Dalí Museum, Saint Petersburg, Florida

Integrated Curriculum Tour Form

Education Department, 2014

TITLE:

“Salvador Dalí: Middle School Dalínian Science”

SUBJECT AREA:

(VISUAL ART, LANGUAGE ARTS, SCIENCE, MATHEMATICS, SOCIAL STUDIES)

Visual Art (Next Generation Sunshine State Standards listed at the end of this document)

GRADE LEVEL(S):

Grades: 6-8

DURATION: (NUMBER OF SESSIONS, LENGTH OF SESSION)

One session (30 to 45 minutes)

Resources: (Books, Links, Films and Information)

Books:

- The Dalí Museum Collection: Oil Paintings, Objects and Works on Paper.
- The Dalí Museum: Museum Guide.
- The Dalí Museum: Building + Gardens Guide.

Links:

- Florida Art Education Association:  www.faea.org
Films:

- *Dalí Condensed*: 5 lecture series, Peter Tush, Curator of Education Dali Museum You Tube Site.
- *The Dalí Dimension, Decoding the Mind of a Genius*, Psychoanalysis, Relativity Theory, DNA & Genetics, Mathematics, Nuclear Physics.

Information:

Leonardo da Vinci (1452-1519)

- Italian polymath, scientist, mathematician, engineer, inventor, anatomist, painter, sculptor, architect, botanist, musician and writer. Leonardo has often been described as the archetype of the Renaissance man.
- Painstaking observations and carried out research in fields ranging from architecture and civil engineering to astronomy to anatomy and zoology to geography, geology and paleontology.
- Leonardo had a device for waking.
- Spring Device, geometric perspective.
- c. 1478: Studies of Self-Propelled cart, Codex Atlanticus.
- 1480: Parachute.
- 1480: Archimedes screws and pumps to draw up water.
- 1485: Drawing of a flying machine.
- 1485: Scythed Assault Chariot.
- 1487: Canon Foundry.
- 1490: Study of Horses.
- 1492: *Vitruvian Man*.
- 1500: Scuba.
- 1502: Armored Tank.
- 1503-04: Study of battles on horseback and foot.
- 1503-05: The Battle of Anghiari (detail), copy by Peter Paul Reubens.
- 1504-05: Head Studies.
- 1505: *The Battle of Anghiari*.
- 1505: Studies of wing for glider, Codex on the Flight of Birds.
- 1509-10: Muscles of the Shoulder, Geometric proportions applied to the human figure, Windsor.
- 1510-13: Catapult drawings.
- 1510-13: Old man with studies of the action of water.
- 1510-13: Studies of anatomy, including embryos.
- 1513-14: Anatomy of bird wing.
- 1515: Study of Dancers.
- 1651: *Treatise on Painting* published. In the posthumous *Treatise on Painting* (1550), Leonardo advocates the visual study of stains on walls, ashes in a fire place, or mottled and grainy stones, mud, or clouds – things that are formless and “confused.” He says that in and of themselves they are meaningless. However, through visual subjective fantasy, “a new invention of speculation” emerges by which “if you consider them well, you will find really marvelous ideas.”

Sigmund Freud

- Vienna was the center of Medical Research.
- Freud as Scientist.
- The Dream Subjected to Rational Inquiry.
- Dreams have Meaning: ‘The Royal Road’ to the Unconscious.
- Freud’s Theory of Dream Construction:
  1. The purpose of the dream is to preserve sleep.
  2. The dream expresses a concealed wish.
  3. Manifest versus latent content.
  4. The dream content is instigated by something in the past day or so. (Day Residue)
  5. The Day Residue is also used to express a wish from the past, often childhood.
  6. Latent wish attaches to day residue.
  7. Censor employs the Dream Work to disguise the wish.
  8. In dreaming there is also a ‘topographical regression’ to primary process expression in the dream work.
- The Dream Work:
  1. Displacement.
  2. Condensation.
  5. Secondary Revision upon awakening.
Freud and Surrealism.
- Dali reads *Interpretation of Dreams* in art school and the rest of Freud’s work in the 20’s.
- Paranoiac-Critical method influenced by psychoanalysis.
- Salvador Dalí, Drawings of Freud.
- 1934: Salvador Dalí, *Skull with Its Lyric Appendage Leaning on a Night Table Which Should Have the Exact temperature of a Cardinal Bird’s Nest*.
- Scientific Status of Freud’s Dream Theory Now.
  1. REM Studies: Dement (Stanford)
  2. Human Lesion Studies.
  3. PET and fMRI studies.
- Controversy.
  2. No manifest v. latent distinction.
  3. Dreams express no latent instinctual wish.
  4. Dreams derive from Pons region of brain and only during REM sleep.
  5. Mark Solms (London)
  6. REM and Dreaming comes from activation of different areas.
  8. Hobson pulls back.
- Neuroanatomical Studies: Calvin Wu (Hong Kong)
  1. Dream work: Parietal lobule (supramarginal gyrus.
  2. Topographical regression: infero temporal cortex (BA 37) is pathway for transforming motivated urges (wishes) into perceptual hallucinatory satisfactions.

**Salvador Dalí (1904-1989)**

- Key scientific areas of interest to Dalí:
  1. Scientists and Inventions.
  2. Psychoanalysis.
  4. Physics (Optics, Atomic Theory, Quantum Mechanics, and Holography Fourth Dimension).
- When asked if scientists believe him to be mad, Dalí responded: “Quite the opposite, they all find me pleasant and say some of my statements: ‘Well, he doesn’t talk as much rubbish as it seemed.’ My only advantage is that I don’t know anything about anything, so I can give rein to my most capricious and irrational little whims on the basis of my light reading. And I am blessed with a certain amount of genius, from time to time I say something that doesn’t strike them as all that improbable.”
- “Scientists give me everything, even the immortality of the soul.”
- Dalí had a device for remembering dreams.
- 1920’s: Erwin Schrodinger, Viennese theoretical physicist who achieved fame for his contributions to quantum mechanics in the 1920’s, specifically his discovery of a new form of atomic theory – wave mechanics.
- 1927: Werner Heisenberg, German theoretical physicist who laid the foundation for quantum mechanics. Heisenberg Uncertainty Principle: In quantum physics, an electron is both a particle and a wave simultaneously as it moves around a nucleus. But we are unable to know both the position and the momentum of an electron atom simultaneously. We can only know one or the other, never both (this is called wave-particle duality).
- Dalí’s illustration of a viewing device from *50 Secrets*.
- Andre Breton, the leader of the Surrealists, felt that poets have the same right to explore and experiment with the unconscious as scientists did.
- 1931: Salvador Dalí, *The Persistence of Memory*, Camembert cheese was the inspiration for the melted watches.
- 1933-35: *Archeological Reminiscence of Millet’s Angelus*, For Dalí, the female figure’s posture is “...symbolic of the exhibitionistic eroticism of a virgin in waiting, the position before the act of aggression such as that of a praying mantis prior to her cruel coupling with the male that will end with his death.”
- 1935: Salvador Dalí, *Conquest of the Irrational*, Dalí described himself as a fish swimming between “the cold water of art and the warm water of science.”
- Albert Einstein, German theoretical physicist. One of the most influential scientists of all time, best known for his theories of special relativity and general relativity. Einstein developed a theory of the universe based on a space-time continuum. Gravity was an integral part, and light and other electromagnetic signals propagated through it at a constant speed – the speed of light.
- Consequences of Einstein’s theory of relativity:
  1. Two events, simultaneous for one observer, may not be simultaneous for another observer if the observers are in relative motion.
2. Rays of light bend in the presence of a gravitational field.
3. A moving clock ticks more slowly than an observer's "stationary" clock.
4. Time goes more slowly in higher gravitational fields.

- The Observer Effect: In science, the observer effect refers to changes that the act of observing has on the phenomenon being observed. For example: observing an electron will change its path because the observing light or radiation contains enough energy to disturb it. In quantum mechanics, if the outcome of an event has not been observed, it exists in a state of superposition, which is being in all possible states at once. The most famous example is the thought experiment Schrodinger's cat, in which the cat is neither alive or dead until observed – until that time, the cat is both alive and dead (technically half-alive and half-dead in probability terms).

- 1935-72: Dalí hired Murcian architect Emilio Perez Pinero, a young architect who shared Fuller’s enthusiasm for geodesic domes.
- 1945: August 6, 1945 “Little Boy” bomb dropped on Hiroshima by the Enola Gay B-29. The world changed with the explosion of the first atomic bomb. For Jean-Paul Sartre, this was the moment that founded Existentialism. For Jackson Pollock and his peers, painting became about process rather than representation. In the mid 1940’s, Dali shifts from a Freudian symbolic language system to a Catholic symbolic language system, expanding his audience while remaining true to his symbolic approach to art.
- 1945: Salvador Dalí, Atomic Idyll and Melancholic Uranium.
- 1945: Dalí read a Spanish translation of Reverend Monsignor Ronald Knox’s essay, God and the Atom, which helped him envision reconciliation between God and science.
- 1946: Nuclear testing on Bikini Atoll, July 24, 1946.
- 1948: Philippe Halsman, Dalí Atomicus, Photograph.
- 1949: Salvador Dalí, Study for Madonna of Port Ligat.
- 1949: Salvador Dalí, Leda Atomica.
- 1951: Dalí states that he is a Nuclear Mystical artist. In his Manifeste Mystique, he writes: “…for the first time in the history of science, physics was providing proof of the existence of God.”
- 1951: Salvador Dalí, Raphaëlesque Head Exploding, The Wheelbarrows (Cupola Consisting of Twisted Carts), employing the dome in the Pantheon, Rome, and site of Raphael’s grave.
- 1952: Salvador Dalí, Assumpta Corpuscularia Lapislazulina, “If Nietzsche’s Superman has not come into being, a Nietzsche’s Superwoman exists in the Assumption. She rises to heaven pushed by anti-matter angels.”
- 1953: James Watson and Francis Crick, American and British molecular biologists who co-discovered the double helix structure of DNA.
- 1954: Salvador Dalí, Soft Watch at the moment of First Explosion, Sketch for Soft Watch Exploding into 888 Pieces After Twenty Years of Complete Motionlessness.
- 1954: Salvador Dalí, Crucifixion (Corpus Hypercubus), “I want my Christ to be the painting containing the most beauty and joy of anything that anyone has painted up to the present day. I want to paint the Christ who will be the absolute antithesis of the materialistic and anti-mystical Christ of Grunewald.” (Mathis Grunewald, 1470-1528, Isenheim Alterpiece, 1515)
- 1955: Salvador Dalí, Nature Morte Vivante (Still Life–Fast moving), similar to Floris van Schooten (1590-1655), Table with Food, 1617. Dalí describes this painting as “[an] explanatory painting where one can observe the dynamic and irrational division of a fruit dish following the coefficients of uncertainty of Heisenberg in opposition to the positive security which cubist pictures once tried to offer us.” Logarithmic spirals are found in the rhino horn on the left and in the cauliflower on the right, double helix spiral structure of the DNA molecule found in the balcony’s baluster and in the disintegrating fruit dish. The stars on the table are a reference to those in the cloisters of the Santiago de Compostela, the Spanish hospital built at the end of the Pilgrim’s Way (“Milkyway”) by Isabelle and Ferdinand. The star shape is found in the cloister’s heart-shaped groin. “... [the color shards at the lower left represent the] final bits of meaningless particles left over from [my] singe-handed assault on Abstract-Expressionism.”
- 1958: Salvador Dalí, Anti-Matter Manifesto, Dalí proclaims that “Today the exterior world – that of physics – has transcended the one of psychology. [Instead of Freud,] my father today is Dr. Heisenberg.”
- 1958: Dalí employs Ben Day dot pattern.

Fibonacci sequence: 0 1 1 2 3 5 8 13 21 34 55... Fibonacci numbers can be seen in the spirals of the pine cones, in the spirals of the artichokes, and – above all – in the spirals of the sunflowers.
- 1963: Salvador Dalí, Fifty Abstract Pictures Which as Seen from Two Yards Change into Three Lenins Masquerading as Chinese and as seen from Six Yards Appear as the Head of a Royal Bengal Tiger.
- 1963: Salvador Dalí, Galacidalacidesoxiribunucleicacid (Homage to Crick and Watson), soldiers as double helix DNA molecule [life], inorganic mineral molecule made of soldiers pointing guns [non-life]. The September 1962 flood of the Rio Llobregat killed 450 poor immigrants, with another 300 missing. God reaching down, in his foreshortened head, the image of Mary and Christ’s silhouette in blessing, Christ after death being pulled up to Heaven for rebirth, Gala/Madonna’s hair like Catalan bread.
- Pierre Teilhard de Chardin, French Jesuit priest who trained as a paleontologist and geologist who took part in the discovery of Peking Man. He was interested in integrating religion and natural science, particularly Christian theology.
with theories of evolution. He came into conflict with the Catholic Church and several of his books were censured.

- **1965**: Salvador Dali, *The Railway Station at Perpignan*.
- **1973**: Salvador Dalí, "The atomic explosion of August 6, 1945, shook me seismically. Thenceforth, the atom was my favorite food for thought." An atom consists of a centrally located nucleus, made up of neutrons and protons surrounded by orbiting electrons. Most importantly, atoms are tiny particles suspended in a vast vacuum, more space than particle.
- **1973**: Salvador Dalí, *First Cylindric Chromo-Hologram Portrait of Alice Cooper's Brain*, Dalí produced the first three dimensional hologram with Alice Cooper wearing a 2 million dollar tiara. Dennis Gabor, Hungarian electrical engineer who invented holography.
- **Buckminster Fuller**, American architect, author, designer, inventor, and futurist. He developed numerous architectural inventions, the best known of which is the geodesic dome.
- Teatro Museo, Dalí's geodesic dome and the Torre Galatea, designed by Emilio Perez Pinero.
- The geodesic shape of the Enigma surrounding the east side of our new Dalí Museum refers back to the Teatro’s dome and ultimately back to Fuller.
- **1973**: Leon Harmon, "The Recognition of Faces", *Scientific American*, November issue, Cyberneticist who worked at Bell Labs, where he worked on human perception, computer vision and graphics in relation to pattern recognition.
- **1975**: Dalí met with Thomas F. Banchoff, American geometer and professor at Brown University who assisted Dali in his understanding of the fourth dimension. Dali was photographed holding a "hypercube."
- **1976**: Salvador Dalí, Gala Contemplating the Mediterranean Sea Which at Twenty meters Becomes the Portrait of Abraham Lincoln (Homage to Rothko) (Second Version). The Scientific American photo by Leon Harmon collaged in the lower left of Dalí’s work.
- **1985**: One of Dalí’s last public acts was to host the Symposium, “Culture and Science: Determinism and Freedom” at his Dali Theater-Museum.
- **1989**: When Dalí passed away, there were four books on his bedside table. They were works by Stephen Hawking, Matils Ghyka, Rene Thom and Erwin Schrodinger.

### Youth and Origin of Scientific Interests

- **1901**: Salvador Galo Anselmo Dalí, Born on October 12, 1901, he died on August 1, 1903.
- **1919**: Dalí contributed an essay on Leonardo da Vinci to the student magazine Studium. "Above all Leonardo was a passionate soul, in love with life; he studied and applied everything with the same ardor and the same pleasure; in life everything appeared to him positive and attractive." Da Vinci’s paintings are exemplary in the "reflective, constant, loving work" that went into them.
- **1948**: 50 Secrets of Magic Craftsmanship, including Dalí’s comparative table of artists listing in order: Vermeer, Raphael, Leonardo, Velazquez, Dalí, Picasso, Ingres, Meissonier, Manet, Bouguereau and Mondrian.
- Both Dalí and Da Vinci had fathers who were notaries.

