have for someone else who wanted to do a similar project/activity? What life skills were you developing through your project? Why are life skills important? What new questions do you have about yourself, others, and future goals?

4) Generalize (So what?)
Questions: What did you learn about yourself or about the activity? What key points have you learned? How did you decide what to do? What else could you have done? How does this relate to something else in life? Where have you faced similar challenges in your life? Where might this situation occur in the future? Why is it important to have plenty of information before making decisions? What did you learn about your own skill in communicating with others?

5) Apply (Now what?)
Questions: How does this project/activity relate to your everyday life? Why is this project/activity important to you? Where else can this skill be used? How will you use this in the future? What will you do differently after this experience? How can I make an impact? What will I create next? In what ways do people help each other learn new things? What are qualities you think are important in a leader? If someone helped or mentored you in this project, what would you tell them you learned and what difference it has made in your life? How would you express your appreciation?

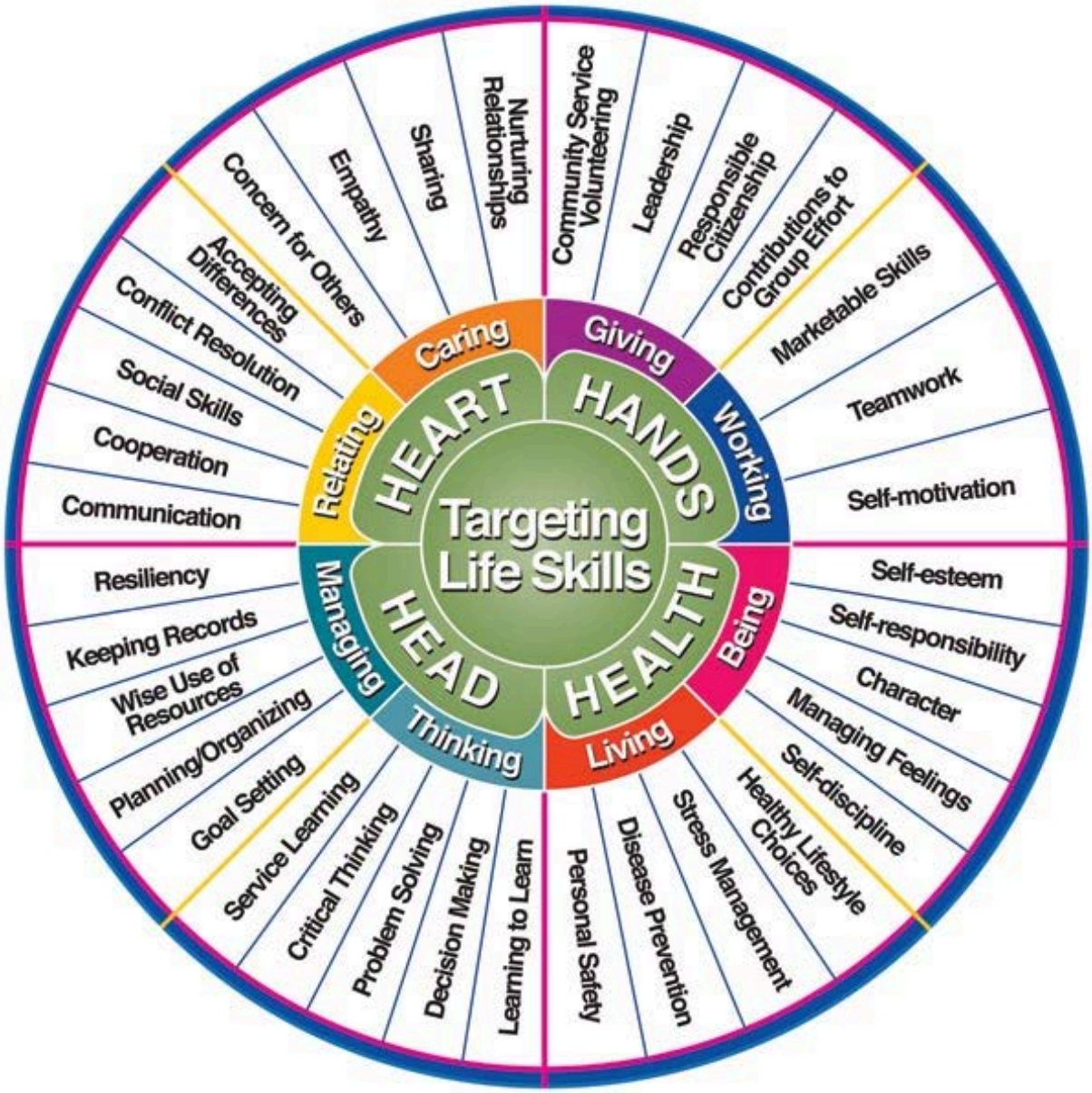


Image: Hendricks, P. (1998) "Developing Youth Curriculum Using the Targeting Life Skills Model" http://www.extension.iastate.edu/4H/skls.eval.htm

Targeting Life Skills

A skill is a learned ability. Life skills are those abilities that assist individuals to lead successful, productive, and satisfying lives. In 4-H, we use the Targeting Life Skills Model to help youth become competent and prepared for adulthood. The Targeting Life Skills Model categories are based on the four H's from the 4-H clover (Head, Heart, Hands, and Health). Under each of these main categories, there are four categories and eight subcategories listing specific skills youth learn in 4-H. The main goal in 4-H positive youth development is to provide developmentally appropriate opportunities for youth to experience life skills and to be able to use them throughout a lifetime. By understanding the importance of the 4-H framework and its structure, 4-H members, parents, professionals, and leaders will know the expectations and will be able to effectively use 4-H delivery methods to help youth learn these life skills.

National Standards for Art Education

National Art Education Association standards were originally developed in 1994 and were updated in 2014. Visual Arts Anchor Standards provide 4-H Ceramics essential questions and standards for all grade levels. Visit https://nationalartsstandards.org/ to see the standards for each category and grade level. Many can be applied to each unit in the 4-H Ceramics Manual.

Creating

- Anchor Standard 1: Generate and conceptualize artistic ideas and work.
- Anchor Standard 2: Organize and develop artistic ideas and work.
- Anchor Standard 3: Refine and complete artistic work.

Presenting

- Anchor Standard 4: Select, analyze, and interpret artistic work for presentation.
- Anchor Standard 5: Develop and refine artistic techniques and work for presentation.
- Anchor Standard 6: Convey meaning through the presentation of artistic work.

Responding

- Anchor Standard 7: Perceive and analyze artistic work.
- Anchor Standard 8: Interpret intent and meaning in artistic work.
- Anchor Standard 9: Apply criteria to evaluate artistic work.

Connecting

- Anchor Standard 10: Synthesize and relate knowledge and personal experiences to make art.
- Anchor Standard 11: Relate artistic ideas and works with societal, cultural, and historical context to deepen understanding

Fun with Ceramics - History

Learning about the history of ceramics is just as important as making pottery today. Ceramics go back to prehistoric times. After people discovered fire, they started experimenting with clay and found they could make it hard by heating it. From that point, clay became a material with endless possibilities.

Ceramic Fragment,14th–15th century, Earthenware; incised decoration through a white slip and coloring under transparent glaze, Courtesy of The Metropolitan Museum of Art, New York, https://www.metmuseum.org/art/collection/search/445159

Early ceramics were very simple. People shaped clay by pinching and rolling it into bowls, plates, and tools. They fired these pieces in fire pits at low temperatures. Over time, people learned that fire changed clay in amazing ways. They worked to make pottery stronger and less porous by smoothing and polishing the outside. Many pieces from these early times were everyday tools or religious items with simple decorations.

Pottery is one of the few art forms that shows history from all over the world. It tells the story of how people lived, worked, and created.

Ceramics in the Western World

Pottery in the Western World has a long history. It started in Mesopotamia around 5000–3000 BC. People there made bricks and tiles for buildings and farming. They also invented the pottery wheel, which changed ceramics forever.

In Egypt, pottery became more decorative. Egyptians made sculptures, religious statues, and vessels using the pottery wheel. They created colorful glazes called Egyptian paste, known for turquoise and copper colors. They also used iron oxides to paint pictures and hieroglyphs on pottery.

In the Mediterranean, people built kilns to fire pottery at higher temperatures. This made pieces stronger and better quality. They also improved how they used the pottery wheel.

In the Americas (around 800–1200 AD), early pottery was mostly hand-built with coils. Pieces were thin and often had geometric designs. In the Southwest United States, handled jugs were common. Central and South American potters made beautiful pieces that looked like nature. They painted animals and plants with bright colors on red clay.

