



Exploring Nuclear Energy through the Elements and Principles of Art

Submitted by: Cheryl Burchett, Visual Art
Central High School, Knoxville, TN

Target Grade: 9th–12th Grade, Visual Art

Time Required: 90 minutes

Standards

National Core Arts Standards (Visual Arts): VA:Cr1.2.IIa: Choose from a range of materials and methods of traditional and contemporary artistic practices to plan works of art and design.

This aligns with the lesson as students will select materials and use abstract art techniques to visually communicate scientific ideas related to nuclear fission and fusion.

Next Generation Science Standards (NGSS): HS-PS1-8: 8. Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.

This directly connects to the scientific background provided in the lesson and the challenge for students to represent these processes through abstract art.

Lesson Objectives

Students will:

- Identify how elements and principles of art can communicate scientific information.
- Use elements and principles of art to communicate ideas about fission and fusion.
- Reflect on their own understanding by viewing and discussing peer artwork.

Central Focus

In this lesson, students will explore how visual art can be used to interpret and communicate scientific concepts, specifically nuclear fission and fusion. Through the analysis of Alma Thomas' work and the creation of their own abstract art, students will apply their understanding of the elements and principles of art to represent complex scientific ideas in a creative and meaningful way.

Keywords: science-inspired art, STEAM education, cross-curricular

Background Information

Teacher background information



This lesson bridges visual art and science by encouraging students to use artistic tools to represent scientific processes. Teachers should be familiar with the basic differences between nuclear fission and fusion. Teachers should also be familiar with Alma Thomas' work, particularly her space-themed paintings, and how she used abstraction to convey scientific and technological themes.

Student background information

Students should have prior knowledge of the Elements and Principles of Art.

- Elements of Art: line, color, value, texture, space, shape (2D), form (3D)
- Principles of Art: balance, pattern, movement, proportion, variety, unity, contrast

Materials

- [Alma Thomas, Artist Information handout](#)
- [Printed handouts on nuclear fission and fusion](#)
- Art supplies (paper, paint, colored pencils, markers, etc.)
- Writing utensils
- Optional: digital projector for displaying artwork

Instructions

Opening (15 minutes)

- Project or pass out a photocopy of Alma Thomas' *Blast Off* painting for the class to view. Without providing context, ask students to share their initial observations. If needed, ask students guiding questions such as:
 - What shapes or patterns do you notice first, and why do you think they stand out?
 - How do the colors in this painting make you feel, or what do they remind you of?
 - If you had to guess what this painting is about, what story or idea might it be telling?
- After a few responses, share a brief biography of Alma Thomas.
 - In the 1950s, artist Alma Thomas developed a distinctive abstract style using small dabs of color arranged in rhythmic patterns. In the 1960s, inspired by the Apollo missions and the 1969 moon landing, she used this style to depict scientific ideas and space travel, capturing the energy of rocket launches and astronauts in motion through vibrant streaks of color and light, even though she had never flown in an airplane.
- Next, share the photograph that inspired the artwork. Then, lead a brief discussion comparing the photo to the artist's painting, focusing on how the artist used the elements and principles of art to interpret the image.



Figure 1: *Blast Off*, 1970





- As students share their observations, guide them in making connections to the artistic concepts they've previously learned. Example responses could include:
 - *The warm hues could represent heat. And because they stand out so strongly against the background, they also show contrast.*
 - *The shape of the fire, like a triangle with diagonal lines, can suggest movement. The way it points upward helps our eyes imagine the rocket continuing to move, even though it's out of view.*

Group Discussion (15 minutes)

- Explain that students will now analyze how Alma Thomas used art to communicate scientific ideas.
- Divide students into small groups and provide each group with the [Alma Thomas, Artist Information handout](#). The handout includes a brief biography, images of *Blast Off*, *Splash Down Apollo 13*, and *Starry Night and the Astronauts*, as well as the photographs that inspired these paintings.
- On the board, project the guiding questions students will discuss in their small groups.
 - What elements of art are used in each painting?
 - Sample answer: In *Blast Off*, Alma Thomas uses color and shape to create movement and energy. The bright reds, oranges, and yellows suggest fire and propulsion. In *Splash Down Apollo 13*, she uses cool colors like blues and greens to represent water and the ocean. The repetition of shapes in *Starry Night and the Astronauts* creates a feeling of stars and space. She also uses line and texture to give the paintings rhythm.
 - How do these elements communicate scientific ideas?
 - Sample answer: The colors and shapes in *Blast Off* represent a rocket launching into space, which connects to the science of space travel. In *Splash Down Apollo 13*, the use of blue and circular patterns shows the capsule landing in the ocean, which is part of the re-entry process in space missions. *Starry Night and the Astronauts* use dots and swirling patterns to represent stars and galaxies, showing the vastness of space and the presence of astronauts exploring it.
 - What principles of art are evident?
 - Sample answer: Rhythm and movement are very strong in all three paintings. The repeated shapes and colors guide our eyes across the canvas, almost like we're watching the events happen. Balance is also important. Thomas spreads the colors evenly so no part of the painting feels too heavy. There's also emphasis, especially in *Blast Off*, where the bright center draws our attention to the rocket launch.
 - How do these compare to the scientific images or concept art provided?
 - The scientific photos are more realistic and detailed, showing exactly what happened during the space missions. Alma Thomas's paintings are more abstract, but they still capture the feeling and energy of the events. For



example, the photo of the Apollo 13 splashdown shows the capsule in the water, while Thomas's painting uses color and shape to show the same idea in a expressive way.