### Freud’s Leonardo

- Sigmund Freud: Austrian neurologist who founded the psychoanalytic school of psychology.
- **1910**: Freud published the analysis of Da Vinci’s Virgin and St. Anne under the title *Leonardo da Vinci, A Memory of His Childhood*. Later Freud said that it was “the only beautiful thing I have ever written.”
- **1932-34**: Dalí wrote *The Tragic Myth of Millet’s Angelus*.
- **1963**: Dalí painted *Portrait of My Dead Brother*. Dalí states, "The Vulture, according to the Egyptians and Freud, represents my mother’s portrait. The cherries represent the molecules, the dark cherries create the visage of my dead brother, the sun-lighted cherries create the image of Salvador living thus repeating the great myth of the Dioscures Castor and Pollux."

### Invention

- **1509-11**: Leonardo da Vinci, Study of water falling into still water.
- **1480**: Leonardo da Vinci, Skis with which one can walk on water.
- **1508**: Leonardo da Vinci, Breathing apparatus for diver.
- **1513-14**: Leonardo da Vinci, Studies on flight of birds in relation to the wind.
- **1487-90**: Leonardo da Vinci, Detail of studies of wing articulation.
- **1493**: Leonardo da Vinci, Study for helicopter and lifting wing.
- **1480-82**: Leonardo da Vinci, Giant crossbow.
- **1502**: Leonardo da Vinci, Scythe chariot and armored tank.
- Dalí's school master, Senor Trayter, introduced him to scientific mysteries and inventions in his apartment of curiosities. Dalí loved Trayter’s "optical theater," probably a stereoscope or an early slide projector, where he saw images that “were to stir me most deeply, for the rest of my life.”
- **1862**: Narcis Montuoriol i Estarriol, Catalan engineer, artist and intellectual who invented the first combustion engine driven submarine, El Ictineo.
- **1936**: Dalí in London at the International Surrealist Exhibition dressed in a deep sea diving suit.
Scientific American was Dalí’s favorite magazine.

1959: Dalí demonstrates his new invention, the Ovocipede.

Dalí explains his interest in science, “Because artists scarcely interest me at all. I believe that artists should have some notions of science in order to tread a different terrain, which is that of unity.”

Optics & Perspective
- 1480: Leonardo da Vinci, Sketch with bellows machine for drawing up water and a man using a perspectograph. A point X on the subject image is projected to a point x on the image plane via a straight ray from X to the viewer’s eye.
- Salvador Dalí, Illustration of viewing device with sea urchin from 50 Secrets.
- 1926: Salvador Dalí, Woman at Window in Figueres.

Mathematics & the Golden Section
- 1495: Jacopo de Barbari, Portrait of Fra Luca Pacioli with Young Man.
- 1496: Luca met Leonardo.
- 1509: Luca Pacioli, Divine Proportion, Polyhedra, including a Rhombicuboctahedron, illustrated by Leonardo da Vinci.
- Dalí’s parody transformation of Leonardo’s polygons in 50 Secrets of Magic Craftsmanship.
- 1946: Prince Matila Costiesco Ghyka met Dalí while a visiting professor of aesthetics at the University of San Diego. Ghyka was a poet, novelist, mathematician, historian, diplomat, and the Romanian Plenipotentiary Minister in the United Kingdom during the late 1930’s until 1940.
- The Geometry of Art and Life, Matila Ghyka, “Inspiration, even passion is indeed necessary for creative art, but the knowledge of the Science of Space, of the Theory of Proportions, far from narrowing the creative power of the artist, opens for him an infinite variety of choices within the realm of symphonic composition. There is a geometry of art as there is a geometry of life, and, as the Greeks had guessed, they happen to be the same.”
- 1956: Nature Morte Vivante (Still Life-Fast Moving), Salvador Dalí, Transcription of Ghyka’s golden section diagram used to align images.
- 1960: The Ecumenical Council, Employs an inverted grid of dynamic triangles as illustrated in Geometry of the Greek Vase by Dr. Caskey. (Greek Vase, Stamnos, Harmonic Analysis)
- Golden Spiral: A Fibonacci spiral created by drawing arcs connecting the opposite corners of squares in the Fibonacci tiling. (1,1,2,3,5,8,13,21,34, etc.)
- Columbus, Salvador Dalí, Spiral composition, harmony.

Architecture
- 1488: Leonardo da Vinci, Sketch of a square church with central dome and minaret, as well as study of a central church.
- 1943: Salvador Dalí, The Esthetic is the Greatest of Earthly Enigmas including sketches similar to Da Vinci’s churches.
- 1949: Salvador Dalí, Project for Icosahedral Studio, Port Lligat. Regular Icosahedron has 20 identical equilateral triangular faces.
- Teatro Museo: Dalí’s geodesic dome and the Torre Galatea. Dalí wanted a dome on his museum designed by Buckminster Fuller.

Anatomy & Proportion in Nature
- 1492: Vitruvian Man, For Da Vinci, man was the perfect proportion of all things. He also applied geometric proportions to the human face.
- 1509-10: Leonardo da Vinci drew the muscles of the shoulder.
- 1504-07: Leonardo da Vinci drew a grotesque head recording the features accurately.
- 1936: Salvador Dalí painted The Great Paranoiac with figures showing muscular structure.

Paranoiac Criticism
- c. 1550: Treatise on Painting, a compilation of Leonardo’s instructional writings on drawing and painting, compiled by Francesco Melzi, one of his pupils.
- 1503: Leonardo da Vinci, Battle Study, Leonardo advocated the study of stains on walls, ashes, grainy stones, mud or clouds – things that are formless, in order to see a subjective fantasy. “…if you consider them well, you will find really marvelous ideas.”
- 1938: Dalí wrote, in an exhibit catalog, that Leonardo’s Treatise and Freud’s Leonardo study had contributed to the “epistemological and philosophical corner stone of the majestic edifice of imminent paranoiac painting.”
- 1938: Salvador Dalí, Enchanted Beach with Three Fluid Graces including a horse similar to Da Vinci’s monument horse in the background.

Leda & the Swan
- 1506: Leonardo da Vinci, Studies of a woman’s head and coiffure, for Leda and the Swan.
- 1948: Salvador Dalí, Leda Atomica, Created with assistance from Matila Ghyka including sketches showing Ghyka’s grids.
**Last Supper**
- 1495-98: Leonardo da Vinci, *The Last Supper* is on the rectory wall of the former Dominican monastery of the Santa Maria delle Grazie, Milan. The mural employs grid lines based on the golden sections and with the perspective vanishing point located at Christ's right eye.
- 1955: Salvador Dalí, *Last Supper*, "The Communion must be symmetrical" under the dodecahedron. Regular Dodecahedron is a platonic solid composed of 12 regular pentagonal faces, with three meeting at each vertex.

**Mona Lisa**
- 1919: Marcel Duchamp, *L.H.O.O.Q. (Elle a chuad au cul).*

**Suggested Illustrations:**

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<td>Figueres, Spain, Ampuridan Plain, Province of Gerona</td>
<td>Map of Italy</td>
<td>Palazzo Vecchio, Florence</td>
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**Leonardo da Vinci**  **1452 - 1519**  **Italy**

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<tr>
<th>1452-1519</th>
<th>1452-1519</th>
<th>c. 1474-78 Ginevra de’ Benci</th>
<th>c. 1478 Studies of Self-Propelled Cart, Codex Atlanticus</th>
<th>1480 Sketch with bellows Machine for Drawing up Water and A Man Using a Perspectograph</th>
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<tr>
<td>1480 Parachute</td>
<td>1480 Skis With Which One Can Walk On Water</td>
<td>1480 Detail of Man Using a Perspectograph</td>
<td>Illustration of Leonardo’s Perspectograph</td>
<td>1480 Archimedes Screws and Pumps to Draw up Water</td>
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<td>1480-82 Machine Gun</td>
<td>1480-82 Giant Crossbow</td>
<td>1481 Perspective Study for Adoration of the Magi</td>
<td>1481 Adoration of the Magi</td>
<td>c. 1482-83 Lady with the Ermine</td>
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<td>1483-85</td>
<td>Madonna of the Rocks</td>
<td>1485</td>
<td>Drawing of a Flying Machine</td>
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<td>1488</td>
<td>Sketch of a Square Church with central dome and Minaret</td>
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<td>Study of a Central Church</td>
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<td>1490</td>
<td>Grotesque Heads</td>
<td>c. 1492</td>
<td>Vitruvian Man</td>
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<td>1495</td>
<td>Duke Ludovico Sforza (Detail from the Sforzesca Alterpiece, Master of the Pala Sforzesca, Brera, Milan)</td>
<td>1495-98</td>
<td>Copy of The Last Supper</td>
<td>The Last Supper with Golden Sections Highlighted</td>
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<td>The Last Supper, Detail of Christ Before Cleaning</td>
<td>The Last Supper as Theatrical Stage Setting</td>
<td>1500</td>
<td>Scuba</td>
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<td>1503-04</td>
<td>Study of Battles on Horseback and on Foot</td>
<td>1503-07</td>
<td>Mona Lisa (La Giocanda, “The Merry One”)</td>
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<td>1506</td>
<td>Studies of a Woman's Head and Coiffure, for Leda and the Swan</td>
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<td>Leda and the Swan (copy by C. da Sesto) and 1510-15 Leda and the Swan (copy)</td>
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<td>Divine Proportion, L. Pacioli, Illustrated by Leonardo</td>
<td>1509-10</td>
<td>Muscles of the Shoulder, Windsor</td>
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<td>1510-13</td>
<td>Catapult from Notebook</td>
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<td>Studies of Embryos</td>
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<td>1511-15</td>
<td>Raphael, Alba Madonna</td>
<td>c. 1511-15 Deluge</td>
<td>1512 Self Portrait</td>
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<td>Raphael, Sistine Madonna</td>
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<td>Studies of an Old Man and The Action of Water from Journals</td>
<td>1513-14 Anatomy of Bird Wing and Codex on the Flight of Birds</td>
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<td>c. 1550 Treatise on Painting (Compiled by F. Melzi, One of Leonardo’s Pupils)</td>
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<td>1570 The Four Books of Architecture, A. Palladio (1508-80)</td>
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<td>Spring Device</td>
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<td>Studies of Overbalanced Wheels (Perpetual Motion devices) from Notebooks</td>
<td>Drawing of a Woman’s Torso</td>
<td></td>
</tr>
<tr>
<td>1602</td>
<td>J.S. Cotan, Still Life with Quince, Cabbage, Melon and Cucumber</td>
<td>1617 Flooris van Schooten (1590-1655), Table with Food</td>
<td>1651 Treatise on Painting</td>
<td>1666 J. Vermeer, Allegory of Painting (The Painter in His Studio)</td>
</tr>
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<td>Salvador Dalí</td>
<td>1904-1989 Figueres, Spain</td>
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<td>Artworks numbered in red (1-53) include descriptions below.</td>
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<td>Oct. 12, 1901 – Aug. 1, 1903 Salvador Galo Anselmo Dalí</td>
<td>S. Dalí</td>
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<td>Dalí’s Inquisitive Mind</td>
<td>Dalí and Science</td>
<td>Dalí and Nature</td>
<td>Dalí on the BBC</td>
<td>A. Breton</td>
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<td>A. Einstein</td>
<td>Spacetime Continuum</td>
<td>Warping of Time</td>
<td>Theory of Relativity</td>
<td>A. Eddington</td>
</tr>
<tr>
<td>Dalí and Halsman</td>
<td>Dalí and Halsman</td>
<td>Narcis Monturiol i Estarriol, Catalan Engineer, Artist and Intellectual (Invented El Ictineo)</td>
<td>1862 El Ictineo, First Combustion Engine Driven Submarine</td>
<td>Virgin and St. Anne</td>
</tr>
<tr>
<td>Sigmund Freud, Austrian Neurologist who Founded the Psychoanalytic School of Psychology</td>
<td>1910 Freud Published the analysis of Da Vinci’s Virgin and St. Anne under the title Leonardo da Vinci, A Memory of His Childhood</td>
<td>1915 P. Picasso</td>
<td>1919 Facsimile of “Studium,” Student Magazine in which Dalí contributed</td>
<td>1919 Dalí’s Essay on Leonardo</td>
</tr>
<tr>
<td>1919 M. Duchamp, L.H.O.O.Q. (&quot;Elle a chaud au cul&quot;)</td>
<td>Dalí’s school master, Senor Trayter, Apartment of Curiosities</td>
<td>Stereoscope</td>
<td>Early Slide Projector</td>
<td>1925 <em>Study for Girl Sewing</em>, Single Point Perspective</td>
</tr>
<tr>
<td>6. 1926 Anna Maria</td>
<td>7. 1926 Woman at a Window in Figueres</td>
<td>1927</td>
<td>1927 Uncertainty Principle</td>
<td>W. Heisenberg</td>
</tr>
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<td>Year</td>
<td>Event</td>
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<td>12.  1932/1974</td>
<td>The Tragic Myth of Millet’s Angelus</td>
<td></td>
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<td>13.  1933-35</td>
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<td>14.  1935 Paranoiac Critical Visage</td>
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<tr>
<td>Postcard of African Village</td>
<td>15.  1935-36 Paranoia</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>16.  1936 The Great Paranoiac</td>
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<tr>
<td></td>
<td>17.  1938 The Image Disappears</td>
<td></td>
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<td></td>
<td>18.  1938 Enchanted Beach with Three Fluid Graces</td>
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<td>19.  1939 Dream of Venus Pavilion at the New York World’s Fair</td>
<td></td>
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<tr>
<td></td>
<td>20.  1942 P. Halsman, Dalí in an Egg</td>
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<tr>
<td></td>
<td>21.  1943 The Esthetic is the Greatest of Earthly Enigmas</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>22.  1945 My Wife, Nude, Contemplating Her Own flesh</td>
<td></td>
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<td>23.  1945 Idylle Atomique</td>
<td></td>
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<td></td>
<td>24.  1947</td>
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<td>2020</td>
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</tbody>
</table>

**Notes:**
- **1935 Paranoiac Critical Visage**
- **Postcard of African Village**
- **Dalí and Da Vinci’s Horses**
- **Dalí’s Signature**
- **1936 International Surrealist Exhibition, London**
- **Dressed in a Deep Sea Diving Suit Emilio Perez Pinero (1935-72)**
- **Aug. 6, 1945 Hiroshima “Little Boy” bomb**
- **July 24, 1946 Bikini Atoll**
- **Atoms and Molecules Fat Man World War II Japan & The Atomic Bomb**