Jar from the tomb of Sennedjem, Dynasty 19, Painted red pottery, Courtesy of The Metropolitan Museum of Art, New York, https://www.metmuseum.org/art/collection/search/544702

Ceramics in the Eastern World

Pottery in the Eastern World is known for its elegance and prestige that is separate from the rest of the world's historical ceramic lineage. Pottery dates all the way back to 3500 BC in China where it was often used for religious ceremonies such as funerals, with black colored clay, and mostly smooth cylindrical shaped pieces. Ceramic practices spread to Japan around 2000 BC, then on to Korea around the 1st century and later in Arabia by the 12th century.

Eastern pottery is considered some of the most refined in the world. Eastern Asian pottery was mastered through intense practices in the houses of monks and by other passionate artistic craftsmen. Japan produced the breathtaking and world renowned terracotta soldiers, developed mold making works, and produced exquisite sculptures from its region. The refined practices with porcelain developed the art of making tea pots which supported the sacred tea ceremony practice within its culture. Around the 16th century, Japan birthed the Raku process which has now become a world wide favorite in ceramics studies due to its unpredictable nature in the glazes and high intensity firing process. The ornate and delicate decorations found in Arabian and Persian pottery have strong eastern Asian pottery influences as well.

Foliated plate with rocks, plants, and melons, 14th century, Porcelain painted in underglaze cobalt blue (Jingdezhen ware, Courtesy of The Metropolitan Museum of Art, New York, https://www.metmuseum.org/art/collection/search/42495

Popular Through the Centuries

The art of ceramics can be traced throughout history and can be found in nearly every point of time since the discovery of fire. Ceramics is one of the oldest art forms. It has been used for cooking, building, and religious ceremonies in every culture. Even today, pottery connects us to the past. When you work with clay, you are part of a tradition that is thousands of years old.

As a 4-H member, you get to use modern tools like electric and gas kilns. These help control temperature so you can try different clays, glazes, and colors. In this project, you will learn skills developed over centuries. As you learn, help others too! Teaching others makes you a leader and keeps the tradition of creating beauty from clay alive—whether for everyday use or as fine art.

Ceramics Units

The 4-H Ceramic project units are divided by skills you can learn, beginning with working with clay, then moving into various types of glazes using either clay objects you have made or purchased, and finishing with sculpture and throwing on a potter's wheel.

It is suggested (not required) to do Units 1 and 2 in order. Units 3 through 6 may be taken in any order based on the member's interests. Members may exhibit in more than one unit, provided the member is enrolled in and has completed the requirements of each of the units they are exhibiting in. It is suggested (not required) to do Units 7 through 9 after completing Units 1 or 2 and any of the glaze units. Units may be repeated with different exhibit item(s) to learn and master new skills in a particular area. All work must be done by the 4-H member, including the cleaning of greenware where applicable.

One piece consists of no more than one item with a lid. More than one piece is considered a set. Pieces in a set must be related. All ceramic pieces that are exhibited must be free for close inspection by the judge **(i.e., flowers should not be fastened with floral clay in a flowerpot**). If not, the piece/pieces will be disqualified. The entry card should be attached in a way to allow the judge to inspect all parts of the item (i.e., tied or taped on with a string).

If the exhibit item is purchased bisqueware or greenware, it should already be cleaned and fired before judging and can be exhibited in Unit 3 through Unit 6. For Unit 3 through Unit 6, purchased items and hand constructed items will be judged in separate classes.

Ceramics Units

Exhibit requirements may change year to year, so be sure to check the State 4-H Website as you are deciding which unit to complete. The Ceramic project units are:

Hand-Constructed Unit 1

Includes hand-constructed items using earthenware and stoneware. Members learn the basics of hand-construction skills by creating a pinch pot, a drape shape or sagged shape exhibit and completing the learning activities.

Slab and Coil Constructed Unit 2

Includes hand-constructed items using earthenware and stoneware. Members learn to slab or coil hand-construction methods by creating a slab or coil exhibit piece and completing the learning activities.

Underglazes Unit 3

Includes underglazes on earthenware, stoneware, and porcelain. Members learn underglaze techniques by creating one exhibit piece that is between 4" in width or height and 12" in width or height and completing the learning activities.

Unfired Finishes Unit 4

Includes underglazes on earthenware, stoneware, and porcelain. Members learn unfired finish techniques by creating one exhibit piece that is between 4" in width or height and 12" in width or height and completing the learning activities.

Glazes Unit 5

Includes underglazes on earthenware, stoneware, and porcelain. Members learn basic reactive glaze techniques by creating one exhibit piece that is between 4" in width or height and 12" in width or height and completing the learning activities.

Ceramics Units

Overglazes Unit 6

Includes underglazes on earthenware, stoneware, and porcelain. Members learn overglaze techniques by creating one exhibit piece that is between 4" in width or height and 12" in width or height and completing the learning activities.

Sculpture Unit 7

Includes underglazes on earthenware and stoneware. Members learn glazed sculpture techniques by creating one exhibit piece meant to be hung and completing the learning activities.

Wheel Throwing Unit 8

Includes wheel-thrown items using earthenware and stoneware. Members learn wheel throwing techniques by creating a set of two matching functional glazed pieces of equal height, width and shape and completing the learning activities.

Production Mold Unit 9

Members learn production mold techniques utilizing porcelain slip by completing a set of three to five articles using a slipcasting mold showing consistency in production and completing the learning activities. Members learn entrepreneurial skills by creating a business plan for selling items they have made using production molds.

Consult the Exhibit Requirements and Ceramics judging score sheets on the State 4-H Website at https://co4h.colostate.edu/colorado-4-h-state-fair/

Records

A completed Ceramics e-Record presented in a sturdy binder/notebook must be entered with the exhibit piece. Include two completed learning activity projects with information listed on the Ceramics Activities Page.

Include the Ceramics Technique Page with at least three projects listed that you completed for the unit this year. The technique page should have enough information included so the exhibitor or other people would be able to make a project very similar by following the instructions. You should have a technique page with each piece you exhibit. The technique page should include:

1. A list of all tools and brushes used. Sizes should be included, if applicable.
2. A list of brand names, numbers, and colors used.
3. A list of steps.
   - A. If the piece was bisque-fired before application of color and to what cone size or temperature.
   - B. How the color/colors were applied and number of coats. The cone size or temperature the color/colors were fired.
   - C. A list of other products used.

Points to Remember

Choose greenware with sharp detail for proper thickness.

The ceramic clay body must be fired at a proper temperature to ensure proper maturity.

Read all labels on all containers for important information and instructions.

Follow instructions closely.

Follow the safety rules to prevent any health hazards and/or complications with your project.

Keep accurate and neat notes to enter into your Ceramics e-record supplement sheets.

Any unit may be repeated with new skills learned.

The unit criteria, for the unit in which you were enrolled, must be met.

More than one unit may be completed in one 4-H year.

The Ceramics e-records must be completed per unit.

Be creative! Have fun!

Safety Rules

Do not have food and/or drink at your work area.

Keep your hands away from your mouth and eyes.

Do not blow clay dust from the ceramic piece, use a damp sponge or rag to wipe a piece clean.

Be sure your hands are clean before handling your piece.

Protect Your Lungs: Clay dust can be harmful if inhaled. Always clean up carefully and avoid creating dust.

Always work in a well ventilated room when you are working with overglazes.

Wear an N91 fine particle mask when dealing with any dry mix materials or in situations where you're dealing with heavy dust from pottery or its materials.

Wear an apron to protect your clothing.

Use the Kiln Safely: Only trained adults should operate the kiln.

Records

Information that may be included in the story in the record book includes:

- Your name and age
- A little information about yourself
- What you liked most and/or least about doing your projects
- About difficulties you had in doing your projects, if any
- What you have learned about ceramics
- What you would like to learn next year
- What you and/or your club may have done for a community project

A minimum of four pictures are required to show the progress of your project. You should have two pictures showing your two activity pieces and at least two pictures showing your exhibit piece. You can add more photos if you want.

Be consistent (i.e., if you start your record with black pen, continue to use black pen throughout). You may use pen, pencil, or the computer to complete the record book in either a Word document, a fillable PDF, or a Google Doc. E-records for the Ceramics project are available at https://co4h.colostate.edu/creative-arts/.

Resources

Below are some resources you may want to consider as you learn about ceramics.