- After 10 minutes, ask each group to share one insight with the class.

Independent Art Activity (30 minutes)

- Introduce the art-making challenge: Students will design an abstract artwork inspired by either nuclear fission or nuclear fusion, accompanied by a 2–3 sentence explanation describing the elements and principles of art they used, and how these choices visually represent the scientific concept.
- Distribute and review the [Nuclear Fission and Fusion Information handout](#), which includes scientific background on nuclear fission, fusion, and radioactive decay.
- Encourage students to think about how to visually represent the differences and similarities between the two processes using elements and principles of art.
- Allow students to choose their materials and begin creating. Remind them that, for abstract art, clarity of concept is more important than realism.



Figure 3: Student Artwork: Using lines and shapes, this piece creates a circular, swirling design that highlights the principle of motion, representing the chain reactions of nuclear fission as atoms collide and interact.



Figure 4: Student Artwork: Through the use of value and color, this piece emphasizes the principle of contrast to depict the intense heat required for a nuclear fusion reaction within a star.



Gallery Walk & Reflection (10 minutes)

- Ask students to leave their artwork on their desks.
- Lead a gallery walk where students circulate and observe each other's work.
- Periodically pause and ask students to reflect on the artwork nearest to them:
 - What elements and principles are used?
 - What scientific ideas are being communicated?

Differentiation

- Provide visual aids or simplified handouts for students who need additional support.
- Allow students to work in pairs or small groups if needed.
- Provide students with [a list of art elements/principles](#) for students to reference during the lesson.
- Provide additional illustrations or examples for students who need more context.
- Encourage students to research additional images or videos about fission and fusion as inspiration for their abstract artwork.
- Encourage early finishers to explore advanced nuclear concepts like chain reactions or half-life.

Assessments

Formative Assessment:

- Observe student participation during group discussions and the gallery walk.
- Review student responses to guiding questions during group work.
- Provide feedback during the art-making process to ensure understanding of both artistic and scientific concepts.

Summative Assessment:

- Evaluate student artwork using a rubric that assesses:
 - Effective use of elements and principles of art to support the abstract composition
 - Clarity and accuracy in visually communicating the concept of nuclear fission or fusion
 - Thoughtfulness and creativity in the artistic interpretation, including the written explanation of artistic choices



Sample Rubric

| Criteria | 4 Excellent | 3 Proficient | 2 Developing | 1 Beginning |
|--|--|--|---|---|
| Use of Elements & Principles of Art | Artwork demonstrates exceptional use of elements (color, line, shape, texture, etc.) and principles (balance, contrast, rhythm, etc.) to create a strong, cohesive abstract composition. | Artwork shows clear and appropriate use of elements and principles to support the abstract design. | Some elements and principles are used, but the composition may feel incomplete or inconsistent. | Minimal or unclear use of elements and principles; composition appears disorganized or lacks intention. |
| Communication of Scientific Concept | The artwork clearly and accurately represents nuclear fission or fusion in a visually compelling way. Viewers can easily understand scientific ideas through the art. | The artwork mostly communicates the chosen concept with some clarity and accuracy. | The scientific concept is somewhat represented but may be confusing or inaccurate. | The artwork does not clearly represent nuclear fission or fusion or contains major inaccuracies. |
| Creativity & Thoughtfulness | Artwork and written explanation show deep thought, originality, and strong connection between artistic choices and the scientific concept. | Artwork and explanation show creative thinking and a clear connection to the concept. | Some creative effort is evident, but the explanation or connection to the concept is unclear or underdeveloped. | Artwork and explanation show limited creativity or lack a clear connection to the scientific idea. |
| Written Explanation | Explanation is well-written, concise (2–3 sentences), and clearly describes the artistic choices and how they represent the scientific concept. | Explanation is clear and mostly complete, with some connection between art and science. | Explanation is vague or incomplete, with limited connection to the artwork. | Explanation is missing, unclear, or unrelated to the artwork. |

Nuclear Fission and Fusion Information:

Nuclear: Relating to the nucleus of an atom

Atoms: the smallest unit into which matter can be divided without the release of electrically charged particles.

Atoms consist of **protons**, **neutrons**, and **electrons**.