**Sources:**
- *The Geometry of Art and Life*, Matila Ghyka
- *Pages from The Geometry of Art and Life*
<table>
<thead>
<tr>
<th>No.</th>
<th>Year</th>
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</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>1948</td>
<td><em>Leda Atomica</em>, Created with Assistance from Matila Ghyka</td>
</tr>
<tr>
<td>26</td>
<td>1948</td>
<td>Study for <em>Leda Atomica</em></td>
</tr>
<tr>
<td>27</td>
<td>1948</td>
<td>Study for <em>Leda Atomica</em></td>
</tr>
<tr>
<td>28</td>
<td>1949</td>
<td>Project for Icosahedral Studio, Port, Lligat</td>
</tr>
<tr>
<td>29</td>
<td>1949</td>
<td>Catholic Symbolic Language</td>
</tr>
<tr>
<td>30</td>
<td>1951</td>
<td>Pantheon, Rome</td>
</tr>
<tr>
<td>31</td>
<td>1951</td>
<td>Assumpta Corpuscularia Lapislazulina</td>
</tr>
<tr>
<td>32</td>
<td>1952</td>
<td>Double Helix DNA Molecule</td>
</tr>
<tr>
<td>33</td>
<td>1952-54</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>1954</td>
<td>Project for Icosahedral Studio, Port, Lligat</td>
</tr>
<tr>
<td>35</td>
<td>1954</td>
<td>Self-Portrait as Mona Lisa</td>
</tr>
<tr>
<td>36</td>
<td>1954</td>
<td>Nature Morte Vivante (Still Life-Fast Moving)</td>
</tr>
<tr>
<td>37</td>
<td>1955</td>
<td>Last Supper, The Communion Must be Symmetrical under the Dodecahedron (A Platonic Solid Composed of 12 Regular pentagonal Faces, with Three Meeting at Each Vertex)</td>
</tr>
<tr>
<td>38</td>
<td>1956</td>
<td>Nature Morte Vivante (Still Life-Fast Moving)</td>
</tr>
<tr>
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<td>1956</td>
<td>Transcription of Ghyka's Golden Section Diagram Overlaid on Nature Morte Vivante</td>
</tr>
</tbody>
</table>

### Notes:
- Regular Icosahedron (20 Identical Equilateral Triangular Faces)
- Dalí’s Comparative Table of Artists (50 Secrets)
- Illustration of Viewing Device from *50 Secrets*
- Dalí’s Parody Transformation of Leonardo’s Polygons in *50 Secrets*
- Dalí’s Parody Transformation of Leonardo’s Polygons in *50 Secrets*
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<table>
<thead>
<tr>
<th>Opposite Corners of Squares in the Fibonacci Tiling.</th>
<th>39. Spiral Composition</th>
<th>40. 1958 Pope John XXIII</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dalí Painting Fibonacci Sequence</td>
<td>Cauliflower Floret</td>
<td>Harmony</td>
</tr>
<tr>
<td>1959 Dalí Demonstrates his Invention, <em>The Ovocipede</em></td>
<td>41. 1960 <em>The Ecumenical Council</em></td>
<td>Dynamic Triangles in Portions of a Greek Vase</td>
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<tr>
<td></td>
<td></td>
<td>Inversion of the Dynamic Triangles Grid</td>
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<td>1960 Dynamic Triangles over The Ecumenical Council</td>
</tr>
<tr>
<td>The Expanding Universe</td>
<td>Nuclear Mystical</td>
<td>Nuclear Mysticism</td>
</tr>
<tr>
<td>1963 R. Lichtenstein</td>
<td>44. 1963</td>
<td>45. 1965</td>
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<td></td>
<td>46. 1968 Leonardo da Vinci</td>
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<td></td>
<td>D. Gabor (Holography)</td>
</tr>
<tr>
<td>47. 1973 A. Cooper Hologram</td>
<td>1973 Dalí and Cooper</td>
<td>1973 Dalí and Cooper</td>
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<tr>
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<td></td>
<td><em>Scientific American, Dalí’s Favorite Magazine</em></td>
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<td></td>
<td>1973 <em>Scientific American</em></td>
</tr>
<tr>
<td>L. Harmon (Bell Labs)</td>
<td>1973 Recognition of Faces</td>
<td>1976 <em>Scientific American</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td>48. Gala Contemplating the Mediterranean Sea…</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1974 <em>Alchemy of the Philosopher</em></td>
</tr>
<tr>
<td>49. 1974-76</td>
<td>1975 T.F. Banchoff</td>
<td>The Observer Effect</td>
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<tr>
<td></td>
<td></td>
<td>Schrodinger’s Cat</td>
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<td></td>
<td></td>
<td>50. 1975 <em>The Chair</em></td>
</tr>
<tr>
<td>51. 1976 <em>The Chair</em></td>
<td>R. Thom</td>
<td>Catastrophe Theory</td>
</tr>
<tr>
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<td></td>
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<td>53. 1983</td>
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Suggested Tour Artworks: (Title, Date, Medium, Scale and Description)

Suggested Number of Artworks per Tour: (Eight to Twelve)

Artwork 1:

**Dalí Museum**
- Dalí Museum, St. Petersburg, FL (Y. Weymouth)
- New Building opened 1.11.11 at 11:11 am.

Artwork 2:

**Port Lligat, Spain**
- Dalí Residence and Studio.

Artwork 3:

**Cadaqués, Spain**
- Dali Family Summer Residence and Dali’s first studio.

Artwork 4:

**Figuera, Spain**
- Theatro-Museo (E.P. Pinero)

Artwork 5:

**Salvador Felipe Jacinto Dalí**

Artwork 6:

Anna Maria, 1926.

- Portrait of Dalí’s sister sewing.

Artwork 7:

The Girl of Figueres, 1926.

- Strong lines and structure of form.
- Solidarity of presence.
- This painting of his sister Ana Maria can be seen as an early attempt by Dalí to re-work The Lacemaker.
- The painting by the seventeenth-century Dutch painter Jan Vermeer, became an obsession with Dalí during the fifties.
- She is turned away from the viewer so you cannot see her face.
- The balcony overlooks the town of Figueres, Dalí’s home town.
- The blue color of the distant mountains and of the sky contrasts with the sunlit stone of the buildings to capture the viewer’s eye.
- This blue is repeated in the shimmering blue-black hair of Ana Maria.

Artwork 8:

The First Days of Spring, 1929, oil and collage on panel, 19 ¾ x 25 5/8 in.

- This painting is considered Dalí’s first surrealist painting.
- With this painting, Dali makes a strong impression on Andre’ Breton.
- This piece is constructed in a semi-autobiographical narrative that indulged his fantasies.
- Dalí’s portrait appears twice in the painting; once using collaged elements.
- Dalí uses techniques illustrated by De Chirico, Magritte and Ernst to insist that the subject matter is real.
- Everything about this painting is calculated to shock the viewer.

Artwork 9:


- Fledging director Luis Buñuel and painter Salvador Dalí create this ultimate surrealist film, which is essentially a barrage of striking and irrational images designed to shock and provoke.
- During the course of the film, we witness a close-up of a woman’s eye being slashed open with a razor; a man dragging a piano, two bishops, and a pair of rotting asses across a room; ants swarming around a hole in a man’s palm; and sundry severed limbs and gratuitous slayings.
- Though this was originally a silent film, Buñuel later added a recorded score consisting of Liebestod from Wagner’s opera Tristan und Isolde and a number of popular tangos of the time.

Artwork 10:
The Great Masturbator, 1929, oil on canvas.

- *The Great Masturbator* is a self-portrait painted in July 1929.
- Dalí’s head has the shape of a rock formation near his home and is seen in this form in several paintings dating from 1929.
- The painting deals with Dalí’s fear and loathing of sex.
- He blamed his negative feelings toward sex as partly a result of reading his father’s extremely graphic book on venereal diseases as a young boy.
- The head is painted “soft”, as if malleable to the touch: it looks fatigued, sexually spent: the eyes closed, the cheeks flushed.
- Under the nose a grasshopper clings, its abdomen covered with ants that crawl onto the face where a mouth should be.
- From early childhood, Dalí had a phobia of grasshoppers and the appearance of one here suggests his feelings of hysterical fear and a loss of voice or control.
- Emerging from the right of the head, a woman moves her mouth toward a man’s crotch.
- The man’s legs are cut and bleeding, implying a fear of castration.
- The woman’s face is cracked, as though the image that Dalí’s head produces will soon disintegrate.
- To reiterate the sexual theme, the stamen of a lily and tongue of a lion appear underneath the couple.
- This work takes as its central image the profile of a strangely distorted figure.
- This painting was included in Dalí’s first solo exhibition.
- It derives from the shape of a rock formation located at Cap Creus and appears in many of Dalí’s works as a self-portrait.
- The figure is soft and represented as sleeping, its softness suggesting the condensation of the dream-work as explained in Freud’s writings.
- Freud’s *On Dreams* (1911) explained this mechanism: “the dream-work has carried out work of compression or condensation on a large scale. It is impossible at first to form any judgement of the degree of this condensation: but the deeper we plunge into a dream-analysis the more impressive it seems. From every element in a dream’s content associative threads branch out in two or more impressions or experiences.”

Artwork 11:

The Persistence of Memory, 1931, oil on canvas, 9.5 x 13 in.

- Many of Dalí’s paintings were influenced and inspired by the landscapes of his youth. Several in particular were painted on the slopes of Mount Pani, which was covered in beautiful umbrella pines at the time.
- Many of the strange and foreboding shadows in the foreground of many Dali paintings is a direct reference to and result of Dalí’s love of this mountain near his home.
- Even long after he had grown up, Dalí continued to paint details of the landscape of Catalonia into his works, as evidenced by such works as the Persistence of Memory, completed in 1931.
- Note the craggy rocks of Cape Creus in the background to the right. One of Dalí’s most memorable Surrealist works, indeed the one with which he is most often associated is *The Persistence of Memory*.
- It shows a typical Dalinian landscape, with the rocks of his beloved Cape Creus jutting up in the background. In the foreground, a sort of amorphous self portrait of Dalí seems to melt.
- Three Separate Melting Watch images even out the foreground of the work. The melting watches are one symbol that is commonly associated with Salvador Dali’s Surrealism.
- They are literally meant to show the unreliability of time.
- When Dalí was alone with Gala and his paintings in Cape Creus, he felt that time had little, perhaps no significance for him.
- His days were spent eating, painting, making love, and anything else he wanted to do.
- The warm, summery days seemed to fly by without any real indication of having passed.
- One hot August afternoon, in 1931, as Dalí sat at his work bench nibbling at his lunch, he came upon one of his most stunning paranoiac-critical hallucinations.
- Upon taking a pencil, and sliding it under a bit of Camembert cheese, which had become softer and runnier than usual in the summer heat, Dalí was inspired with the idea for the melting watches.
- They appear often throughout Dalí’s works, and are the subject of much interest.
- In short, this particular work, is an important referral back to Dalí’s Catalan Heritage, that was so very important to him.
- The well-known surrealistic piece introduced the image of the soft melting pocket watch.
- It epitomizes Dalí’s theory of “softness” and “hardness”, which was central to his thinking at the time.
- As Dawn Ades wrote, “The soft watches are an unconscious symbol of the relativity of space and time, a Surrealist meditation on the collapse of our notions of a fixed cosmic order”.
- This interpretation suggests that Dalí was incorporating an understanding of the world introduced by Albert Einstein’s *Special Theory of Relativity*. 
1. Asked by [Ilya Prigogine](https://en.wikipedia.org/wiki/Ilya_Prigogine) whether this was in fact the case, Dalí replied that the soft watches were not inspired by the theory of relativity, but by the surrealist perception of a [Camembert cheese](https://en.wikipedia.org/wiki/Camembert_cheese) melting in the sun.
2. Although fundamentally part of Dalí’s [Freudian phase](https://en.wikipedia.org/wiki/Salvador_Dalí#Freudian_phase), the imagery precedes his transition to his scientific phase by fourteen years, which occurred after the [atomic bombings of Hiroshima and Nagasaki](https://en.wikipedia.org/wiki/Nuclear_bombing_of_Hiroshima) in 1945.
3. It is possible to recognize a human figure in the middle of the composition, in the strange “monster” that Dalí used in several contemporary pieces to represent himself – the abstract form becoming something of a self-portrait, reappearing frequently in his work.
4. The orange clock at the bottom left of the painting is covered in ants. Dalí often used ants in his paintings as a symbol of decay.
5. The figure in the middle of the picture can be read as a “fading” creature, one that often appears in dreams where the dreamer cannot pinpoint the creature’s exact form and composition.
6. The iconography may refer to a dream that Dalí himself had experienced, and the clocks may symbolize the passing of time as one experiences it in sleep or the persistence of time in the eyes of the dreamer.
7. The Persistence of Memory employs “the exactitude of realist painting techniques” to depict imagery more likely to be found in dreams than in waking consciousness.
8. The craggy rocks to the right represent a tip of [Cap de Creus](https://en.wikipedia.org/wiki/Cap_de_Creus) peninsula in north-eastern Catalonia.
9. Many of Dalí’s paintings were inspired by the landscapes of his life in Catalonia. The strange and foreboding shadow in the foreground of this painting is a reference to Mount Pani.
10. Dali returned to the theme of this painting with the variation [The Disintegration of the Persistence of Memory](https://en.wikipedia.org/wiki/The_Disintegration_of_the_Persistence_of_Memory) (1954), showing his earlier famous work systematically fragmenting into smaller component elements, and a series of rectangular blocks which reveal further imagery through the gaps between them, implying something beneath the surface of the original work; this work is now in the [Dalí Museum in St. Petersburg, Florida](https://www.dalimuseum.org/), while the original [Persistence of Memory](https://en.wikipedia.org/wiki/Persistence_of_Memory) remains at the [Museum of Modern Art in New York City](https://www.moma.org/).

### Artwork 12:

**Object of Symbolic Function (also known as Scatalogical Object Functioning Symbolically – Gala’s Shoe),** 1931 lost; reconstructed 1973, assemblage of objects, 19 x 11 x 15 in.

- Breton provided a genealogy of the Surrealist Object, arguing that Surrealist Objects transformed our understanding of the sensible world.
- The object revealed a new inner logic lying beyond the surface of appearance.
- Anti-metaphysical and materialistic.
- The hidden real was there to be discovered in the object, only to unmask internal laws of natural structures.
- The aim of the Surrealist Object was to dislocate one’s false sense of rational certainty and thrust the viewer into the disorienting realm of enigmatic doubt.
- The subversive goal of discrediting reality, reaching its paramount example in Dali’s deliberately bizarre objects, captured an essential element of the revolutionary surrealist project.

### Artwork 13:

**Archeological Reminiscence of Millet’s “Angelus,”** 1933-35, oil on panel, 12 ⅜ x 15 ½ in.

- Millet’s Angelus painting had a profound impact on Salvador Dalí.
- He had first seen the work as a child in school, but in 1932, he has a series of experiences that led him to have several paranoiac-critical transformations on the subject.
- The original painting shows several peasants, working in a field, who have stopped for an afternoon prayer.
- Their heads are bowed reverently, and there is a wheelbarrow between them, with field scenery stretching out behind them.
- This painting is a continuation on that theme, but has several instances of Dalinian continuity included as well.
- The original two Angelus figures have been transformed into towering architectural ruins, which probably were inspired by Dalí’s visits to the Roman ruins near his childhood home.
- The third figure of the dead son is absent in this rendition of Dalí’s obsession with the original Millet painting.
- Instead, the female has been made to look even more like a praying mantis, thus reinforcing Dalí’s association of sex with death.
- Dalí spent time on the plain of Ampuridan, and has added elements from that landscape into this one.
- In the foreground, however, is another example of Dalinian continuity.
• Here we see yet again the tiny father/son figure that began to show up in Dali’s works starting in 1929 with *The First days of Spring*.
• Inspired by obsession with Jean-Francois Millet’s *Angelus*.
• *Angelus* obsession: male terrified of female, who will cannibalize him after mating.
• For Dali, the theme of Millet’s work: sexual anxiety.
• *Angelus* was a childhood image of escape from Dali’s classroom.
• Female resembles a praying mantis who devours the male after mating.
• Female a femme fatale, like succubus or a vampire.
• Male as terrified victim.
• Male tries to distract female by hiding arousal.
• Millet couple in ruins: this terrifying relationship has existed for generations.
• Psychological landscape.
• Ruins of Empúries.
• Father is showing son “this is who we are.”
• Lucia with young Dali.
• Cypress trees do not regenerate = death.
• Moonlight or twilight setting.
• Two enormous figures suggesting geological formations and the ruins of ancient towers dominate the vast open plain of the Empordà.
• The petrified pose of the figures that resemble the "Angelus" couple alludes to a theme of predatory aggression and death, death being both literal and symbolic.
• Groups of figures contemplate the couple, which is the reminiscence to which the title refers.
• The dual petrifaction and erosion of the male figure suggests both a literal death (of the peasant couple’s child—a likely surrogate for Dali himself—and of the father figure at the hands of his mate) and a symbolic death referring to the Oedipal interdiction and the child’s separation from the maternal body.