- **Google your nearest pottery stores/studios near you**

- **CO Pottery Suppliers**:
  Stone Leaf Pottery (Denver, has online purchasing options), Rocky Mountain Clay (Denver, has online purchasing options), Continental Clay Company (Denver, has online purchasing options), Friend Assembly (Aurora, has classes, can fire your pieces, has open studio hours either guided or independent, etc), Northern Colorado Potters Guild (Fort Collins, another studio share style establishment), AlSi Ceramics Studio (Denver, studio share, classes, firing, etc)

- **Online suppliers:**
  https://rockymountainclay.com/
  https://www.dickblick.com/categories/ceramics-sculpture/
  https://www.theceramicshop.com/,
  https://seattlepotterysupply.com/,
  https://www.penguinpottery.com/,
  https://www.pottersshop.com/supplies/

- **Greenware suppliers:** Hobby Hut (Canon City)
  https://hobbyhutceramics.com/,
  Wholesale Bisqueware
  https://www.bisqueimports.com/

YouTube Teachers (Please be sure your parents or guardians approve of you searching for teachers on the internet.):

- **Simon Leach:**
  Resource for beginners

- **Hsinchuen Lin:**
  Technique focused videos

- **Florian Gadsby:**
  Detailed instruction and general learning resources

- **Earth Nation Ceramics:**
  Resource for beginners, offering a playlist that covers the basics of pottery, including wedging, centering, and throwing.

- **The Clay Teacher - Cindy Clarke Pottery:**
  Pottery tutorials, including hand-building and air-dried pottery.

"Vendors are listed as a service to Extension clientele. CSU Extension does not guarantee nor warrant the standard of any vendor's product, nor does it imply approval of the product to the exclusion of others which also may be available, nor does it intend discrimination or criticism of products or providers that are mentioned or not mentioned. In addition, CSU Extension assumes no liability for harvesting or use of vendors' product."

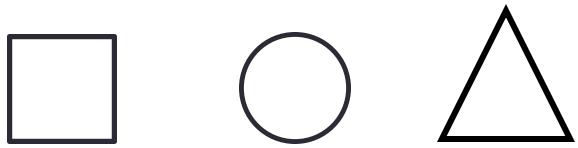
Elements and Principles of Design - Ceramic Specific

In ceramic design, the elements of art (**line, shape, form, space, color, value, and texture**) are the foundational building blocks used to create a project piece. These elements are then organized and manipulated according to the principles of design (**balance, emphasis, movement, pattern, rhythm, unity, variety, proportion and contrast**) to achieve a desired look and to convey artistic intent.

Elements of Design in Ceramics

Line: A mark with length and direction, defining shapes and outlines, and can be used to create texture.

Shape: A two-dimensional area defined by lines or color changes, which in ceramics can be on the surface decoration or in the form of the object.



Form: A three-dimensional object with height, width, and depth, which in ceramics involve the manipulation of form through modeling, carving, or molding.

Space: The area around, between, or within objects, including both positive (occupied) and negative (empty) space, which in ceramics can be seen in terms of the interior and exterior volumes of the object.

Color: The visual response to wavelengths of light, influencing mood and emotional expression, which in ceramics can be used through glazes, slips, the color of the clay, and other surface treatments.

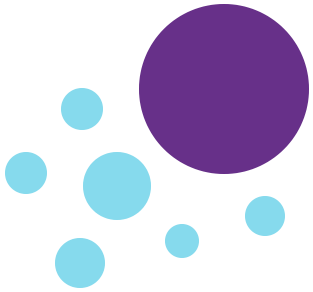
Value: The lightness or darkness of a color, creating contrast and depth, which define the ceramic form through shading and highlighting.

Texture: The surface quality of the ceramic piece, either tactile (felt) or visual (implied), which in ceramics can be explored through surface treatments like carving, incising, adding relief or glazing.

Principles of Design in Ceramics

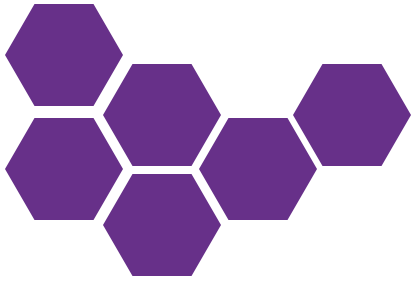
Balance:
The distribution of visual weight within the piece, achieving stability, which in ceramics can be achieved through symmetrical or asymmetrical arrangement of forms and design elements.

Emphasis:
Drawing attention to a specific area or focal point, which in ceramics can be achieved through variations in texture, color, form, or scale to draw attention to specific areas of the object.



Movement:
Guiding the viewer's eye through the piece, often towards the focal point, which can be suggested through the flow of lines or patterns on the surface.

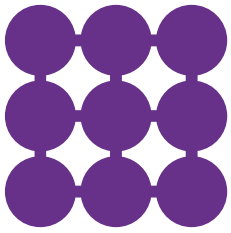
Pattern:
The repetition of elements to create a decorative effect through surface decoration or structural repetition.



Rhythm:
The organized movement or flow created by the repetition of elements.

Principles of Design in Ceramics

Unity:
The harmonious relationship between all elements, creating a sense of wholeness, which can be achieved through the consistent application of design elements throughout the piece.



Variety:
Using diverse elements to add visual interest and prevent monotony.

Proportion:
The relationship between the sizes of different parts of the ceramic piece, which is essential for creating a sense of harmony and balance in the overall composition.

Contrast:
The juxtaposition of opposing elements to create visual impact, achieved through variations in texture, color, form, or scale.

Reference:
https://human.libretexts.org/Workbench/Ceramics/10%3A_Design_and_Aesthetics/10.01%3A_Principles_of_Ceramic_Design

Sketching Your Design Ahead of Time

It is helpful to draw out design ideas before you start working with your clay, so you have an idea of what you want to make. This will help you think creatively before gathering all the supplies you will need. Get some drawing paper and a pencil, marker, or crayons and draw some ideas for your design.

Color Wheel Exercise

Before beginning your projects, try your skill at mixing colors. Having knowledge of "color mixing" is very important. You will be amazed at what you can achieve.

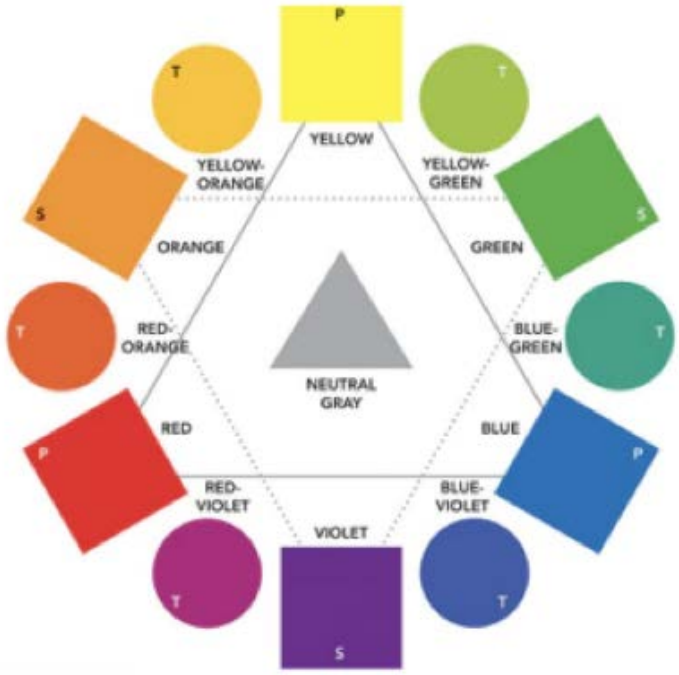
Colors you will need:

- The primary colors (yellow, red, and blue)
- Black and white

Directions:

1. Draw a large circle, the size of a saucer, on a smooth side of butcher paper. Inside the large circle, draw twelve circles that are the size of a nickel. Number the circles as if you were making a clock dial.
2. Draw a solid line, making an equilateral triangle, connecting 12 (yellow)-4 (red) and 8 (blue).
3. Draw another equilateral triangle, this time with broken lines, connecting 2 (orange)- 6 (violet) and 10 (green). Your drawing should look similar to the color wheel below.

Paint yellow in the 12 o'clock square. Blue in the 4 o'clock square and red in the 8 o'clock square. Be sure to wash the paint knife and brush well between each color.



Primary Colors:

Yellow Red Blue

(They are the strongest colors.)

Secondary Colors:

Orange Violet Green

(Secondary colors are a combination of two primary colors).

Mixing Secondary Colors

Mix an equal amount of yellow and red, with a paint knife, on a piece of foil or on a plastic lid. Did you get an orange? Great!! Paint the orange in the 11 o'clock square. Save the left over orange paint.

Mix an equal amount of red and blue. You made a violet. Paint the violet in the 6 o'clock square. Save the left over violet paint.

Mix an equal amount of blue and yellow. Did you get a green? Fantastic! Paint the green in the 2 o'clock square. Save the left over green paint.

Mixing Intermediate Colors

Yellow-Orange, Red-Orange, Red-Violet, Blue-Violet, Blue-Green, Yellow-Green (these are made by mixing a secondary color with an adjacent primary color). Always mix a small amount of the dark color into the light color until you achieve the desired color.