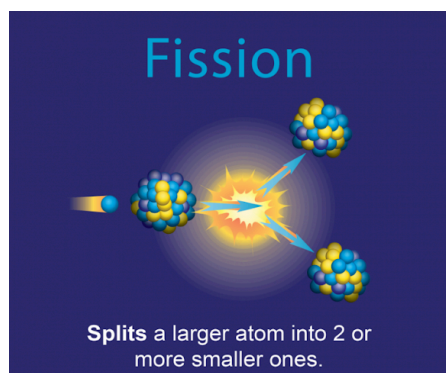
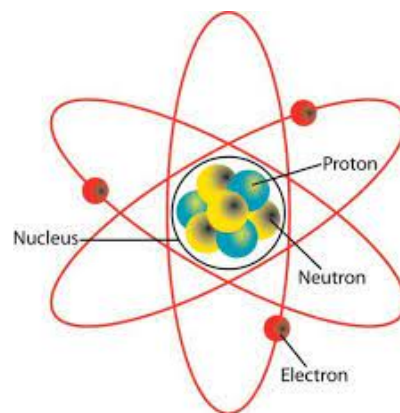
Protons and **neutrons** are in the atom's nucleus.

Electrons surround the atom's nucleus.

Protons have a positive electrical charge.

Electrons have a negative electrical charge.

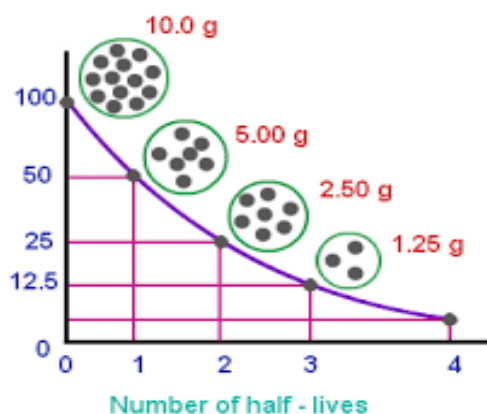
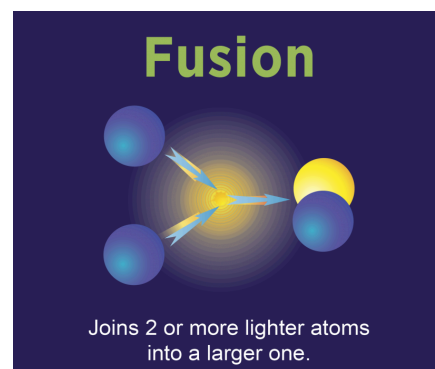
Neutrons do not have an electrical charge.



Nuclear Fission: A nuclear reaction where an atom's nucleus splits into smaller fragments, releasing nuclear energy.

Nuclear Chain Reaction: During nuclear fission, the neutrons that are released when the atom splits continue to collide with other atoms. This causes more atoms to split, and the process repeats over and over. These reactions are created and controlled in nuclear power plants to produce energy.

Nuclear Fusion: A nuclear reaction where two lighter atoms are fused together to form a larger atom. Fusion happens naturally inside stars and in the sun where extreme high temperatures and pressure make it possible for atoms to fuse. Unfortunately, for scientists on Earth, it is currently too difficult to achieve and maintain the conditions needed to create a fusion reaction so research into nuclear fusion as a source of energy continues with the hope of viable fusion reactors in the future.



Radioactive Decay: A natural process where an unstable nucleus releases radiation to become more stable. While radiation can harm plants and animals, it can also be used by scientists for medical imaging and dating archeological finds.

Half Life: the amount of time it takes for half of the atoms in a radioactive sample to decay and transform into another element.

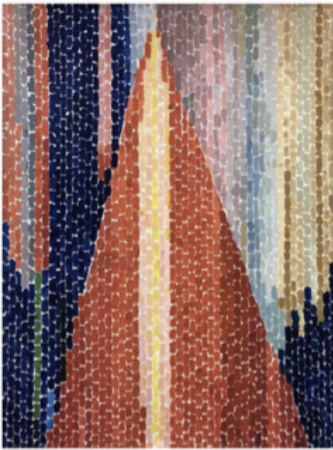
Alma Thomas, Artist Information:



In the 1950's, artist Alma Thomas developed a unique abstract style consisting of small dabs of colors arranged in rhythmic patterns. In the 1960's she used this new style to illustrate scientific concepts and space travel. She was inspired by the 1969 moon landing and the Apollo missions to create a series of "Space Paintings". She had never flown in an airplane but, using streaks of color and patterns of light, Alma Thomas captured the energy and emotion of rocket launches and astronauts moving through space.

Alma Thomas' Photograph by Michael Fischer, 1976

Alma Thomas' paintings



Blast Off, 1970



Splash Down Apollo 13, 1970



Starry Night and the Astronauts, 1972

Photographs and Concept Art related to Alma Thomas' space paintings.



Saturn V Rocket 1967- 73, NASA



Apollo 15 Splashdown, 1971, NASA



Apollo 11 Concept Art 1969, NASA