**Artwork 14:**

**Paranoiac Critical Visage,** 1935.

• In the 1930’s Breton was still unsure about visual Surrealism. Until then Breton believed that Surrealism was primarily a literary movement.
• Dali invented his paranoic-critical method and revealed it with this piece in the journal *Le Surréalisme au Service de la Révolution*.
• The image is a photograph of African people in front of a hut which arrived at Dali’s house as a postcard sent by Pablo Picasso.
• Dali instantly recognized the double image of a “phantom head” when the postcard is turned 90º.
• Just as clinical paranoia involves the obsessive reinterpretation of external phenomena, Dali’s method also involved obsessive reinterpretation.
• The resulting back-and-forth between the reality of the African people and illusionary visage creates a "mental crisis" in the viewer.
• Dali reproduced this effect many times in numerous artworks. A few of these have been featured here.
• Breton was convinced, but as Dali’s popularity grew, Breton criticized Dali, calling his work “puzzle-paintings” where the only purpose was to decipher the image. Dali, being rich, famous, and an egomaniac, didn’t seem to notice Breton’s criticism.

**Artwork 15:**

**Paranoia,** 1935-36, oil on canvas, 15 x 18 ½ in.

• Belongs to a series of “anthropomorphic landscapes” of the 1930s in which Dali explores the visual conceit of dual or multiple figurations.
• Dali challenges the viewer’s visual mastery of form and opens the interpretative process to multiple and often conflicting significations.
• The head of the woman/bust simultaneously configures a scene of horsemen in battle.
• Reading Leonardo’s recipe for visual inspiration through the grid of Freud’s psychobiography of the artist’s life and work, Dali suggested that the motivation for and the meaning of his figuration was anything but arbitrary: “The ‘paranoiac phenomenon’ is consubstantial with the human phenomenon of sight.”
• The theoretical roots of Dali’s obsession with multiple images can be traced to 1929 with references to Rene Magritte.
• The paranoiac-critical method provided a means for Dali to test his hypothesis that desire is always/already implicated in the structure of the visual field, and to reproduce that structure symbolically in painting while simultaneously exploring its latent content.
• The horses in the background are reminiscent of Da Vinci’s horse studies.
“The Great Paranoiac” is another in a long line of double-image strokes of genius by Salvador Dalí – but this one holds special significance. A cluster of human figures of both genders appears in a sort of dry, barren landscape. Some stand, some recline, some sit, some kneel. But the two largest figures in the foreground – both appearing to be female, one kneeling with head bowed, the woman to her left standing and seen from behind – form the face of a man looking downward and rather anguished or ashamed. The lighter space just above those two figures, together with the mélange of figures above and to the right of that space, completes the head of the at once visible and invisible man. The same basic double-image is repeated in smaller dimension at the upper left part of this remarkable picture. But what do we notice about all of the figures in “The Great Paranoiac”? None of them show their faces! Not one. In fact, their postures and demeanors suggest a sense of shame. Every human figure is either turning away or hiding their face in shame. In all probability, this was the 32-year-old Dalí examining his own obsessions and neuroses, much as he did in his important 1929 canvas, “The Great Masturbator.” Not only did Dalí candidly paint his dream world without any restraint, but he sometimes laid bare his inner-most concerns, obsessions, and preoccupations. Perhaps this painting could just as well have been titled “The Great Shame.” Of course, the illusionary characteristics of this painting are consistent with Dalí’s fascination with double- and hidden-imagery, an interest surely derived from his admiration of the 16th century artist, Arcimboldo – famous for assembling fruits and vegetables and other objects to form human portraits. It also reminds us of how Dali revered Leonardo DaVinci, who had proclaimed that even random water stains on a wall could yield great battles and other hidden images to a creative artist’s mind. What’s more, Dalí recognized – from reading Freud and studying the tenets of psychoanalysis – that the true paranoid person “sees” in a very different way – often detecting hidden images, or at least imagining they’re there. This was the basis of Dalí’s Paranoiac-Critical creative method, where he was able to envision things the way an actual paranoid does, but then transformed them onto canvas for the rest of us to see. That was the critical part of his method. “The Great Paranoiac” demonstrates just how honest Dalí was in sometimes holding a mirror up to himself – providing us with fascinating glimpses into the mind of the greatest of all the Surrealists. The important painting was among the many gems at the 2012-2013 Dalí retrospective at the Centre George Pompidou in Paris, France.

Double image painting.

Belongs to Dalí’s extended series of “anthropomorphic landscapes” of the mid – late 1930s. Contains the visual conceit of a woman’s face composed of figures and horsemen, and the configuration of a head composed of landscape elements: a boulder in the case of the figure to the left, and an open cavity in a rock formation in the case of the figure to the right. As Dalí continued to exploit the fluid passage between objects and ambient space, he increasingly resorted to a vocabulary of stock images and familiar visual puns. The classical reference to the three Graces, symbols of ideal beauty, may be interpreted as an allegory of Dalí’s assault on the Renaissance tradition of form, which locates a unitary subject at the origin of a rational spatial system. As Dalí collapses perspective and dismantles familiar figure/ground relationships, a different conception of the subject engenders the visual field: the mobile subject of desire whose precise coordinates cannot be mapped.
**Dream of Venus Pavilion** at the New York World’s Fair, 1939.

- Dalí’s pavilion was entitled “Dream of Venus,” and was a surrealistic dream world.
- Patrons entered through a pair of women’s legs (John Malkovich copied this for his Lisbon Nightclub called “Lux”- it is a weird place), and purchased tickets from a fish head booth.
- Dalí designed two pools where topless sirens and mermaids swam about, women dressed as pianos and lobsters cavorted amongst paintings and props in front of a giant four paneled painting by Dalí, and other tableaus with costumes designed by Dalí.
- Sadly, creative compromise happened even then.
- The fair organizers made major modifications to Dalí’s original ideas, which caused him to dramatically write a pamphlet called, “Declaration of the Independence of the Imagination and the Rights of Man to His Own Madness.”
- Although Dalí wasn’t thoroughly satisfied, the exhibition brought Surrealism and Dalí’s creative ideas out of the artistic world and to the masses.

Artwork 20:

*Dali in an Egg*, Phillipe Halsman, photograph, 1942.

- Philippe Halsman and Salvador Dalí lived and worked in Paris in the 1930s, when surrealism flourished.
- But they first met in New York in 1941, when both were new émigrés. They had arrived within months of each other – Dalí in August 1940, and Halsman three months later.
- During the previous ten years, their paths must have criss-crossed frequently in the narrow streets of Montparnasse, where Halsman had a studio at 22 Rue Delambre, and Dalí was part of the surrealist enclave at 54 Rue du Chateau.
- In 1936, Halsman exhibited photographs at the Galerie de la Pleiade, where surrealist photographer Man Ray also showed his work.
- But until 1941, Halsman and Dalí had never met.
- Within a year of his arrival in New York, Halsman had re-established himself.
- His iconic portrait of model Connie Ford silhouetted against an American flag had been featured in a major Elizabeth Arden advertising campaign.
- In April, 1941, Halsman was assigned by the Black Star Agency to photograph the installation of Dalí’s first New York exhibit — at the Julien Levy Gallery.
- Halsman’s relationship with Dalí deepened in October, when he photographed the outsize costumes Dalí created for the Ballets Russes production of “Labyrinth” at the Metropolitan Opera House — with music by Franz Schubert, choreography by Leonid Massine, and scenery and costumes by Salvador Dalí.
- Lacking a large studio, Halsman took the company’s prima ballerina, Tamara Toumanova, and another dancer dressed as a giant white rooster, to a nearby rooftop.
- When Halsman photographed bird and ballerina against the soaring towers of Rockefeller Center, he produced a photograph that evoked one of Dalí’s own sharply-focused, surreal works of art.
- The photo became LIFE’s “Picture of the Week,” the artists became inspired friends, and their creative rapport would last for the next 37 years.
- Several weeks later they collaborated again; this time they produced a collaged photograph of Dalí lying naked in the embryo pose within an enlarged photo of an egg.
- The image, entitled “Pre-Natal Memory,” was published the following year in Dalí’s autobiography, “The Secret Life of Salvador Dalí.”
- In the decades ahead, Halsman and Dalí would “play” together at least once a year — “an elating game,” Halsman wrote in 1972, “creating images that did not exist, except in our imaginations.
- Whenever I needed a striking protagonist for one of my wild ideas, Dalí would graciously oblige. Whenever Dalí thought of a photograph so strange that it seemed impossible to produce, I tried to find a solution.”
- Usually they conspired in Halsman’s large, strobe-equipped studio at 33 West 67th Street, around the corner from St. Nicholas Arena in Manhattan.
- Other “sittings” took place at Dalí’s home in Cadaques, in Los Angeles, and at the St. Regis Hotel, where Dalí invariably stayed when he was in New York.
- Their intense, prolific, 37-year collaboration is unique in the history of 20th Century art.

Artwork 21:
**The Esthetic is the Greatest of Earthly Enigmas**, 1943, red and black ink on paper, 10 7/8 x 8 in.

- The title comes from the larger block of text in the lower right of the composition, and the marginal notations along the right side describe in some detail both the decorative pedestal that the central figure is standing on, as well as the fantastically decorated religious structure in the middle ground.
- Architecture was always a subject of fascination for the artist, and he wrote in 50 Secrets of Magic Craftsmanship that it is “the first art with which the painter must make himself familiar.”
- The elaborately detailed element in the top right is a pendant from the collection of jewelry items that Dalí was working on in collaboration with Duke Fulco di Erdura.
- Dalí was a voracious reader and student of art history from an early age, and his works from this period are a physical reflection of the artist’s desire to “continue the conquest of the irrational by becoming classic and pursuing the research in Divina Proportione interrupted since the Renaissance.”
- As a young artist, Dalí expressed his admiration for classical painters such as da Vinci, Raphael, Velazquez and Durer in essays published in the student magazine Studium in the spring of 1919.
- These early interests waned during his participation in the surrealist movement, were to resurface again in a vigorous manner starting in 1941.

Artwork 22:

**My Wife, Nude, Contemplating Her Own flesh Becoming Stairs, Three Vertebrae of a Column, Sky and Architecture,** 1945.

- Dalí had a thing for backs – his wife Gala’s back, to be sure, but backs in general.
- Many of his portraits of Gala and, earlier, of his sister Ana Maria, show the sitters from behind.
- Indeed, in a clear stroke of Dalínian Continuity – where certain imagery in Dalí’s paintings gets repeated from one year or even from one decade to another – virtually the same view of Gala seen in the present work was to appear 15 years later in Gala Nude, Seen from behind.
- In the 1945 picture, Gala sits aristocratically, nearly naked, save for a beautifully handled white cloth and the same pearl-studded barrette in her hair as in the 1960 work.
- Gala contemplates the same image of her back-to-the-viewer pose, only now it’s formed by architectural columns and other details surrounding a tiny figure of a man.
- Her left shoulder and arm become what looks like they could be both a tower and a rocket ship.
- A detail in her hair serves as both a balcony railing of an edifice and the aforementioned pear-studded barrette.
- The undeniably classic look to the work – it almost looks like it could have been painted during the Renaissance! – is accentuated by the classical figure on the stone wall, while authors Elizabeth Keevil and Kevin Eyres have noted that the dandelion is “a symbol of transience that is reinforced by the struggle of its roots to find a home in the rock.”
- Was Dalí trying to convey how beauty itself is transient?
- How the lovely Gala of 1945 (she would have been about 51 then) would perhaps see her looks fade with time?
- This remarkable painting was reproduced on the dust jacket of the first hardcover edition of Dalí’s important book, Fifty Secrets of Magic Craftsmanship, and is a fitting work for that purpose, given the sheer perfection with which the Catalan Master painted it.

Artwork 23:

**Idylle Atomique,** 1945.

- In 1945 Salvador Dalí, a well-known artist, painted an abstract piece that takes reality to another deep, dark place in his mind.
- Although the painting looks like it represents a bazar dream, it could also tell a story about a man’s favorite pastime and fears during a time of war.
- The lighting in the painting is very obscure with many well-lit objects to emphasize their importance. Most of the colors are cool versus warm.
- This element creates a cold, depressing, and nightmarish setting for the audience.
- The sky is exposed in two areas: one representing the daytime and one in the evening.
- There are various objects throughout and the lighting plays a large part in telling a story.
- There are several objects painted throughout the piece that seem to be random, but are in fact relevant to the whole picture.
- The focal point is on the bottom left corner, where there is an old man looking up at the whole image in fear.
- There are baseball players throughout who are creating clouds of dust and one who is holding up a baseball bat.
- He is facing an object that at first appears to be a person in a hooded robe holding a bat, but it if one looks closer, it turns out to be a melting clock.
- Right next to the melting objects there is an explosion from a bomb. There are also airplanes dropping bombs throughout...
the painting.
- All of these are in a room of some kind because there is a hard wood floor and shadows on the walls.
- On the upper right, there is an opening where the roof would be and the outside world is exposed.
- There are elephants with extremely long legs with gold balls falling out of their torsos.
- There are so many different images throughout the painting that may not make sense or have multiple meanings behind them; such as elephants with very tall legs or objects that seem to represent human faces.
- Images like this are why some may think this painting could be a dream with no meaning behind it.
- Life changing events can make the mind perceive the world differently.
- In the story being told, the man in the bottom right corner could be hallucinating during a war.
- The painting tells a story about man’s favorite pastime, baseball, and the idea of time melting away as he fears his death.
- There is a war obviously going on around him, and he is trying to hold onto the life he knew.
- The whole story is about a man fearing what the world is becoming.
- Clocks and faces melting show what happens when a bomb drops. Familiar faces and ways of life disappear.
- In one rather large part of the painting, there is a face with a tongue sticking out with razor sharp teeth and an eye ball melting out of its socket.
- It isn’t as graphing as it sounds because the object is all one color and blends with the dark background.
- The old man staring into the painting probably symbolizes the artist overlooking his confusing feelings about the world around him.
- It depends on personal life experience, culture, and philosophies on life.
- This painting was probably intended for those with the ability to use their imagination as well as people who have knowledge of events that occurred in the 1940’s; such as World War II.
- The painting may seem like a dream to some, but it is a representation of how a man views fear. When people express their emotions with art, it often reveals their passions, fears, and moods.
- Those who are exposed to abstract art such as this can usually use their own experience in life to relate to the meaning and interpret.
- The painting shows Dalí’s personal fears and the inability to grasp onto the precious life he has when he is consumed by the fear.