Mix orange into the yellow until you have a nice yellow-orange color. Paint this color in the 11 o'clock circle.

Mix red into the orange until you have a nice red-orange color. Paint this color in the 9 o'clock circle.

Mix red into violet until you have a nice red-violet color. Paint this color in the 7 o'clock circle.

Mix blue into the violet until you have a nice blue-violet color. Paint this color in the 5 o'clock circle.

Mix blue into the green until you have a nice blue-green color. Paint this color in the 3 o'clock circle.

Mix green into the yellow until you have a nice yellow-green color. Paint this color in the 1 o'clock circle.

The placement of the colors should be the same as shown on the color wheel on the previous page. Save your color wheel for future references.

Color Wheel Exercise Worksheet

What color did you get when you mixed green and violet?

What color did you get when you mixed violet and orange?

What color did you get when you mixed orange and green?

The colors you obtained by mixing the secondary colors above are called Tertiary colors.
What color did you get when you mixed blue and white?

What color did you get when you mixed red and white?

What color did you get when you mixed green and white?

Color Wheel Exercise Worksheet

The colors you obtained by mixing white with the darker colors are called shades and tints.

A project that is done in several shades of one color is known as a Monochromatic color scheme (pale blue, sky blue, baby blue, etc.)

What color did you get when you mixed blue and black?

You can obtain darker shades of colors when you mix black or brown with your colors. These are excellent colors for shadowing. The exception to the rule would be mixing black with yellow.

What color did you get when you mixed black into yellow?

A darker shade of yellow can be obtained by using brown.

What color did you get when you mixed red, orange, and green?

What color did you get when you mixed yellow and violet?

If you decide to mix colors to paint your piece, be sure to mix enough of the color that you will need for that particular area. Some mixed colors may vary in color if the exact formula is not followed.

Remember that all colors will work well together if you watch the placement, using the five basic color schemes. Your pieces will be more interesting if the amounts of colors are unequal. (Rhodes, 2000, page. 94)

Fun with Ceramics - Introduction to Terms

What is a clay body?
A clay body is a mixture of clay or clays and other earthly mineral substances which are blended together to achieve a specific ceramic purpose. (Rhodes, 2000, page. 94) Clay comes from the earth, it is rocks and minerals that have broken down into a mud-like consistency, collected, sifted of small particles, partially dehydrated then formed into large clumps of moldable, workable clay.

There are several Clay Body Classifications. The three most common clay bodies produced are Earthenware, Stoneware, and Porcelain. Each are determined by the type of clay body make up and temperature levels they are fired to.

What is greenware?
Greenware is simply unfired or “raw” pottery, a clay body that has been shaped into something but has not been fired yet. The stages of Greenware include: Plastic (moldable) Clay, Leather Hard Clay, and Bone Dry Clay

What is bisqueware?
Bisqueware is clay that has been fired once at a low temp to remove all moisture out of it to prepare it for glazing.

What are different uses of pottery?
There are primarily two uses of pottery: functional and non-functional. Functional pottery is pottery you can use everyday such as bowls, plates, cups, etc. Non-Functional pottery serves as decorative art pieces with interpretations subject to the viewer and or the cultural or contextual references presented by the artist.

What are different styles of pottery?
This project will introduce you to several different styles of pottery including: Pinching, Hand Building - Slab or Coil, Wheel Throwing, and Casting.

What are glazes and glaze types?
Ceramic glazes are glassy coatings applied to bisque-fired pottery used for waterproofing, decoration, durability, and functionality. Their composition is made from finely ground minerals and other materials, often including silica, alumina, and fluxes, which lower the melting point of the glaze allowing it to fuse to the clay at kiln temperatures. Glazes also include colorants, metal oxides or stains added to achieve different colors.

There are several glaze types:

- **Engobes or slips** - clay-based mixtures used to change the surface color or texture
- **Underglazes** - glazes applied to the surface to decorate the pottery before applying a transparent glaze over it, creating a design that appears beneath the glaze
- **Ash glazes** - made from wood or plant ash
- **Overglazes** - decorations applied over a fired and glazed surface and then fired again at a lower temperature to fuse the colors onto the glaze
- **Oxides or Stains** - oxides are raw pigments and stains are manufactured powders used to create specific colors
- **Crystalline (glass)** - a glaze mixed with zinc silicate crystals, which form in the glaze during the kiln firing process

Glazes can be either glossy (shiny) or matte (non-reflective).

What does it mean to "fire" ceramics?
In ceramics, firing means heating clay and glazes in a kiln to a high temperature, which causes the clay particles to fuse together and the glazes to melt and form a durable, permanent surface. There are two ways of firing clay with either a kiln or a pit.

What are different types of firing?
Bisque firing is a crucial step in pottery that transforms clay into a durable, porous form. It involves heating the clay to a specific temperature, typically between 1650-1940°F (900-1060°C), to remove moisture and burn out organic matter. This process results in a fired, bisque-ware that is ready for glazes or further decoration.

Oxidation firing is firing with adequate oxygen throughout the firing process. Reduction firing uses a fuel burning kiln with incomplete combustion, an atmosphere with an excess of hot carbon. The excess carbon draws oxygen from metallic oxides in the clay body and glaze chemicals to create carbon monoxide and carbon dioxide which create a change in the glaze colors.

What are firing cones?
Firing cones are different firing temperatures. There are many different cones (temperatures) to fire clay at, and the type of clay determines the temperature cone to fire to.

The term "cone" represents a measurement of temperature over time as well as a measurement of energy.

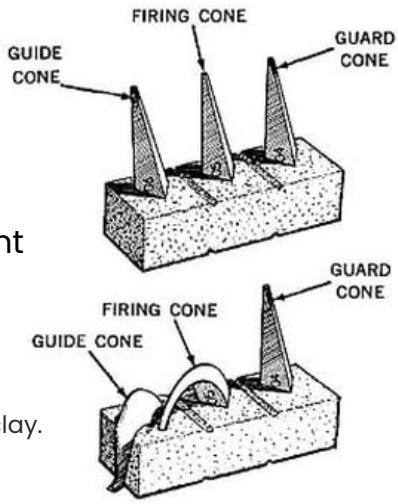


Image source: https://www.armadilloclay.com/articles/cones-explained#/

Basic Tools for Your Pottery Kit

Sponges
Usually of natural origin in many shapes and sizes. Used for moistening clay for throwing, cleaning, and smoothing pieces. An Elephant Ear is a special fine grained sponge ideal for pottery.

Ribs
Also called kidneys, are made of carved hardwood, rubber, and metal. They are used for shaping and refining pieces.

Needle Tool
This tool has a thin needle projecting from one end of a wooden handle, and is used for trimming, decorating, and scoring.

Cutting Wire
Thin wire with wooden handles at each end used to cut clay.

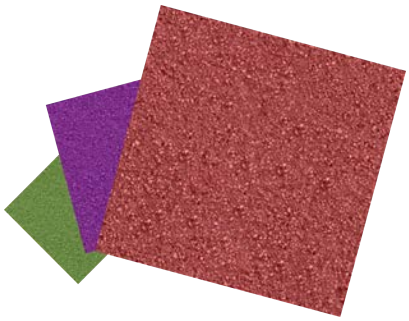
Fettling Knife
A special knife with a long, narrow blade used for trimming, carving and slicing clay.

Loop Tools
Made of hardwood with a loop of thin wire or flat metal at either end. They are used for trimming, carving, decorating and many other uses.

Basic Tools for Your Pottery Kit

Apron
Wearing an apron will help protect your clothing from the materials you are working with.

Grit Cloth
Used to finish smoothing seams on greenware.



Detail Brush
Excellent to paint features (eyes, eyebrows, etc.) or very fine lines.

Stiff Bristle Brush
Used for design, full coverage of textured areas, lettering, stippling, and dry brushing.

Rolling Pin Set
Rollers come either smooth or in a variety of textures carved into the wood of the rolling pin that transfers onto the clay. Rolling pins can be used to make slabs for sculpting clay, to adjust the thickness of the clay until it is flat, or for pressing out plaids, stripes, or other patterns and textures.

Glaze Brushes
Used to apply glaze and underglazes (if applying underglaze to a large area) with precision and accuracy.

Translucent Brush
For application of oil-based translucents. It can also be used for dry brushing oil-based colors as well as used for chalks.

Brushes

Brushes are instruments made from natural animal hair, or man-made synthetic fibers like nylon. Most hair or bristles are bound together and fastened into a metal ferrule.

Camel Hair:
These brushes can be made up from many different animals. The best camel hair brush is made up from the hair of squirrels. The camel hair brushes are generally soft and are mostly used for the application of glazes and lustres. They are highly recommended for lustres because they allow these media to flow smoothly, without leaving apparent brush marks.