Artwork 24:

Three Sphinxes of Bikini, 1947.
- Between the years of 1946 and 1958 (AFTER world war two), the United States conducted 23 nuclear tests at the Micronesian atoll, Bikini.
- The tests caused the radioactive contamination of the entire system of islands.
- The (roughly) two hundred Micronesians who inhabited the islands were relocated by the US before the tests, and eventually brought back in 1968.
- The US lost a lawsuit to the Micronesians in the amount of $100 million when it was discovered, ten years later in 1978, that the levels of radioactivity were still dangerously high.
- These experimental explosions on the atoll of Bikini inspired Dalí to paint the Three Sphinxes of Bikini.
- Dalí himself was a surrealist painter.
- If you look at the point of view of “expressionism,” then paintings in general are supposed to emphasize the expression of inner experience rather than a solely “photographic” portrayal of reality.
- It is subjective emotions and responses that objects and events arouse in the artist. In surrealism, it goes one step further: it’s the unconscious that is emphasized, and paintings express the workings of the mind by using symbolic imagery and interesting juxtaposition of subject matter.
- The painting consisted of one head, one tree and one nuclear mushroom.
- The head might represents humanity, while the tree represents nature and mushroom cloud represents destruction.
- When nuclear exploded, the tree was the one closest to it then come to the head, which could mean that impact on nature is far greater than impact on human.

Artwork 25:

Leda Atomica, 1947.
- Renaissance inspired perspective using architectural elements as well as classical figure proportions, based on the Golden Ratio.
- Intentional use of a pentagon whose angles intersect with a circle to create the optimum aesthetic organization of visual elements.
- Reminiscent of Leonardo da Vinci’s Vitruvian Man, 1490, based on the work of the architect Vitruvius.
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Artwork 27:

*50 Secrets of Magic Craftsmanship*, 1948.

- Important volume in which famed Surrealist expounds — in his inimitably eccentric fashion — on what painting should be, the history of painting, what is good and bad painting, the merits of specific artists, and more.
- Includes his 50 "secrets" for mastering the craft, including "the secret of the painter's pointed mustaches."

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Artwork 28:

*Project for Icosahedral Studio, Port, Lligat*, 1949.

- Design for a studio based on a plantonic solid form.
The Madonna of Port Lligat, 1949.

- The Madonna of Port Lligat is the name of two paintings by Salvador Dalí.
- The first was created in 1949, measuring 49 x 37.5 centimetres (19.3 x 14.8 in), and is housed in the Haggerty Museum of Art at Marquette University in Milwaukee, Wisconsin, USA.
- Dalí submitted it to Pope Pius XII for approval, which was granted.
- Dalí created a second painting in 1950 with the same title and same themes, with various poses and details changed, measuring 144 x 96 centimetres (57.7 x 37.8 in); As of 2008, the 1950 Madonna is exhibited at the Fukuoka Art Museum in Japan.
- The paintings depict a seated Madonna (posed by Dalí’s wife, Gala) with the infant Christ on her lap.
- Both figures have rectangular holes cut into their torsos, suggestive of their transcendent status.
- In the 1950 version Christ has bread at the center of his figure.
- They are posed in a landscape, with a view of Port Lligat, Catalonia seashore in the background, with surrealist details, including nails, fish, seashells, and an egg.
- The 1949 Madonna has a sea urchin; the 1950 Madonna has a rhinoceros and figures of angels, also posed by Gala.


Artwork 30:
Exploding Raphaelesque Head, 1949-51.

- The face in this painting is influenced by a Madonna by the Renaissance artist, Raphael.
- Dalí has fragmented the head to show how the sense of order from the past, illustrated by the balance and reason of a classical icon, has been shattered by the advent of nuclear weapons.
- The motif of the shattered head was a common one amongst artists in the post-war years.
- This reflects the emotional turmoil of a period when nuclear war seemed like a reality, following the use of nuclear weapons in Hiroshima and Nagasaki.
- In this context, the delicate halo of the Madonna now suggests a nuclear mushroom cloud and her expression, with eyes downcast in prayer, seems particularly appropriate.

Artwork 31:
The Wheelbarrows. 1951, wash and pencil on paper, 40 x 30 in.

- Dalí executed The Wheelbarrows the same year as the publication of his tract, the Manifeste Mystique, which signaled the official beginning of his "Nuclear mysticism."
- Dalí brings together the dome and part of the interior of the Pantheon; a large superimposed figure, portrayed from the chest upward; and many wheelbarrows in various states of segmentation.
- The wheelbarrows in the bottom half of the picture give definition to the upper arms and chest of the large figure.
- The central role of the Pantheon in the composition further underlines the picture's spiritual dimension and its connection to classicism.
- There are elongated shapes that bear resemblance to both wheelbarrow handles and rhinoceros horns.
- To Dalí, the logarithmic spiral of the rhinoceros horn was an example of spiritual order in the universe.
- The wheelbarrow had long been interpreted by Dalí as a sexual symbol, representing in its configuration a popular sexual position and thus having an “erotic personality [that] is among the most unquestionable ones.”
- Dalí’s mysticism was inseparable from erotic deliria.

Artwork 32:
Assumpta Corpuscularia Lapislazulina, 1952, oil on canvas, 90 1/2 x 56 3/4 in.

- This painting has not been exhibited publicly since 1959.
• The subject is Dalí’s imaginative explanation for the Assumption of the Virgin Mary.
• When Pope Pius XII established the ‘Blessed Virgin’s Assumption’ as infallible dogma in 1950, Dalí set to work trying to understand how this miracle might have scientifically taken place.
• He even wrote a letter to the Pontiff asking how exactly the Virgin levitated into Heaven and, once elevated, how she stayed aloft.
• The Pope did not answer Dalí’s inquiry – unsurprising since the Church demanded “unquestionable belief” and “supernatural faith” -- though the artist’s ultimate conclusion was imaginative: it was not miraculous that the Virgin ascended to Heaven, but the product of a spiritually guided atomic reaction.
• He wrote in Diary of a Genius: “The Virgin does not ascend to heaven while praying. She ascends by the very strength of her antiprotons.”
• With this work, the artist juxtaposed a recent event of the regarding the Church with contemporary physics: anti-protons had only just been discovered in 1952, when it was found scientists learned that protons had an associated antiparticle with the same mass and opposite electric charge.
• As in other particle-antiparticle pairs, protons and anti-protons can annihilate one another in a burst of energy.
• When Dalí theorized that the Virgin ascended through the “very strength of her antiprotons,” he insinuated that a subatomic reaction had taken place in which colliding protons and anti-protons had created enough energy to rocket the Virgin into Heaven.
• Once in Heaven, he continued, the Virgin’s body was “reintegrated” and held in place by “cosmic glue,” a notion he credited in 1952 to physicist Enrico Fermi, who he said had given him the idea for a “gelatinous universe.”

Artwork 33:

The Disintegration of the Persistence of Memory, 1952-54, oil on canvas, 10 x 13 in.

• Dalí expresses his interest in the exterior world of physics and Werner Karl Heisenberg.
• Dismantled his earlier surrealist masterpiece to reveal a new structure that visualizes quantum mechanics.
• Extreme use of perspective employed in the grid like construction throughout the foreground and extending into the middle ground, also referencing the mathematical concept of fractals.
• Reinterpretation of Dalí’s most famous painting, The Persistence of Memory, 1931 (Museum of Modern Art, New York), showing how in two decades Dalí and the world moved from Surrealism to Nuclear Mysticism.
• By showing the disintegration of the familiar composition, Dalí indicates how he has changed, and indeed how the world has changed, over the two decades between 1931 and 1952. Where once the mysteries of the universe were explained through psychoanalysis, now they are explained through quantum mechanics.
• Original title: “The chromosome of a highly colored fish’s eye starting the harmonious disintegration of the persistence of memory.”
• The fish bears witness to the end of the world.
• The atomic bomb dissolves objects into elemental particles, a metaphor for the material world dissolving into its atomic structure.
• Rhinoceros horns, containing perfect mathematical spirals, are like the bombs being dropped. For Dalí, even explosions have an underlying harmonious nature.
• Dalí’s great masturbator self-portrait dissolves into jellied skin.
• The watches have become unanchored, with their melting oozing form becoming more brittle like smashed glass or ice.
• During the surrealist period Dalí created the iconography of the interior world of Sigmund Freud.
• With this painting, the exterior world has transcended the one of psychology, the world of physics and Werner Karl Heisenberg.
• Dalí has dismantled his earlier surrealist masterpiece at the figurative level, pulling back the skin of the distant seascape to reveal a new structure that is meant to visualize quantum mechanics.

Artwork 34:

Crucifixion (Corpus Hypercubus), 1954, oil on canvas, 76.5 x 43.75 in.

• Depicts the Crucifixion of Jesus, though it deviates from traditional portrayals of the Crucifixion by depicting Christ on the polyhedron net of a hypercube and adding elements of Surrealism.
• It is one of his most well-known paintings from the later period of his career.
• Dalí’s inspiration for Corpus Hypercubus came from his change in artistic style during the 1940s and 1950s.
• Around that time, his interest in surrealism diminished and he became fascinated with nuclear science, feeling that “thenceforth, the atom was [his] favorite food for thought.”
• His interest grew from the bombing of Hiroshima at the end of World War II which left a lasting impression on him.
• In his 1951 essay “Mystical Manifesto”, he introduced an art theory he called "nuclear mysticism" that combined Dalí’s interests in Catholicism, mathematics, science, and Catalan culture in an effort to reestablish Classical values and
techniques, which he extensively utilizes in *Corpus Hypercubus*.

That same year, to promote nuclear mysticism and explain the "return to spiritual classicism movement" in modern art, he traveled throughout the United States giving lectures.

Before painting *Corpus Hypercubus*, Dalí announced his intention to portray an exploding Christ using both classical painting techniques along with the motif of the cube and he declared that "this painting will be the great metaphysical work of [his] summer."

Juan de Herrera's Treatise on Cubic Forms was particularly influential to Dalí.

Consistent with his theory of "nuclear mysticism", Dalí uses classical elements along with ideas inspired by math, science, etc.

Some noticeably classic features are the drapery of the clothing and the Caravagesque lighting that theatrically envelops Christ, though like his 1951 painting *Christ of Saint John of the Cross, Corpus Hypercubus* takes the traditional Biblical scene of Christ's Crucifixion and almost completely reinvents it.

While he did attempt to distance himself from the Surrealist movement after his development of "nuclear mysticism", Dalí still incorporates dream-like features consistent with his earlier surrealist work in *Corpus Hypercubus*, such as the levitating Christ and the giant chessboard below. Jesus’ face is turned away from the viewer, making it completely obscured.

The crown of thorns is missing from Christ's head as are the nails from his hands and feet, leaving his body completely devoid of the wounds often closely associate with the Crucifixion.

With *Christ of Saint John of the Cross*, Dalí did the same in order to leave only the "metaphysical beauty of Christ-God".

Dalí sets the painting in front of the bay of *Port Lligat* in Catalonia, Dalí's home, which is also the setting of other paintings of his including *The Madonna of Port Lligat, The Sacrament of the Last Supper*, and *Christ of Saint John of the Cross*.

One's eyes are quickly drawn to the knees of Christ which have a grotesque exaggeration of realism detail.

If one observes the original painting closely, 5 different images of Gala appear in Christ's right knee and 5 different images of Salvador appear in his left; the most prominent two being Gala's back/neck/back of head with right arm extended upward and Salvador's face replete with trademark up swept mustache.

Additional knee images translate extremely poorly to reproductions/prints.

The most striking change Dalí makes from nearly every other crucifixion painting concerns the cross.

Instead of painting Christ on a wooden cross, Dalí depicts him upon the net of a hypercube, also known as a tesseract.

The unfolding of a tesseract into eight cubes is analogous to unfolding the sides of a cube into six squares.

The use of a hypercube for the cross has been interpreted as a geometric symbol for the transcendental nature of God.

Just as God exists in a space that is incomprehensible to humans, the hypercube exists in four spatial dimensions, which is equally inaccessible to the mind.

The net of the hypercube is a three-dimensional representation of it, similar to how Christ is a human form of God that is more relatable to people.

The word "corpus" in the title can refer both to the body of Christ and to geometric figures, reinforcing the link Dalí makes between religion and mathematics and science.

Christ’s levitation above the Earth could symbolize His rise above Earthly desire and suffering.

The motif of the cube is present elsewhere: Gala is standing on one and the chessboard is made up of squares.

On the bottom left of the painting, Dalí painted his wife *Gala as Mary Magdalene* looking up at Jesus.

Dalí thought of her as the "perfect union of the development of the hypercubic octahedron on the human level of the cube".

He used her as a model because "the most noble beings were painted by Velázquez and Zurbarán.

[He] only [approaches] nobility when painting Gala, and nobility can only be inspired by the human being."

Upon completing *Corpus Hypercubus*, Dalí described his work as "metaphysical, transcendent cubism."

The union of Christ and the tesseract reflects Dalí's opinion that the seemingly separate and incompatible concepts of science and religion can in fact coexist, which has been lauded by viewers and has been widely considered one of Dalí’s masterworks.


Artwork 35:

*Soft Watch at the Moment of First Explosion*, 1954

- Created in 1954, Dalí used the presence of a dreamlike quality and ghostly appearance to accentuate the mysterious and unexplainable in his painting.
- Surrealism rejects logic, reason and natural order. It uses techniques such as dreamlike or ghostly qualities, juxtaposition (a method for rejecting harmony in their work) and incorporates surreal objects and subject matter.
- Dalí uses these same techniques in his painting *Soft Watch at the Moment of Explosion* to intrigue his viewers and provoke thought.
- In his painting, Dalí assimilates shadowy outlines of objects and uses the dreamlike quality in the way the watch twists and its broken pieces unexplainably float above it.
- Also, the ghostly way the watch drapes over one edge of the box as if melting.
- The watch seems to be pulling apart and stretching. It may denote Dalí's belief that time passing brings eventual destruction.
- In *Soft Watch at the Moment of Explosion*, Dalí incorporates a great deal of color juxtaposition.
- Most of the background consists of deep browns and gold and is contrasted by the white clock in the center of the painting.
Dalí’s painting also displays surreal objects, although most of these are in the foreground (a moth, a fly and a bizarre clock). In the background we see a small cluster of mountains.

As Dawn Ades wrote: The soft watches are an unconscious symbol of the relativity of space and time, a Surrealist meditation on the collapse of our notions of a fixed cosmic order.

This interpretation suggests that Dalí was incorporating an understanding of the world introduced by Albert Einstein’s Special Theory of Relativity.

Asked by Ilya Prigogine whether this was in fact the case, Dalí replied that the soft watches were not inspired by the theory of relativity, but by the surrealist perception of a Camembert cheese melting in the sun.

**Artwork 36:**

**Self-Portrait as Mona Lisa,** 1954, photograph, P. Halsman and Dalí.

- Philippe Halsman and Salvador Dalí lived and worked in Paris in the 1930s, when surrealism flourished.
- But they first met in New York in 1941, when both were new émigrés. They had arrived within months of each other – Dalí in August 1940, and Halsman three months later.
- During the previous ten years, their paths must have criss-crossed frequently in the narrow streets of Montparnasse, where Halsman had a studio at 22 Rue Delambre, and Dalí was part of the surrealist enclave at 54 Rue du Chateau.
- In 1936, Halsman exhibited photographs at the Galerie de la Pleiade, where surrealist photographer Man Ray also showed his work.
- But until 1941, Halsman and Dalí had never met.
- Within a year of his arrival in New York, Halsman had re-established himself.
- His iconic portrait of model Connie Ford silhouetted against an American flag had been featured in a major Elizabeth Arden advertising campaign.
- In April, 1941, Halsman was assigned by the Black Star Agency to photograph the installation of Dalí’s first New York exhibit — at the Julien Levy Gallery.
- Halsman’s relationship with Dalí deepened in October, when he photographed the outsize costumes Dalí created for the Ballets Russes production of “Labyrinth” at the Metropolitan Opera House — with music by Franz Schubert, choreography by Leonid Massine, and scenery and costumes by Salvador Dalí.
- Lacking a large studio, Halsman took the company’s prima ballerina, Tamara Toumanova, and another dancer dressed as a giant white rooster, to a nearby rooftop.
- When Halsman photographed bird and ballerina against the soaring towers of Rockefeller Center, he produced a photograph that evoked one of Dalí’s own sharply-focused, surreal works of art.
- The photo became LIFE’s “Picture of the Week,” the artists became inspired friends, and their creative rapport would last for the next 37 years.
- Several weeks later they collaborated again; this time they produced a collaged photograph of Dalí lying naked in the embryo pose within an enlarged photo of an egg.
- The image, entitled “Pre-Natal Memory,” was published the following year in Dalí’s autobiography, “The Secret Life of Salvador Dalí.”
- In the decades ahead, Halsman and Dalí would “play” together at least once a year — “an elating game,” Halsman wrote in 1972, “creating images that did not exist, except in our imaginations.
- Whenever I needed a striking protagonist for one of my wild ideas, Dalí would graciously oblige. Whenever Dalí thought of a photograph so strange that it seemed impossible to produce, I tried to find a solution.”
- Usually they conspired in Halsman’s large, strobe-equipped studio at 33 West 67th Street, around the corner from St. Nicholas Arena in Manhattan.
- Other “sittings” took place at Dalí’s home in Cadaques, in Los Angeles, and at the St. Regis Hotel, where Dalí invariably stayed when he was in New York.
- Their intense, prolific, 37-year collaboration is unique in the history of 20th Century art.

**Artwork 37:**

**The Sacrament of the Last Supper,** 1955, oil on canvas, 105 x 66 in.

- This painting is designed with connections to the number twelve including: the 12 Apostles, Dodecahedrons and references to numerology.
- The Communion Must be Symmetrical under the Dodecahedron
Nature Morte Vivante (Still Life – Fast Moving), 1956, oil on canvas, 49 ¼ x 63 in.

- This is a key painting that shows Dalí’s intense interest in the geometry of art, the science of beauty and the spiral form.
- Inspired by Matila Ghyka, a Romanian mathematician, who explored “dynamic symmetry” in art and nature using simple mathematical formulas (such as Phi) to explore natural forms.
- Dalí incorporated several of these symmetrical grids as the compositional basis for many paintings, such as the harmonic rectangle (the Phi rectangle) and the dynamic triangle (from Greek canons of proportion).
- The ideas of geometry of art and life are further expanded with the connection of the Fibonacci spiral; the numerical sequence of the Golden spiral: (1,1,2,3,5,8,13,21...).
- Werner Karl Heisenberg’s work on quantum theory is linked with a rudimentary conception of atomic physics.
- DNA double-helix molecular structure represented in the railing post.
- The mathematical concept of fractals is evident in the repeated pattern within the painting of the sea.
- One of Dalí’s most accomplished paintings of the postwar years.
- He produced numerous preparatory sketches and oil studies.
- Emblematic of nuclear mysticism.
- Post-atomic variation on Dutch artist Floris Van Schooten’s *Table with Food* (1617), in the Prado Museum.
- Dalí breaks down the composition into smaller particles.
- Dalí proposes the idea of a “Fast-moving” still life in which matter is suspended within a dynamic space-time continuum.
- Word play “still life – fast moving.”
- Dalí had become friends with Romanian mathematician Matila Ghyka, whose studies of the Golden Section helped Dalí to create his compositions. This painting laid out rigorously according to the Golden ratio.
- Dalí: Nature Morte Vivante is “(an) explanatory painting where one can observe the dynamic and irrational dividing a fruit dish following the coefficients of uncertainty of Heisenberg in opposition to the positive security which cubist pictures once tried to offer us.”
- Werner Karl Heisenberg’s work on quantum theory is linked with a rudimentary conception of atomic physics. By referring to Heisenberg, Dalí declares his interest in modern physics.
- Heisenberg’s Uncertainty Principle: In quantum mechanics, a fundamental limit to the precision with which the position and momentum of a particle cannot be known simultaneously. The more precisely the position of a particle is determined, the less precisely its momentum can be known, and vice versa.
- Dalí shows this several times with doubled objects (the fruit dish, apple, and cherry) where the located version of the objects casts a shadow, the momentum of the same object just resemble the shooting of the object through space.
- Dalí’s pseudoscientific approach extends to an analysis of the double-helix structure of the DNA molecule and, more generally, of the logarithmic spiral.
- In 1953, Watson and Crick had just proposed that the DNA molecule should have a double helix spiral shape. Here Dalí includes a twisting banister and a rhino horn, with its own perfect spiral, in reference.
- The cauliflower floret on the right looks like the top of a mushroom cloud or a meteor, but Dalí uses it because of its growth patterns of perfect Golden spirals.

Artwork 39:

The Discovery of America by Christopher Columbus, 1958-59, oil on canvas, 161 ½ x 122 1/8 in.

- The structure of the painting is based on the harmonic rectangle calculated by Matila Ghyka in *The Geometry of Art and Life*.
- Two symmetric mirrored images of Dalí’s *Christ of Saint John of the Cross*, 1951.
- Repeated linear pattern of crosses, staffs and weapons create movement throughout the canvas.
- One-point perspective employed in the angled crosses and shadows to create the illusion of depth.
- Originally titled “The Dream of Columbus.”
- A late Nuclear Mystical painting.
- Commissioned for Huntington Hartford’s New Gallery of Modern Art which opened on Columbus Avenue in New York in 1962.
- Composition device is a Golden Spiral starting with gala’s face, spiraling clockwise up and sweeping back down through the crosses and out where St. Narciso stands.
- Dalí had read a historian who believed that Columbus was from Catalonia, thus the great discovery of the new world parallels Dalí’s own discovery of the new world.
- Columbus shown as a Grecian youth in toga discovering New World, so it is like he is in a dream.
- Circle at top contains: 1. Michelangelo’s *Pieta*, 2. Michelangelo’s *Moses*, 3. King and Queen of Spain with Columbus prior to voyage – blessed by secular and spiritual power.
- On right: Vertical lances, quoted from Velazquez’s *Lances of Breda*, hold the image of Christ on the cross, a Spanish
mystical image inspired by Spanish mystic St. John drawing of Christ seen from God’s point of view.

- Dali signs work by painting himself in as a monk holding the same cross found in the lances.
- Gala appears twice: First in the banner as The Immaculate Conception and second as the shrouded figure in the lower right who had removed herself from the three ring circus of Dalí’s public life.
- The ship is the Santa Maria – the crow’s nest becomes the Catholic chalice (holding the blood of Christ) and the circle in the upper cross is the Catholic Eucharist (the Body of Christ).
- St. Narciso and the Miracle of the Flies: On three occasions French invaders came over the Pyrenees to capture the city of Girona, the capital of Catalonia. According to the folk legend, large gadflies rose from St. Narciso’s crypt, bringing pestilence and disease to the French, keeping the city free.
- Depicts Columbus stepping ashore on the New World and planting the banner of the Inmaculada on its soil.
- Dali worked on his largest canvas to date for six months, assisted by Isador Bea.
- Weaves historical sources with popular legends.
- The bishop, a portrait of Bea, represents Saint Narciso, the patron of the medieval city of Girona.
- Images also include gadflies, Ferdinand and Isabella receiving Columbus, scene of the pieta in a mandorla, as well as references to his Christ of St. John of the Cross.
- The sea urchin surrounded by cosmic rings is an illusion to the new age of space travel, depicted without spines but with celestial spheres rotating it – looks like some sort of cosmic satellite.
- It is a “sputnik” sea urchin, probably chosen by Dalí because its name suggests Sputnik, the unmanned Russian Satellite shot into space the previous year.
- The sea urchin suggests that the discovery of new worlds does not end with America, but continues into space.
- The structure of the painting is based on the harmonic rectangle calculated by Matila Ghyka in *The Geometry of Art and Life*.

**Artwork 40:**


- *Pope John XXIII.*
- Dalí employs Ben Day dot pattern.
- Action painting technique produces representational image.
- Trompe-l’oeil detail of cherry.

**Artwork 41:**

*The Ecumenical Council*, 1960, oil on canvas, 118 x 100 in.

- Matila Ghyka’s investigation of proportion leads him to a study in Greek proportion from various Greek vase designs.
- Greek vases have specific mathematic ratios that can be studied in terms of geometry.
- Dalí utilized the analysis of the Greek vase “Stamnos” and used its reversed direction as a compositional basis for this monumental painting.
- Dalí’s last epic painting on the theme of religious mysticism.
- The scene is divided into two zones: an earthly realm and a vast heavenly paradise, interceding between them is Gala as Saint Helena, discoverer and defender of the True Cross.
- Gala appears as a muse through which the artist’s religious and creative energies are channeled.
- Refers to Pope John XXIII’s historic meeting with the archbishop of Canterbury in 1960 in a gesture of religious ecumenism.
- Dalí represents the Pope’s coronation four times as well as God, the Son and the Holy Ghost.
- The rendering of St. Peter’s Basilica, the work of Dalí’s assistant Isador Bea, adds a note of historical accuracy.

**Artwork 42:**

*Galacidalacidesoxiribunucleicacid (Homage to Crick and Watson)*, 1963, oil on canvas, 120 x 163 ½ in.

- Dalí combined his name, the name of his wife Gala, Allah, and Cid Campeador (the feminine Cid) with desoxiribunucleic acid.
- Dalí weaves his beliefs on nuclear mysticism into a complex and often esoteric historical narrative.
- DNA molecule represents the building-block of life (Dr. Francis Crick and Dr. James Watson, 1953).
- Group of Arab gunmen in “molecular” formations in a geometric cube design.
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
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<tbody>
<tr>
<td>1962</td>
<td>Rio Llobregat floods filling hundreds.</td>
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<td></td>
<td>Commemorates the Riu Llobregat flooding just outside of Barcelona, killing more than four hundred people.</td>
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<tr>
<td></td>
<td>Dalí combined his name, the name of his wife Gala, Allah, and Cid Campeador (the feminine Cid) with desoxiribonucleic acid (DNA).</td>
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<td></td>
<td>Dalí weaves his beliefs on nuclear mysticism into a complex and often esoteric historical narrative.</td>
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<td></td>
<td>Elaborate cycle of birth, death, and rebirth.</td>
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<td></td>
<td>Left - DNA molecule represents the building-block of life (Dr. Francis Crick and Dr. James Watson, 1953) and the persistence of genetic human memory.</td>
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<tr>
<td></td>
<td>Watson &amp; Crick receive Nobel Prize for proposal that DNA has a double helix shape.</td>
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<td></td>
<td>Right - Group of Arab gunmen in “molecular” salt formations signify death and self-annihilation (nonlife – one pulls trigger, all die) in addition to the scientific legacy of the Arabs in Spain.</td>
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<td></td>
<td>Middle - God the Father reaches down to lift the body of Christ back to heaven to be reborn, as Gala looks on.</td>
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<td></td>
<td>God’s head contains the Madonna and Christ (consubstantial).</td>
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<td></td>
<td>Bottom – Gala as Madonna witnesses Christ’s ascension.</td>
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<tr>
<td></td>
<td>Christ forms arch around Gala, his head is upside down.</td>
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<td></td>
<td>Upper left – Michelangelo’s Prophet Isaiah holds scroll with painting title – he foretold Christ’s birth.</td>
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<td></td>
<td>Dalí’s older brother, Salvador, died and Dalí inherited his brother’s name.</td>
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<td>Dalí imagined himself as one-half of a double whose unity was irretrievable and kept him in a state of perpetual crisis.</td>
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<td>Cherries joined in a molecular structure of a cube design representing platonic solids.</td>
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<td>Geometric pattern of dots/cherries create his dead brother’s imaginary visage.</td>
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<td>Dalí returns to the theme of mythic autobiography recounting the traumatic events surrounding his older brother’s death.</td>
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<td>Dalí, his brother, and his father all shared the name &quot;Salvador.&quot;</td>
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<td>The death of his brother haunted Dalí throughout his life.</td>
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<td>The maternal vulture, Freud’s essay on Leonardo da Vinci, is an image of incestuous desire and restates the theme of predatory female aggression.</td>
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<td>Images of Spanish guards, cherries joined in a molecular structure, and the Angelus.</td>
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<tr>
<td></td>
<td>Dalí forges an elaborate network of associations redefining his past in relation to myth, psychoanalysis, art history and modern science to shore up a divided self.</td>
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Artwork 43:

**Portrait of My Dead Brother**, 1963, oil on canvas, 69 x 69 in.

- Dalí’s older brother, Salvador, died and Dalí inherited his brother’s name.
- Dalí imagined himself as one-half of a double whose unity was irretrievable and kept him in a state of perpetual crisis.
- Cherries joined in a molecular structure of a cube design representing platonic solids.
- Geometric pattern of dots/cherries create his dead brother’s imaginary visage.
- Dalí returns to the theme of mythic autobiography recounting the traumatic events surrounding his older brother’s death.
- Dalí, his brother, and his father all shared the name “Salvador.”
- The death of his brother haunted Dalí throughout his life.
- Dalí imagined himself as one-half of a double whose unity was irretrievable and kept him in a state of perpetual crisis.
- The visage of the child suggests a generic image of wholeness and completion.
- The maternal vulture, Freud’s essay on Leonardo da Vinci, is an image of incestuous desire and restates the theme of predatory female aggression.
- Images of Spanish guards, cherries joined in a molecular structure, and the Angelus.
- Dalí forges an elaborate network of associations redefining his past in relation to myth, psychoanalysis, art history and modern science to shore up a divided self.

Artwork 44:

**Fifty Abstract Paintings Which Seen from Two Yards Change into Three Lenins Masquerading as Chinese and as Seen from Six Yards Appear as the Head of a Royal Bengal Tiger**, ca. 1963, oil on canvas.

- Each of the fifty panels of this painting is a separate abstract painting, which as seen from two yards away, change into three Lenins masquerading as Chinese.
- When seen from six yards away, the whole painting comes together to appear as the head of a royal tiger.
- This is an excellent use of geometry, based on the square, employing the mathematical concept of tiling.

Artwork 45:


- Salvador Dalí was an eccentric Catalan artist of the Surrealist movement.
- His persona was as unruly and unconventional as the art he created.
- Born in Figueres, Spain, not far from the French border, Dalí developed a deep love for Catalonia during childhood. Dalí traveled throughout the world, but had an interest in the city of Perpignan because of its evident Catalan roots.
- Dalí used to claim that he gained the most inspiration simply by sitting in the train station’s lobby.
- On August 27, 1963 Dalí made a proclamation that changed the reputation of La Gare de Perpignan.
- “It all became clear in a flash: There, right before me, was the center of the universe,” Dalí said. Dalí publically declared
that the Perpignan train station was the “centre du monde,” the center of the world.