Red Sable:
This type of brush is made from any one of the Asiatic mink or weasel hairs. They are one of the finest brushes and valued for brush work. Red sable brushes are strong, springy and have fine points.

Russian Sable:
The hairs are made up of the spotted American skunk and other polecats. It is sometimes referred to as a "fitch."

Bristle:
Bristle brushes are made from a boar's or hog's body hairs. The finest quality bristles come from the hog's neck, which taper to a split end of several fine filaments.

Glaze Brush:
This brush comes in camel hair, red sable, ox hair, and nylon. The sizes run from 1/4" to 1-1/2". Nylon is recommended for satin and matt glazes because it applies these non-moving glazes smoothly.

Fan brush:
They come in various sizes and are highly recommended for crystal type of glazes. Crystals have a tendency to go into the ferrule of the other brushes. It is very hard to determine if the crystals are completely out of the ferrule when the brush is cleaned. These crystals may slip out when another color is used. This ruins the finish.

Square Shader:
Red sable square shaders are full bodied, sharp-edged, and resilient. They are most valuable for design work.

Sabeline:
This brush is made from the tufts of silken hair found in the ears of cattle. They are strong and pointed, but do not have the ability to retain their shape.

Blenders or Dusting Brush:
These brushes are made from badger hair and are sometimes referred to as a badger brush.

Stiff Bristle:
Mostly used to apply chalks, some oil base colors and to "scrub in" opaque stains.

Brushes

Brushes are manufactured in a round or flat shape and vary in bristle length and fullness. They are made in several sizes.

To ensure a long life for your brushes thoroughly clean them, then shape and let them dry flat on a paper towel. Brushes that need to be cleaned in a turpentine base or other solvent cleaner, must always be cleaned with soap and water as a final cleaning. A brush should never be jammed against the bottom of a container.

Never leave your brush in the cleaning water. The water will travel up the bristles onto the wooden handle and cause the finish to peel from the handle. It will also cause the brush to become deformed, and it rarely will take shape again. If the brush is severely misshapen, after it is totally cleaned, shape it using styling hair gel. Then wrap it in foil and place it in the freezer for a few days.

It is important not to loan your brushes to others. Brushes used for brushstroke work form to your way of making brushstrokes. There is a possibility they might be returned improperly cleaned, which shortens the life of a brush.

When storing your brushes for any length of time, place a mothball with them. This prevents tiny insects from eating the glue in the ferrule, which will cause a loss of the brush hair. With proper care, the brushes will last almost indefinitely.

Types of Clay

A clay body is a combination of clay particles and ceramic materials mixed together to a workable consistency that produces predictable firing results. Some clay bodies can be found in nature. The state of Georgia, for example, is known for its red clay. Other clay bodies are made from dry powder materials and mixed with water to create the clay.

Earthenware

Earthenware is a white low-fire clay body (fired between 1728-1945 degrees Fahrenheit). Some earthenware holds iron oxide which can give it a reddish-brown color like in terra cotta flower pots. It is still porous after firing and must be sealed. Though not as durable as stoneware or porcelain, it can be used for dinnerware and ornamental pieces. Low-fired clay dinnerware has a greater tendency to chip and is less expensive. Earthenware can be hand-molded and thrown on a wheel, but is most popular in casted greenware. It will serve you well in all units and skills.

Porcelain

Porcelain is referred to as the "Grand Lady" of all the clay bodies and is the most expensive. (Typically porcelain is fired between 2381-2455 degrees Farenheit.) It is most delicate in greenware, but is highly chip resistant when fired to cone 6. Because it is a vitreous clay, it does not have to be sealed with glaze, but for sanitary reasons all dinnerware and food containers should be glazed with food-safe glazes. A glazed piece of porcelain is called china and is decorated most often with an overglaze. Porcelain comes in many colors and for most techniques, the white and pastel tones are translucent and the dark colors opaque.

Stoneware

Stoneware is a high-fired and chip resistant clay body (fired between 2100-2400 degrees Fahrenheit). Because of its strength, it is most popular in dinnerware, but is also used for many ornamental pieces. If stoneware is fired to proper temperature, it is vitreous (will hold water) and does not need a glaze to seal its clay. Fired clay is vitreous when particles fuse together and become glass-like. Since it is hard to tell if it has been fired to the right temperature, all dinnerware, food, and drink containers must be glazed with food-safe glazes. Stoneware is the easiest kind of standard clay to work with and is mostly hand

formed and thrown on a wheel; however, it is also made in slip form which can be used in casted greenware. Most ceramists do not use unfired finishes on stoneware, since it is more expensive.

Other types of clay you might want to research include:
Kaolin, Ball Clays, Fire Clays, Bentonite Clays, Fluxes, Fillers, Paper Clays, Polymer Clays, Air-Dry Clays

How to Clean Greenware

1. Your greenware piece must be bone dry. Wet or damp greenware can become polished which will repeal ceramic products. With the straight edge blade of the cleaning tool, gently scrape diagonally across the seam line. The seam line should be removed to follow the natural shape of the piece. Use the curved end of the tool to clean the indented and rounded areas.

2. Brush away accumulated clay dust with a soft dusting brush. Do not blow the dust.

3. Smooth the scratch marks made by the cleaning tool, and any surface imperfections with a medium grade grit cloth. Use a circular motion, again, following the natural shape of the piece. You do not want to create flat areas. Remove accumulated dust with the dusting brush.

4. Replace damaged detail with the curved end of the cleaning or a stylus tool. These lines will be sharp in contrast to the surrounding area. With water, dampen a soft brush, soften the harsh lines.

5. Container walls must be of even thickness. Reduce the thicker areas from the inside of the opening with a medium grade grit cloth. Be gentle! To level the top edge of the opening, gently rotate the inverted object in a circular pattern on a piece of fine screen. The bottom of the piece may also be leveled in this manor. Be careful not to squeeze. Remove any clay drips from the inside of the container.

6. Prepare a cup of tepid water with one teaspoon of vinegar. Vinegar water should eliminate hard spots that may appear. A hard spot is caused by a chemical build up in the mold that was used. The vinegar solution makes the greenware more porous. With a natural or synthetic wet sponge, lightly wipe over the piece one time. If more corrections are needed, let the piece dry and repeat steps.

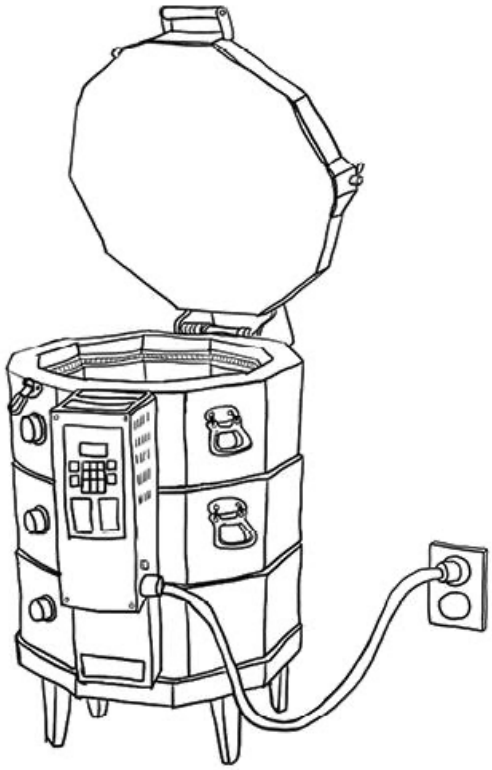
Firing with a Kiln

Typically ceramics are fired in two stages. The first stage is known as the bisque firing and the second stage is known as the glaze firing. The bisque firing process needs to be done under a very controlled heat, as the cleaned greenware (air dried clay) is put in a kiln and heated slowly and then also cooled slowly. When greenware is fired, the moisture is removed and becomes a hard form called bisqueware. During firing, bisqueware goes through a chemical change to become ceramic. This enables the pottery to become porous and able to handle water-based paints without it cracking or failing. The finished piece also becomes stronger, and a harder ceramic with better porosity is perfectly prepared for the application of glazes.

The second stage, called glaze firing, is done after the potter has applied paints, underglazes and glazes to the piece. This is a more drawn out process than bisque firing, depending on the cone temperature that you choose to fire to.