- Dali later created a painting entitled "La Gare de Perpignan.”
- The work of art is considered to be an exceptional example of the Surrealist movement.
- The piece, which features a small image of the train station amid figures of rural farm workers, is intensely symbolic of Dalí’s obsessive concern with immortality.
- Lluis Colet, a local historian and Dali expert, believes that there are numerous reasons Dali chose Perpignan’s train station as the center of the world.
  - “In an emotional way, in a historic way and in a scientific way, many things can show that Perpignan is the centre of the world,” said Colet. “For all those reasons the master thinks the center of the universe is here.”
- Dali’s curiosity for the train station stemmed from his belief in the philosophy of cosmogony.
- Cosmogony is the theory that there is a single universal origin from which all existence and reality emerged.
- It is said that when this origin is found, one may come to understand the meaning of existence.
- In order to name a location a cosmogony, Colet said, there must be many different energies surrounding that place.
- Perpignan’s geographical location invites many of the world’s civilizations to gather there, which creates an undeniably unique energy.
- Perspectives of life and creation, existence and reality meet when passing through the seemingly insignificant train station, according to Colet.
- Today arriving at La Gare de Perpignan is like entering the center of Salvador Dalí’s psyche.
  - The ceilings are painted in large swirls of bright yellows, oranges and blues in a fashion that makes one question if there is such a thing as too much color.
  - The swirls create enormous butterflies, an homage to Dalí’s art, and tempt the imagination to see how many butterflies can be found among the flurry of color.
  - The boarding platform displays the words “Perpignan Centre du Monde” painted in chalky white paint across the black pavement.
- Travelers do not seem to notice the references to Dali or note the station’s immeasurable importance to the great artist.
- They hurry through the center of the world in a flash.
- Dalí did not contribute any art to the station, but with his declaration he transformed La Gare de Perpignan into his personal masterpiece.

Artwork 46:


- Portrait of Leonardo da Vinci.

Artwork 47:

First Cylindric Chrono – Hologram Portrait of Alice Cooper’s Brain, 1973, white light integral hologram, 16 inches diameter x 10 inches height.

- Dalí questioned the traditional ways that an image represents a subject, and he responded to advances in technology.
- By experimenting with double images, he discovered ways to multiply the meaning of his paintings.
- By working in animation, he found a way to bring his metamorphic visions to life for others to share.
- In the early 1970’s, Dalí was one of the first artists to explore holography.
- Holography is a photographic medium proposed by Dr. Dennis Gabor in 1947 using lasers to record an object so that it can appear as a three-dimensional image.
- Choosing Alice Cooper as the focus of the project was a clear indication of Dalí’s enthusiasm for pop culture.
- Working with South African artist holographer Sewyn Lissac, Dalí created a rotating three-dimensional image of the rock star.
- Cooper seated cross-legged and bare-chested on a rotating base, “shish kebabbed” Venus de Milo statue, real million dollar diamond tiara (armed guards), fake plaster brain stuffed with a chocolate éclair and real ants suspended behind his head.
- Through holography Dalí was able to capture the continuity and discontinuity of the image of a real person in real time.

Artwork 48:
Gala Contemplating the Mediterranean Sea which at Twenty Meters Becomes the Portrait of Abraham Lincoln-Homage to Rothko (Second Version), 1976, oil and collage on canvas, 99 ¼ x 75 ½ in.

- Carefully calibrated square cells that form a complex network of multiple images and two for one optical illusions.
- Dalí understood the implications of Harmon’s research for the growing fields of neuroscience and computer imaging.
- This painting is designed with a grid-like pattern of squares of color employing the mathematical concepts of tessellations, tiling and platonic solids.
- Inspiration Source: 1973 issue of Scientific American containing Leon Harmon’s “The Recognition of Faces” about perception and image recognition. He applied distortions to various familiar images, including the Mona Lisa and Lincoln, to see what the minimal conditions were to how much information our mind needs to recognize a face.
- Harmon’s computer generated block portrait demonstrated the minimal conditions needed to recognize a face.
- Dalí’s fascination with double images led to this larger self-imposed challenge: to create a completely new composition out of the distorted image of Lincoln.
- There is an earlier version in the Teatre-Museu Dalí in Figueres, Spain, painted on a large photo.
- The vast size made it difficult to see the face of Lincoln unless viewed by special glasses that reduce the image. Dalí gave visitors binoculars and asked them to look through the “wrong side” of the lens.
- Painted when Dalí was 72, just after he completed his Museum in Spain.
- Theme of passing time.
- Gala is depicted nude, except for her familiar Chanel bow, standing before an open window in a composition Dalí repeated over the years. She was 82 years old when this was painted, so she has become much younger.
- The rising sun also contains Christ in ascension, reminiscent of Dalí’s 1951 painting titled Christ of St. John of the Cross, where Christ has died and is being resurrected.
- The location of the sun, Christ’s head, is possibly where Lincoln was shot.
- Dalí’s title references Mark Rothko (1903-1970), a leading Abstract Expressionist painter who had recently committed suicide.
- Dalí was competing with the Latvian-born American artist Mark Rothko in terms of the size, scale, and chromatic brilliance of his work.
- Carefully calibrated square cells of colors in varying progression of hues is evocative of the meditative “color field” paintings of Rothko, as well as forming a complex network of multiple images and optical illusions.
- The skill and ingenuity required to produce the double image of Lincoln/Gala before the window is matched by Dalí’s exquisite employment of trompe-l’œil effects.
- Affixed a copy of an altered Lincoln photograph directly to the canvas, underscoring Dalí’s interest in collage as well as photographic and reproduction technologies.
- Dalí wed science with psychoanalysis and religious mysticism by means of an extended process of “paranoiac” associations and interpretation, simultaneously engaging the perceptual and critical faculties of the spectator.
- Dalí understood the implications of Harmon’s research for the growing fields of neuroscience and computer imaging.
- Dalí returns to the major themes of his surrealist years declaring in the process his receptivity to new developments in the science of human perception.
- Dalí spent many years living between Spain and the United States and considered America his second home.
- Dalí painted this for America’s Bicentennial in 1976.
- Painted in Dalí’s hotel room at the St. Regis Hotel in New York.

Artwork 49:

Gala’s Foot, 1974-76.

- Stereo-optic painting.

Artwork 50:
The Chair, 1975.

- Stereo-optic painting.

**Artwork 51:**

The Chair, 1975.

- Stereo-optic painting.

**Artwork 52:**

The Swallow’s Tail — Series on Catastrophes, 1983, oil on canvas, 28.7 x 36.3 in.

- Salvador Dalí’s last painting.
- It was completed in May 1983, as the final part of a series based on René Thom’s catastrophe theory.
- Thom suggested that in four-dimensional phenomena, there are seven possible equilibrium surfaces, and therefore seven possible discontinuities, or “elementary catastrophes”: fold, cusp, swallowtail, butterfly, hyperbolic umbilic, elliptic umbilic, and parabolic umbilic.
- "The shape of Dalí’s Swallow’s Tail is taken directly from Thom’s four-dimensional graph of the same title, combined with a second catastrophe graph, the s-curve that Thom dubbed, "the cusp".
- Thom’s model is presented alongside the elegant curves of a cello and the instrument’s f-holes, which, especially as they lack the small pointed side-cuts of a traditional f-hole, equally connote the mathematical symbol for an integral in calculus: $\int$.
- In his 1979 speech, "Gala, Velázquez and the Golden Fleece", presented upon his 1979 induction into the prestigious Académie des Beaux-Arts of the Institut de France, Dalí described Thom’s theory of catastrophes as ‘the most beautiful aesthetic theory in the world’.
- He also recollected his first and only meeting with René Thom, at which Thom purportedly told Dalí that he was studying tectonic plates; this provoked Dalí to question Thom about the railway station at Perpignan, France, which the artist had declared in the 1960s as the centre of the universe.
- Thom reportedly replied, "I can assure you that Spain pivoted precisely — not in the area of — but exactly there where the Railway Station in Perpignan stands today".
- Dalí was immediately enraptured by Thom’s statement, influencing his painting Topological Abduction of Europe — Homage to René Thom, the lower left corner of which features an equation closely linked to the ‘swallow’s tail’: $V = x^5 + ax^3 + bx^2 + cx$. An illustration of the graph, and the term ‘queue d’aronde’.
- The seismic fracture that transverses Topological Abduction of Europe reappears in The Swallow’s Tail at the precise point where the y-axis of the swallow’s tail graph intersects with the S-curve of the cusp.

**Artwork 53:**

Topological Abduction of Europe — Homage to René Thom, 1983. oil on canvas.

- René Thom was a French mathematician who worked in topology.
- Topology is the branch of mathematics that studies shapes and symmetries of abstract geometric figures.
• Thom’s research culminated in his 1972 book *Structural Stability and Morphogenesis* in which he unveiled his *catastrophe theory*.
• Thom concluded that in four-dimensional phenomena there are seven possible equilibrium, and thus, seven possible breaks in equilibrium, which Thom called *elementary catastrophes*.
• Thom called these: *fold*, *cusp* (*s-curve*), *swallow’s tail*, *butterfly*, *hyperbolic umbilic*, *elliptic umbilic*, and *parabolic umbilic*.
• *Topological Abduction* features Thom’s equation for the swallow’s tail in the lower left corner: \[ V = x^5/5 + (ux^3)/3 + (vx^2)/2 + wx \].
• The words *queue d’aronde*, which are French for *swallow’s tail*, appear in the lower left corner and a small graph of the swallow's tail shape follows the equation.
• The canvas is fractured by a large seismic crack, which relates to the catastrophe.
• This was Dali’s penultimate painting, and certainly one of his most conceptual.

**Vocabulary:**

Dalí Museum
Salvador Dalí
Alberti’s grid
Anamorphic Art
Background
Baroque
Board
Buckminster Fuller
Burlap
Cadaqués
Canvas
Catalonia
Chaos Theory
Chiaroscuro
Collage
Cubism
DNA
Double helix
Double image
Elena Ivanovna Diaknonova (Gala)
Glass Enigma
Fibonacci’s sequence
Figueres
Foreground
Foreshortening
Fractals
Geodesic dome
Geometry
Golden spiral
Golden triangle
Golden rectangle
Horizon line
Hypercube
Illusion
Impressionism
Irrational number
Irregular tessellation
Juxtaposition
Labyrinth
Landscape
Leon Battista Alberti
Leonardo da Vinci
Marcus Vitruvius Pollio
Master work
Matila Ghyka
Maze
Middle ground
Nuclear mysticism
Oil painting
Orthogonal lines
Paranoiac critical method
Perspective
Phi (Golden ratio)
Pi
Platonic solids
Polyhedral
Port Lligat
Portrait
Raphael
Renaissance
Rene Thom
Reynolds and Eleanor Morse
Salvador Felipe Jacinto Dalí
Spain
Surrealism
Symmetry
Tessellation
Tiling
Transformation
Trompe l’oeil
Vanishing point
Vermeer
Werner Karl Heisenberg

Declarative Knowledge: (Students will Know/Understand)

Students will know/understand: scientific knowledge is based on empirical evidence, and is appropriate for understanding the natural world, but it provides only a limited understanding of the supernatural, aesthetic, or other ways of knowing, such as art, philosophy, or religion.

Students will know/understand: genetic information is passed from generation to generation by DNA; DNA controls the traits of an organism.

Students will know/understand: that all objects and substances in the world are made of matter. Matter has two fundamental properties: matter takes up space and matter has mass which gives it inertia.

Procedural Knowledge: (Students/Group will be able to do)

Students will be able to: distinguish science from other activities involving thought.

Students will be able to: understand and explain that every organism requires a set of instructions that specifies its traits, that this hereditary information (DNA) contains genes located in the chromosomes of each cell, and that heredity is the passage of these instructions from one generation to another.

Students will be able to: explore the scientific theory of atoms (also known as atomic theory) by recognizing that atoms are the smallest unit of an element and are composed of sub-atomic particles (electrons surrounding a nucleus containing protons and neutrons).

NGSSS: Next Generation Sunshine State Standards (Florida)

Visual Art (VA), Language Arts (LA), Science (SC), Mathematics (MA) and Social Studies (SS)

http://tools.fcit.usf.edu/sss/

| SC.6.N.2 | Big Idea 2  
| SC.6.N.2.1 | Standard 2: Scientific knowledge is based on empirical evidence, and is appropriate for understanding the natural world, but it provides only a limited understanding of the supernatural, aesthetic, or other ways of knowing, such as art, philosophy, or religion.  
| SC.7.L.16 | Benchmark: 1. Distinguish science from other activities involving thought.  
| SC.7.L.16.1 | Standard 8: Genetic information is passed from generation to generation by DNA; DNA controls the traits of an organism.  
| | Benchmark: 1. Understand and explain that every organism requires a set of instructions that specifies its traits, that this hereditary information (DNA) contains genes located in the chromosomes of each cell, and that heredity is the passage of these instructions from one generation to another. |
| SC.8.P.8 | Big Idea 8  
| Standard 6: All objects and substances in the world are made of matter. Matter has two fundamental properties: matter takes up space and matter has mass which gives it inertia.  
| Benchmark: 7. Explore the scientific theory of atoms (also known as atomic theory) by recognizing that atoms are the smallest unit of an element and are composed of sub-atomic particles (electrons surrounding a nucleus containing protons and neutrons). |

**Formative Assessments:**

<p>| 1. Observation of student engagement. |
| 2. Monitoring student progress and “Teachable Moments.” |
| 3. Discussion participation and responses. |</p>
<table>
<thead>
<tr>
<th>LEARNING GOAL(S)</th>
<th>4</th>
<th>COMPLEX</th>
<th>Personal Application</th>
<th>3</th>
<th>TARGET</th>
<th>Success for all Students</th>
<th>2</th>
<th>SIMPLER</th>
<th>Limited Success</th>
<th>1</th>
<th>PARTIAL</th>
<th>Minimal Success</th>
<th>0</th>
<th>NO SUCCESS</th>
<th>Unsatisfactory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students will:</td>
<td></td>
<td>Distinguish science from other activities involving thought.</td>
<td></td>
<td>Distinguish science from other activities involving thought, including any science related work of Salvador Dalí and others.</td>
<td></td>
<td>Distinguish science from some other activities involving thought.</td>
<td></td>
<td>Distinguish science from few other activities involving thought.</td>
<td></td>
<td>No evidence of understanding.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students will:</td>
<td></td>
<td>Understand and explain that every organism requires a set of instructions that specifies its traits, that this hereditary information (DNA) contains genes located in the chromosomes of each cell, and that heredity is the passage of these instructions from one generation to another.</td>
<td></td>
<td>Understand and explain Dalí’s interest that every organism requires a set of instructions that specifies its traits, that this hereditary information (DNA) contains genes located in the chromosomes of each cell, and that heredity is the passage of these instructions from one generation to another.</td>
<td></td>
<td>Understand and explain that every organism requires a set of instructions that specifies its traits, that this hereditary information (DNA) contains genes located in the chromosomes of each cell.</td>
<td></td>
<td>Partially understand and explain that every organism requires a set of instructions that specifies its traits, that this hereditary information (DNA) contains genes located in the chromosomes of each cell.</td>
<td></td>
<td>No evidence of understanding concerning DNA.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students will:</td>
<td></td>
<td>Explore the scientific theory of atoms (also known as atomic theory) by recognizing that atoms are the smallest unit of an element and are composed of subatomic particles (electrons surrounding a nucleus containing protons and neutrons).</td>
<td></td>
<td>Explore Dalí’s Nuclear Mystical Period and the scientific theory of atoms (also known as atomic theory) by recognizing that atoms are the smallest unit of an element and are composed of subatomic particles (electrons surrounding a nucleus containing protons and neutrons).</td>
<td></td>
<td>Explore Dalí’s Nuclear Mystical Period and the scientific theory of atoms (also known as atomic theory) by recognizing that atoms are the smallest unit of an element and are composed of subatomic particles.</td>
<td></td>
<td>Partially explore the scientific theory of atoms (also known as atomic theory) by recognizing that atoms are the smallest unit of an element and are composed of subatomic particles.</td>
<td></td>
<td>No evidence of understanding the scientific theory of atoms.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</table>
REFERENCE SCALE/RUBRIC USED TO ASSESS: Visual Art, Design or any Creative Endeavor.