If you have your own kiln, read the directions and have a parent help you. Kilns come in different sizes and have specific directions that must be followed in order to be safe. Some Ceramics leaders may have their own kilns and can fire for you, or you can have your firing done at a local ceramics store or studio. Each kiln fires differently. The kiln operator often keeps a log to determine how to fire and how to arrange the pieces in the kiln for the best results. Kiln temperature is usually more intense near the top. Some colors of glazes "travel" while being fired. These pieces need to be fired on the top shelf. Floating or traveling flecks of glaze will float upwards and attach themselves to other glazes if they are fired on the lower shelves

Electric kiln temperatures range from approximately 1100 degrees to 2700 degrees Fahrenheit. Each technique may require a different firing temperature.



Kiln image from https://ceramicartsnetwork.org/ceramics-monthly/ceramics-monthly-article/tips-and-tools-kiln-care

Cone Charts

Your leader may show you a Pyrometric Cone Chart that will show you the most recommended firing ranges. You will low fire for the bisque to be stained or for glaze. The Orton Cone Chart is a reference guide developed in the 1890s used in ceramics to show the relationship between pyrometric cones and the temperatures they represent in a kiln.

Here's what it means in simple terms:

Pyrometric cones are small, cone-shaped pieces made of ceramic materials that bend at specific temperatures. They help potters know when their kiln has reached the right heat for firing clay and glazes.

Each cone has a number (like Cone 06, Cone 6, Cone 10). Lower numbers usually mean lower temperatures, and higher numbers mean hotter temperatures.

The Orton Cone Chart lists these cone numbers along with their corresponding temperatures in both Fahrenheit and Celsius. It also shows whether the cone is for low-fire, mid-fire, or high-fire ranges.
Why is it important?

- It helps potters choose the right cone for their clay and glaze.
- It ensures pieces are fired correctly so they don't crack, melt, or stay too soft.

Cone Charts

Cone	Equivalent Cone Temperature at 27°F/Hour Heating Rate at End of Firing	Equivalent Cone Temperature at 108°F/Hour Heating Rate at End of Firing	Equivalent Cone Temperature at 270°F/Hour Heating Rate at End of Firing
022		1087°F - 586°C	1094°F - 590°C
021		1112°F - 600°C	1143°F - 617°C
020		1159°F - 626°C	1180°F - 638°C
019	1213°F - 656°C	1252°F - 678°C	1283°F - 695°C
018	1267°F - 686°C	1319°F - 715°C	1353°F - 734°C
017	1301°F - 705°C	1360°F - 738°C	1405°F - 763°C
016	1368°F - 742°C	1422°F - 772°C	1465°F - 796°C
015	1382°F - 750°C	1456°F - 791°C	1504°F - 818°C
014	1395°F - 757°C	1485°F - 807°C	1540°F - 838°C
013	1485°F - 807°C	1539°F - 837°C	1582°F - 861°C
012	1549°F - 843°C	1582°F - 861°C	1620°F - 882°C
011	1575°F - 857°C	1607°F - 875°C	1641°F - 894°C
010	1636°F - 891°C	1657°F - 903°C	1679°F - 915°C
09	1665°F - 907°C	1688°F - 920°C	1706°F - 930°C
08	1692°F - 922°C	1728°F - 942°C	1753°F - 956°C
07	1764°F - 962°C	1789°F - 976°C	1809°F - 987°C
06	1798°F - 981°C	1828°F - 998°C	1855°F - 1013°C
05-1/2	1839°F - 1004°C	1859°F -1015°C	1877°F - 1025°C
05	1870°F - 1021°C	1888°F - 1031°C	1911°F - 1044°C
04	1915°F - 1046°C	1945°F - 1063°C	1971°F - 1077°C
03	1960°F - 1071°C	1987°F - 1086°C	2019°F - 1104°C
02	1972°F - 1078°C	2016°F - 1102°C	2052°F - 1122°C
01	1999°F - 1093°C	2046°F - 1119°C	2080°F - 1138°C
1	2028°F - 1109°C	2079°F - 1137°C	2109°F - 1154°C
2	2034°F - 1112°C	2088°F - 1142°C	2127°F - 1164°C
3	2039°F - 1115°C	2106°F - 1152°C	2138°F - 1170°C
4	2086°F - 1141°C	2124°F - 1162°C	2161°F - 1183°C
5	2118°F - 1159°C	2167°F - 1186°C	2205°F - 1207°C
5-1/2	2133°F - 1167°C	2197°F - 1203°C	2237°F - 1225°C
6	2165°F - 1185°C	2232°F - 1222°C	2269°F - 1243°C
7	2194°F - 1201°C	2262°F - 1239°C	2295°F - 1257°C
8	2212°F - 1211°C	2280°F - 1249°C	2320°F - 1271°C
9	2235°F - 1224°C	2300°F - 1260°C	2336°F - 1280°C
10	2284°F - 1251°C	2345°F - 1285°C	2381°F - 1305°C

Chart from Soul Ceramics
https://www.soulceramics.com/pages/what-is-a-cone-a-guide-to-pyrometric-cones-and-kilns"

Bisque Firing

Bisque firing is the first, lower-temperature firing of unfired clay (greenware) that transforms it into a durable, hardened, porous ceramic called bisqueware. This crucial step removes remaining moisture, drives off organic materials, and creates a porous surface perfect for absorbing glaze during the next, higher-temperature glaze firing. The bisque-fired piece is now sturdy enough to handle without it breaking, but still porous enough to receive glaze evenly.

The ideal kiln temperature range is usually between cone 06 to cone 04, regardless of clay and glaze temperature. There are reasons why you might choose to fire at one temperature as opposed to another, for example:

- Firing at cone 06 causes the clay to shrink and become porous and therefore will easily accept glaze.
- Firing to cone 04 increases the pottery's strength and durability.

Generally, a higher bisque firing temperature will result in a less porous ceramic.

The purpose of bisque firing is to:

- Harden the clay into ceramic, as well as making it porous and therefore suitable for glazing
- Ensure that the paints, glazes and/or underglazes bond well to the ceramic surface
- Remove any residual moisture to ensure that the finished piece is strong and can withstand further processes
- Ensure that the ceramic piece doesn't fall apart or crack

Loading a Kiln

Before loading or unloading the kiln all switches must be in the OFF position(s) and power to the kiln disconnected. Contact with heating elements or other electrically conductive components within the kiln can result in electrical shock causing injury or death. Before loading or unloading the kiln should be cool, 135°F (57°C) or less to prevent burn injury.

Begin by placing 3 to 4 posts on the kiln floor. These posts will support a shelf and it's best to use ½" to 1" for this purpose. These posts allow for proper air and heat circulation throughout the kiln and to help prevent serious damage to the kiln floor in the case of an overfire.

Loading a Kiln

Place a shelf on the floor posts, placing carefully to avoid contact with the kiln walls, thermocouple (temperature sensor) or Kiln Sitter tube assembly. Check for stability and reposition posts or add more posts if necessary.

Place your ware on the bottom shelf. All ware that is placed in the kiln must be dry. Ware that is not completely dry may crack or explode causing damage to other ware, heating elements, firebrick or Kiln Sitter tube assembly. Slipcast greenware may be fired from several days to one week after pouring. Hand modeled pieces need more drying time, as much as a few weeks. Glazed pieces can typically be fired six hours after application. Consult with your materials supplier for guidance on proper drying time and procedures.

Most ceramic firings use multiple shelf layers separated by posts. To form additional shelf levels choose posts that are about ½" to 1" taller than any ware placed on the proceeding shelf. Use a minimum of three posts, with four being preferred. Once posts are chosen, place them on a shelf and check for stability and readjust or add more posts as necessary. Place your ware on the consecutive shelves.

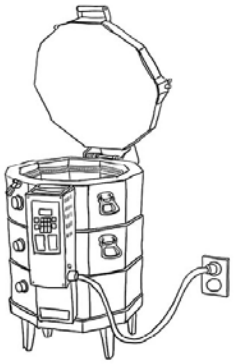
When placing posts, shelves and ware in the kiln, place them at least 1" (more is better) away from thermocouple(s) and Kiln Sitter tube assemblies. These components respond to temperature and you'll want to give them room to operate.

Repeat loading procedure for all remaining shelf levels. When loading is complete make sure that the lid or door will close without making contact with ware, posts or shelves. There should be at least 1" between all kiln ware and the lid or door. The kiln is now loaded and ready to be fired!

Kiln Safety

Students and instructors must read and understand all the safety information that came with the kiln. And a kiln's heat isn't the only safety concern: toxic gases are often released during fuel-burning (carbon dioxide), when firing soluble metal salts (sulfur dioxide), and during reduction firing (carbon monoxide). Overexposure to these volatiles can lead to blood oxygen levels falling, a rise in blood pressure, lung irritation, and in the case of carbon monoxide, drowsiness, fatigue, and even death. The kiln must be properly installed, ventilated, and maintained.

- Make sure the kiln is properly ventilated.
- Turn off and cool the kiln to room temperature to load or unload.
- Do not touch heating elements because of the high voltage. The outside can also get hot while firing. Whenever handling any part of the kiln, kiln mitts or gloves should be worn.
- Do not use extension cords with a kiln.
- Do not leave the kiln unattended while firing and avoid wearing loose or flammable clothing.
- Do not play or allow pets around the kiln while firing.
- Never look into a kiln without safety glasses such as welder's glasses.
- Do not fire with cracked shelves, which could break and damage the inside of the kiln.
- If you smell burning, turn off the kiln and examine the wall outlet/power cord for signs of burning. Unplug your kiln after firing just to be safe.
- Keep the kiln closed when not being used.
- Keep the kiln dry and do not store anything on the lid.
- Do not place objects under or around the kiln (including flammable objects) and keep the area clear from tripping hazards.
- Do not place anything in the kiln you are unsure of. Firing unknown materials is risky.
- Avoid eating and drinking in your work or kiln area, since toxins and dust are easily ingested when you handle food and kiln working materials in the same space.



Guidelines for Judging Your Project

Judges look very closely at the following characteristics of your exhibit piece.

Creativity and Originality
Shows thoughtful design, not just technical assembly.
Unique interpretation of traditional slab/coil methods.
Cohesive artistic voice or theme.

Cleaning
Smooth areas are intentionally smooth; textured areas are cleanly executed.
No unintended tool marks, fingerprints, or smudging.

Construction Quality - This evaluates how well the piece is built.
Structural Integrity

- Walls are even in thickness and appropriate for the form.
- Seams (slab joints, coil joins) are fully blended and secure.
- No cracks, stress fractures, or weak points—especially at joins, handles, rims, and lips.
- The base is level and stable.

Technique Mastery

- Slabs are compressed and joined cleanly; edges are smoothed.
- Coils are consistent and properly blended inside and outside.
- Corners, angles, or curves (if part of the slab form) are crisp or intentionally shaped.
- Attachments are secure

Texture and Design - This evaluates the artistic and functional aspects.
Proportion and Balance

- Form feels visually cohesive and properly weighted.
- The piece stands evenly and is not unintentionally lopsided.
- Pinched and draped or slumped surfaces contribute to the design rather than distract.

Bisque Fired Only
Appropriate for either functional or decorative use
Is the piece strong and sturdy? Check for cracks or areas that might break easily.
Workmanship - This looks at the overall care put into the work.

Attention to Detail

- Edges, rims, and joins are refined.
- Demonstrates skill appropriate for the artist's stated level.

Glossary of Ceramic Terms

Adaptation: The process of changing the original design of the greenware.
Airbrush: Small spray gun used for applying glaze, underglaze or stains. Also used for shading and general decorating.
Air Bubble/Pocket: Air trapped in the body or walls of the clay.
Antiquing: Removing applied color to accent detail.
Banding Wheel: A hand-operated turntable used to apply or blend bands of color and to accomplish other types of decorating.
Beveling: The process of cutting or shaping the edge of a clay piece at an angle, rather than a 90-degree perpendicular, to create a sloped, smoothed, or refined edge.
Bisque: Clay that has been fired to maturity but not glazed.
Blistering: Broken bubbles on fired glaze surface.
Blocking: A painting technique using thin, diluted paint or glazes to cover a blank surface quickly. Large brushes help maintain a loose, expressive, and non-detailed approach to help map out where darks and lights go, which helps create depth and structure before adding finer details.
Bone-dry: Term used to describe greenware that is completely dry, containing no moisture.
Brocade Glaze: A non-flowing glaze that is applied with a tool or brush for raised design.
Butting: Term used to describe placement of two or more glazes in close proximity on the same piece. The glaze is applied so that it comes within the width of a pencil-point line of the first glaze but does not touch, the butting technique prevents glazes from flowing together.
Cat's Tongue: Flat brush with pointed tip.
Casting: The process of filling a plaster mold with casting slip, thus creating a clay object.
Casting Slip: A liquid clay for mold casting.
Ceramics: Any type of clay objects given permanent shape by firing in a kiln.
China: Glazed porcelain with a shiny surface.
China Paint: Paint fired onto glaze and bisque.
Clay Body: Earthenware, Stoneware and Porcelain are the three most popular. Available in both slip and modeling clay.
Cleaning Greenware: Removal of mold seams, lines and imperfections from unfired clay objects.
Cleanup tool: The tool used to clean greenware.
Clear Glaze: A transparent glaze (void of color when fired).
Cloudy Glaze: Glazing problem caused by glaze being applied too thickly.

Glossary of Ceramic Terms

Coil Technique: A rope of clay used for hand-building clay pots.
Concave: Hollow (ex. bowl)
Cone: Heat-measuring device used when firing a kiln. Usually a three-sided pyramidal form of clay and chemicals made to bend when a specific temperature is reached inside a kiln.
Convex: Dome shape, as a bubble.
Crackle Glaze: Glazes which have been especially formulated to produce a delicate "crazed" surface pattern.
Craters: Bubbles that form, break and then set as the kiln cools.
Crawling: A term used to identify a glaze defect in which the glaze pulls away or crawls from the bisque. Caused by glaze being applied over a hard spot, dusty or soiled bisque.
Crazing: Hair-like cracks which appear on a fired glaze surface. Often referred to as either immediate or delayed crazing.
Cross-Hatch: Crisscross scratches made where two pieces of clay are to be joined.
Crystals: A specially formulated colored glaze that have been fired and then ground to various sizes.
Crystal Glaze: Glazes combined with crystals which melt in the firing to form interesting patterns.
Decal: A design on special paper, transferred to a glazed surface and fired for permanency.
Dry-Brushing: Feather-effect brushstroke achieved by using a dry brush with wet color; used also for animal fur.
Dry-footing: Bottom area of article left unglazed so stilting is unnecessary. A technique used with Stoneware and Porcelain.
Dust-free Technique: A method for cleaning without creating dust. Ware and tools are kept wet throughout cleaning.
Earthenware: Non-vitreous (porous) low-fire clay body.
Earth-tones: Buff, red, brown.
Embossing: Is the act of forming a raised design.
Ferrule: The metal that holds the bristles of the brush and the handle together.
Figurines: A small, three-dimensional sculpture or statuette representing a human, deity, or animal; often used for decoration, collecting, or for display; also sometimes called models or figures.
Firing: The process of maturing ceramic products by various degrees of heat.
Flux: A white powder that can be added to china paint to help it bond to the porcelain or to add gloss to the paint. Also helps china paint move more freely.

Glossary of Ceramic Terms

Functional Art/Pottery: The intersection of aesthetics and utility, where everyday, practical objects—such as furniture, lighting, ceramics, and textiles—are designed with high artistic intention, blurring the line between fine art and daily life, allowing functional items to serve as creative, expressive, and decorative pieces.
Greenware: A form of raw clay. May vary in color depending on clay body.
Glaze: A raw material that must be fired to bring out the finish.
Gate: The opening in a plaster slip cast mold that you pour the slip in and out of.
Hand building/Hand built: An ancient manual ceramic technique of creating functional or decorative forms—such as vases, bowls, and sculptures—using only hands and simple tools, rather than a pottery wheel; involving techniques like pinching, coiling, and slab building to create unique, and often organic shapes.
Hard Spot: A spot on greenware that resists decorating material. May be caused by chemical build up on mold used or cleaning greenware with oil on the hands.
Incise: The design is scratched in the greenware before color has been applied.
Kiln: A thermally insulated chamber, essentially a high-temperature oven or furnace, used to harden, burn, or dry materials like clay (pottery), bricks, glass, and cement. It creates permanent physical or chemical changes, such as firing ceramics, roasting metal ores, or drying lumber.
Knead: To condition modeling clay.
Leather-hard: A term used to describe cast or hand formed clay items that are damp but firm enough to handle without losing shape.
Loading: A process of completely filling a brush with color.
Luster: Decorating medium applied over fired glaze for iridescent effect.
Majolica: A glaze or underglaze decoration over any unfired glaze that does not move in the firing.
Matte Glaze: A non-moving glaze which produces a smooth, dull matte finish after firing.
Mending: Repairing broken greenware or bisque.
Modeling Clay: Clay used for hand building or throwing on a wheel.
Mold: A hollow plaster of Paris form in which articles are reproduced through the use of liquid clay.
Mold Keys: Concave and convex interlocking features, often called "registration keys" or "alignment keys," carved into the parting faces of plaster mold segments. They ensure precise alignment and secure locking of the mold halves, preventing shifting during assembly and pouring.
Non-Functional: Ceramic art created primarily for aesthetic, conceptual, or display purposes rather than practical daily use (e.g., as dishes or storage). These pieces focus on artistic expression, often highlighting sculptural forms and unique glazes or textures.

Glossary of Ceramic Terms

One-stroke: A highly concentrated, translucent underglaze paint used for detailed work.
Opaque: A color you are unable to see through.
Overall Wash: Flesh-tone tinting of bisque doll surface. Usually the first China paint firing.
Overglaze: A decorative finish, fired over a glazed surface.
Overfiring/Overfired: Occurs when ceramic material is fired beyond its maturation point, resulting in excessive vitrification, warping, bloating (bubbles/blisters), and severe shrinkage. It often becomes brittle, discolored, or melts, potentially fusing to kiln shelves. Common causes include exceeding temperature limits or improper kiln firing schedules.
Palette Knife: A flexible steel-blade knife for mixing color.
Pinch Pots: Pots made by pinching out the wall of a lump of clay.
Pin-holes: A glaze defect caused by under-fired bisque, dust left on ware or in the kiln, applying glaze to greenware and/or poor condition of greenware.
Plasticity: The characteristic of being workable into many shapes.
Polish: A southeast Indian technique. They polished their pots with stones that were handed down from generation to generation. A soft cloth, tissue or a large burnishing agate may be used to polish underglaze on greenware.
Pooling or Puddle: Fired glaze which has run to the bottom, causing drips or into the detail, causing an over-glazed condition.
Porcelain: The grandest of all the clay bodies. A translucent, vitreous clay body when high fired. Very delicate in the greenware for. Available in many colors.
Pour Gate: The portion of the greenware that was formed when the slip was poured from the mold.
Potters Wheel: Revolving wheel driven by hand, foot or electric power, used in forming articles from modeling clay.
Pottery: Any article formed from clay.
Pouncing: Applying color to ware with quick up-and-down movements, using a brush or a sponge.
Quill: A type of brush used for China painting.
Raku: A 16th-century Japanese pottery technique and style—meaning "enjoyment" or "pleasure"—characterized by hand-modeling, low-temperature firing, and rapid cooling. It often involves removing glowing-hot, glazed pieces from a kiln and placing them in combustible materials (like sawdust) to create unique, smoke-darkened, and crazed finishes.
Release Agent: A specialized substance—often wax, silicone, or soap—applied to plaster or synthetic molds to create a thin barrier that prevents ceramic slurry from sticking, enabling clean, undamaged removal of the cast piece. It reduces surface tension,

protects mold detail, and increases production efficiency.
Rolling Glaze: A method of covering inside area of ware, by rolling thinned glaze inside, then pouring out the excess.
Roughing: Applying translucent stains with a cloth, over an opaque base coat.
Score: To scratch tiny crisscross lines on the areas of greenware that will be attached together with clay slip.
Score: To scratch tiny crisscross lines on the areas of greenware that will be attached together with clay slip
Scrubbing: Application of the initial priming coat of thinned opaque underglaze or glaze. Also, an application of stain with a stiff bristle brush.
Scum: A haze that forms on fired gold and luster from insufficient ventilation in the kiln.
Seasoning: To let the kneaded/wedged clay rest for a day or more to create a dense clay body with a uniform character.
Sealer: A clear fixative to protect unfired finish available in both brush-on and spray.
Seam Line: Outline on casting showing where the mold halves meet.
Sgraffito: A method of creating a design by gently scratching through applied color to the color of the clay body beneath it.
Shivering: Occurs when glaze and clay body are incompatible. Usually the clay body shrinks more than the glaze, causing the glaze to peel.
Silk Sponge: For decorating, recognizable by short hairs over entire sponge.
Slab: A rolled out section of clay.
Slip: A liquid suspension of fine clay particles in water, acting as a versatile material for casting, decoration. A casting medium for plaster molds and a surface decoration technique.
Slip Trailing: Using slip in an applicator to flow on design.
Sling: Burlap used to cradle clay to make a slab bowl.
Slurry: Clay-body, thinned with water, used for joining moist clay sections.
Soft-Firing: Partial porcelain bisque firing (to cone 018 or 019 in kiln sitter) for preparing ware for dust-free cleaning.
Solvent: A dissolving agent used in antiquing and to clean brushes of petroleum base paints.
Spatter: Method of applying small flecks of color to ware.
Spill Glaze: A special effect glaze used over or under glazes, causing them to flow and blend.
Sponge Veiling: The use of a sponge instead of brush to apply colors over a base coat.
Stagger: To separate successive coats of glaze by fractions of an inch to prevent glazes from flowing together or from dripping from base of ware in firing.

Glossary of Ceramic Terms

Stain: Decorative, unfired, finish applied to bisque or to accent pattern.
Stencil: A cut out pattern used to apply a design by brushing, sponging or spraying.
Stick-on: Greenware parts attached to the main cast piece, with slip.
Stilt: Support used to hold glazed article above shelf during firing.
Stipple Brush: Round brush with straight or angled end that apply color with a series of tiny dots.
Stippling: A method of applying color by pouncing the tip of a brush loaded with color against the ware.
Stoneware: A heavily grog clay body requiring a high firing to vitrify. Available in many colors.
Stylus: A pointed instrument for writing or drawing. Best tool for incising.
Template: A pattern or guide used in shaping a clay form.
Terra-Cotta: Natural low and high-fired clay. Also a color.
Texture: Planned surface finish or roughness produced for interest.
Thermocouple: A high-temperature sensor used in kilns to monitor, control, and measure furnace temperatures during firing.
Tint: To lightly apply diluted colors over a base coat or coloring a product with another product.
Tipping: Touching tip of loaded brush with other colors for muted shading or accenting.
Translucent: Allows color underneath to show through.
Underfire/Underfired: Occurs when clay or glaze does not reach the required temperature or time to fully mature, resulting in a fragile, porous, or rough-surfaced piece. It is characterized by dull colors, muted glazes, crazing, and poor durability. Common synonyms include immature, under-matured, or “raw” pottery.
Underglaze: A ceramic color designed to be used under a glaze. Usually applied on greenware.
Utility Items: Dinnerware, cups, canister sets- functional rather then purely decorative items.
Veiling: Involves applying thin, often diluted, layers of glaze over a previously applied base glaze or directly onto the bisqueware. This method allows the underlying colors or texture of the pottery to remain partially visible, creating a luminous, subtle, or layered "stained-glass" effect, rather than a solid, opaque coverage.
Vent Holes: Small holes made by piecing greenware attachments to allow trapped gases and moisture to escape from attachments during bisque firing.
Viscosity: Resistance to flow.
Vitreous: Impervious surface (waterproof).
Vitrify: To become stone-hard, impervious surface.

Glossary of Ceramic Terms

Wash: Paint and water solution, used for shading and antiquing.
Wedge: To condition and work clay into a bubble free mass for throwing and hand building.
Wedging Board: A plaster block used for conditioning modeling clay.
Wet Cleaning: Another name for the dust-free cleaning technique.
Wood Glaze: Satin glazes with tiny dark specks which form a woo-grain effect when brushed on.
Wool Sponge: A sponge with a very open texture that is soft when wet.

Resources

Ceramics Lesson Plans for Teachers and Leaders: https://skutt.com/kidsneedclay/learn-create/ceramics-lesson-plans/

Ceramics Arts Network

- CLAYflicks (A subscription video service with how-to instructional videos, interviews, studio visits, and exhibition tours. The cost is $10.95 per month or $112.00 per year.): https://ceramicartsnetwork.org/clayflicks
- Books for sale on a variety of topics: https://ceramicartsnetwork.org/shop/shop-by-product/books
- Teaching Clay in the Classroom teacher guides for sale on various techniques: https://ceramicartsnetwork.org/shop/shop-by-topic/for-teachers
- Freebie Guides (must create an account to access): https://ceramicartsnetwork.org/freebies
- How to Make Pottery (free download https://ceramicartsnetwork.org/docs/default-source/uploadedfiles/wp-content/uploads/2014/03/fg16-howtomakepots.pdf

Find Pottery Places:
https://mypotteryplace.com/pro-studio-locater/

Sarah Mundy Resources:
This is a separate curriculum not related to the 4-H Ceramics manual, but it may provide some useful ideas for planning a unit.
https://drive.google.com/file/d/1HOTW4cXP7JKxrGJ9BlQJrNte7xGrta8k/view?usp=drive_link

References:
Rhodes, Daniel, (1957b), Clay and Glazes for the Potter, (Third Edition), Krause Publications

Some information in this manual was obtained from the online Knowledge Center of Soul Ceramics, Marco Island, Florida, (https://www.soulceramics.com/) from the following pages:

- A Mini Guide to Bisque Firing [Tips & Tricks!]
- Loading Your Kiln
- Pottery Wheel Throwing Tips & Techniques
- What is a Cone? A Guide to Pyrometric Cones and Kilns