<table>
<thead>
<tr>
<th>FINE ART SCALE (RUBRIC)</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPLEX</td>
<td>TARGET</td>
<td>SIMPLER</td>
<td>PARTIAL</td>
<td>NO SUCCESS</td>
<td></td>
</tr>
<tr>
<td>Personal Application</td>
<td>Success for all Students</td>
<td>Limited Success</td>
<td>Minimal Success</td>
<td>Unsatisfactory</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>KNOWLEDGE</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uses basic directions and concepts of the assignment in a unique way.</td>
<td>All basic directions and concepts of the assignment clearly evident.</td>
<td>Uses most assignment specific directions and concepts.</td>
<td>Minimal assignment specific directions and concepts evident.</td>
<td>No evidence of knowledge.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>REASONING</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connecting information in introspective, logical and sequential choices throughout entire creative process.</td>
<td>Connecting information in logical and sequential choices throughout entire creative process.</td>
<td>Connecting some information in choices throughout entire creative process.</td>
<td>Minimal connection of information in choices throughout entire creative process.</td>
<td>No evidence of reasoning.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TECHNICAL SKILLS</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstrates high level of expertise in techniques appropriately employed.</td>
<td>Uses all relevant techniques appropriately.</td>
<td>Uses most relevant techniques appropriately.</td>
<td>Minimal use of appropriate and relevant techniques.</td>
<td>No evidence of technical skills.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CREATIVITY</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exceptional evidence of personal style continued throughout creative process and product.</td>
<td>Solid evidence of personal style continued throughout creative process and product.</td>
<td>Some evidence of personal style continued throughout creative process and product.</td>
<td>Limited evidence of personal style continued throughout creative process and product.</td>
<td>No evidence of creativity</td>
<td></td>
</tr>
</tbody>
</table>
ADDITIONAL REFERENCE MATERIAL:

Elements of Art:

Line, Shape, Color, Value, Form, Texture, Space.

Principles of Design:

Balance, Contrast, Emphasis, Movement, Pattern, Rhythm, Unity.

National Core Art Standards:

www.nationalartstandards.org

Creating, Performing/Presenting/Producing, Responding, Connecting.

Anchor Standards:

Creating:
1. Generate and conceptualize artistic ideas and work.
2. Organize and develop artistic ideas and work.
3. Refine and complete artistic work.

Performing/Presenting/Producing:
4. Analyze, interpret, and select artistic work for presentation.
5. Develop and refine artistic work for presentation.
6. Convey meaning through the presentation of artistic work.

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

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

Critical Thinking:


Bloom’s Taxonomy:

Remembering, Understanding, Applying, Analyzing, Evaluating, Creating.

Marzano’s Taxonomy:

<table>
<thead>
<tr>
<th>Retrieval</th>
<th>Recognizing, recalling, executing.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehension</td>
<td>Integrating, symbolizing.</td>
</tr>
<tr>
<td>Analysis</td>
<td>Matching, classifying, analyzing errors, generalizing, specifying.</td>
</tr>
<tr>
<td>Knowledge Utilization</td>
<td>Decision making, problem solving, experimenting, investigating.</td>
</tr>
</tbody>
</table>

Feldman’s Model of Art Criticism (1981):

<table>
<thead>
<tr>
<th>Description</th>
<th>What do you see in this work?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis</td>
<td>How is the work organized?</td>
</tr>
<tr>
<td>Interpretation</td>
<td>What is the work about?</td>
</tr>
<tr>
<td>Judgment</td>
<td>Is the work successful? Why?</td>
</tr>
</tbody>
</table>

Anderson’s Model of Art Criticism (1988):

<table>
<thead>
<tr>
<th>Reaction</th>
<th>What is it?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>What does the work show? How, why, where was it made?</td>
</tr>
<tr>
<td>Interpretation</td>
<td>What is the work about? How do we know?</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Is the work well done? How do we decide?</td>
</tr>
</tbody>
</table>
Next Generation Sunshine State Standards (Florida)

http://tools.fcit.usf.edu/sss/

Science 6

Big Idea 1

Standard 1:

A. Scientific inquiry is a multifaceted activity; The processes of science include the formulation of scientifically investigable questions, construction of investigations into those questions, the collection of appropriate data, the evaluation of the meaning of those data, and the communication of this evaluation.
B. The processes of science frequently do not correspond to the traditional portrayal of "the scientific method."
C. Scientific argumentation is a necessary part of scientific inquiry and plays an important role in the generation and validation of scientific knowledge.
D. Scientific knowledge is based on observation and inference; it is important to recognize that these are very different things. Not only does science require creativity in its methods and processes, but also in its questions and explanations. (SC.6.N.1)

Benchmark: 1. Define a problem from the sixth grade curriculum, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigation of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions. (SC.6.N.1.1)
Benchmark: 2. Explain why scientific investigations should be replicable. (SC.6.N.1.2)
Benchmark: 3. Explain the difference between an experiment and other types of scientific investigation, and explain the relative benefits and limitations of each. (SC.6.N.1.3)
Benchmark: 4. Discuss, compare, and negotiate methods used, results obtained, and explanations among groups of students conducting the same investigation. (SC.6.N.1.4)
Benchmark: 5. Recognize that science involves creativity, not just in designing experiments, but also in creating explanations that fit evidence. (SC.6.N.1.5)

Big Idea 2

Standard 2:

A. Scientific knowledge is based on empirical evidence, and is appropriate for understanding the natural world, but it provides only a limited understanding of the supernatural, aesthetic, or other ways of knowing, such as art, philosophy, or religion.
B. Scientific knowledge is durable and robust, but open to change.
C. Because science is based on empirical evidence it strives for objectivity, but as it is a human endeavor the processes, methods, and knowledge of science include subjectivity, as well as creativity and discovery. (SC.6.N.2)

Benchmark: 1. Distinguish science from other activities involving thought. (SC.6.N.2.1)
Benchmark: 2. Explain that scientific knowledge is durable because it is open to change as new evidence or interpretations are encountered. (SC.6.N.2.2)
Benchmark: 3. Recognize that scientists who make contributions to scientific knowledge come from all kinds of backgrounds and possess varied talents, interests, and goals. (SC.6.N.2.3)

Big Idea 3

Standard 3: The terms that describe examples of scientific knowledge, for example; "theory," "law," "hypothesis," and "model" have very specific meanings and functions within science. (SC.6.N.3)

Benchmark: 1. Recognize and explain that a scientific theory is a well-supported and widely accepted explanation of nature and is not simply a claim posed by an individual. Thus, the use of the term theory in science is very different than how it is used in everyday life. (SC.6.N.3.1)
Benchmark: 2. Recognize and explain that a scientific law is a description of a specific relationship under given conditions in the natural world. Thus, scientific laws are different from societal laws. (SC.6.N.3.2)
Benchmark: 3. Give several examples of scientific laws. (SC.6.N.3.3)
Benchmark: 4. Identify the role of models in the context of the sixth grade science benchmarks. (SC.6.N.3.4)

Big Idea 6
**Standard 4:** Over geologic time, internal and external sources of energy have continuously altered the features of Earth by means of both constructive and destructive forces. All life, including human civilization, is dependent on Earth's internal and external energy and material resources. (SC.6.E.6)

**Benchmark:** 1. Describe and give examples of ways in which Earth's surface is built up and torn down by physical and chemical weathering, erosion, and deposition. (SC.6.E.6.1)

**Benchmark:** 2. Recognize that there are a variety of different landforms on Earth’s surface such as coastlines, dunes, rivers, mountains, glaciers, deltas, and lakes and relate these landforms as they apply to Florida. (SC.6.E.6.2)

**Big Idea 7**

**Standard 5:** The scientific theory of the evolution of Earth states that changes in our planet are driven by the flow of energy and the cycling of matter through dynamic interactions among the atmosphere, hydrosphere, cryosphere, geosphere, and biosphere, and the resources used to sustain human civilization on Earth. (SC.6.E.7)

**Benchmark:** 1. Differentiate among radiation, conduction, and convection, the three mechanisms by which heat is transferred through Earth's system. (SC.6.E.7.1)

**Benchmark:** 2. Investigate and apply how the cycling of water between the atmosphere and hydrosphere has an effect on weather patterns and climate. (SC.6.E.7.2)

**Benchmark:** 3. Describe how global patterns such as the jet stream and ocean currents influence local weather in measurable terms such as temperature, air pressure, wind direction and speed, and humidity and precipitation. (SC.6.E.7.3)

**Benchmark:** 4. Differentiate and show interactions among the geosphere, hydrosphere, cryosphere, atmosphere, and biosphere. (SC.6.E.7.4)

**Benchmark:** 5. Explain how energy provided by the sun influences global patterns of atmospheric movement and the temperature differences between air, water, and land. (SC.6.E.7.5)

**Benchmark:** 6. Differentiate between weather and climate. (SC.6.E.7.6)

**Benchmark:** 7. Investigate how natural disasters have affected human life in Florida. (SC.6.E.7.7)

**Benchmark:** 8. Describe ways human beings protect themselves from hazardous weather and sun exposure. (SC.6.E.7.8)

**Benchmark:** 9. Describe how the composition and structure of the atmosphere protects life and insulates the planet. (SC.6.E.7.9)

**Big Idea 11**

**Standard 6:**

A. Waves involve a transfer of energy without a transfer of matter.
B. Water and sound waves transfer energy through a material.
C. Light waves can travel through a vacuum and through matter.
D. The Law of Conservation of Energy: Energy is conserved as it transfers from one object to another and from one form to another. (SC.6.P.11)

**Benchmark:** 1. Explore the Law of Conservation of Energy by differentiating between potential and kinetic energy. Identify situations where kinetic energy is transformed into potential energy and vice versa. (SC.6.P.11.1)

**Big Idea 12**

**Standard 7:**

A. Motion is a key characteristic of all matter that can be observed, described, and measured.
B. The motion of objects can be changed by forces. (SC.6.P.12)

**Benchmark:** 1. Measure and graph distance versus time for an object moving at a constant speed. Interpret this relationship. (SC.6.P.12.1)

**Big Idea 13**

**Standard 8:**

A. It takes energy to change the motion of objects.
B. Energy change is understood in terms of forces—pushes or pulls.
C. Some forces act through physical contact, while others act at a distance. (SC.6.P.13)

**Benchmark:** 1. Investigate and describe types of forces including contact forces and forces acting at a distance, such as electrical, magnetic, and gravitational. (SC.6.P.13.1)

**Benchmark:** 2. Explore the Law of Gravity by recognizing that every object exerts gravitational force on every other object and that
the force depends on how much mass the objects have and how far apart they are. (SC.6.P.13.2)

**Benchmark: 3.** Investigate and describe that an unbalanced force acting on an object changes its speed, or direction of motion, or both. (SC.6.P.13.3)

**Big Idea 14**

**Standard 9:**

A. All living things share certain characteristics.
B. The scientific theory of cells, also called cell theory, is a fundamental organizing principle of life on Earth.
C. Life can be organized in a functional and structural hierarchy.
D. Life is maintained by various physiological functions essential for growth, reproduction, and homeostasis. (SC.6.L.14)

**Benchmark: 1.** Describe and identify patterns in the hierarchical organization of organisms from atoms to molecules and cells to tissues to organs to organ systems to organisms. (SC.6.L.14.1)

**Benchmark: 2.** Investigate and explain the components of the scientific theory of cells (cell theory): all organisms are composed of cells (single-celled or multi-cellular), all cells come from pre-existing cells, and cells are the basic unit of life. (SC.6.L.14.2)

**Benchmark: 3.** Recognize and explore how cells of all organisms undergo similar processes to maintain homeostasis, including extracting energy from food, getting rid of waste, and reproducing. (SC.6.L.14.3)

**Benchmark: 4.** Compare and contrast the structure and function of major organelles of plant and animal cells, including cell wall, cell membrane, nucleus, cytoplasm, chloroplasts, mitochondria, and vacuoles. (SC.6.L.14.4)

**Benchmark: 5.** Identify and investigate the general functions of the major systems of the human body (digestive, respiratory, circulatory, reproductive, excretory, immune, nervous, and musculoskeletal) and describe ways these systems interact with each other to maintain homeostasis. (SC.6.L.14.5)

**Benchmark: 6.** Compare and contrast types of infectious agents that may infect the human body, including viruses, bacteria, fungi, and parasites. (SC.6.L.14.6)

**Big Idea 15**

**Standard 10:**

A. The scientific theory of evolution is the organizing principle of life science.
B. The scientific theory of evolution is supported by multiple forms of evidence.
C. Natural Selection is a primary mechanism leading to change over time in organisms. (SC.6.L.15)

**Benchmark: 1.** Analyze and describe how and why organisms are classified according to shared characteristics with emphasis on the Linnaean system combined with the concept of Domains. (SC.6.L.15.1)

**Science 7**

**Big Idea 1**

**Standard 1:**

A. Scientific inquiry is a multifaceted activity; The processes of science include the formulation of scientifically investigable questions, construction of investigations into those questions, the collection of appropriate data, the evaluation of the meaning of those data, and the communication of this evaluation.
B. The processes of science frequently do not correspond to the traditional portrayal of "the scientific method."
C. Scientific argumentation is a necessary part of scientific inquiry and plays an important role in the generation and validation of scientific knowledge.
D. Scientific knowledge is based on observation and inference; it is important to recognize that these are very different things. Not only does science require creativity in its methods and processes, but also in its questions and explanations. (SC.7.N.1)

**Benchmark: 1.** Define a problem from the seventh grade curriculum, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigation of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions. (SC.7.N.1.1)

**Benchmark: 2.** Differentiate replication (by others) from repetition (multiple trials). (SC.7.N.1.2)

**Benchmark: 3.** Distinguish between an experiment (which must involve the identification and control of variables) and other forms of scientific investigation and explain that not all scientific knowledge is derived from experimentation. (SC.7.N.1.3)

**Benchmark: 4.** Identify test variables (independent variables) and outcome variables (dependent variables) in an experiment. (SC.7.N.1.4)

**Benchmark: 5.** Describe the methods used in the pursuit of a scientific explanation as seen in different fields of science such as biology, geology, and physics. (SC.7.N.1.5)

**Benchmark: 6.** Explain that empirical evidence is the cumulative body of observations of a natural phenomenon on which scientific
explanations are based. (SC.7.N.1.6)

**Benchmark: 7.** Explain that scientific knowledge is the result of a great deal of debate and confirmation within the science community. (SC.7.N.1.7)

**Big Idea 2**

**Standard 2:**

A. Scientific knowledge is based on empirical evidence, and is appropriate for understanding the natural world, but it provides only a limited understanding of the supernatural, aesthetic, or other ways of knowing, such as art, philosophy, or religion.

B. Scientific knowledge is durable and robust, but open to change.

C. Because science is based on empirical evidence it strives for objectivity, but as it is a human endeavor the processes, methods, and knowledge of science include subjectivity, as well as creativity and discovery. (SC.7.N.2)

**Benchmark: 1.** Identify an instance from the history of science in which scientific knowledge has changed when new evidence or new interpretations are encountered. (SC.7.N.2.1)

**Big Idea 3**

**Standard 3:** The terms that describe examples of scientific knowledge, for example; "theory," "law," "hypothesis," and "model" have very specific meanings and functions within science. (SC.7.N.3)

**Benchmark: 1.** Recognize and explain the difference between theories and laws and give several examples of scientific theories and the evidence that supports them. (SC.7.N.3.1)

**Benchmark: 2.** Identify the benefits and limitations of the use of scientific models. (SC.7.N.3.2)

**Big Idea 6**

**Standard 4:** Over geologic time, internal and external sources of energy have continuously altered the features of Earth by means of both constructive and destructive forces. All life, including human civilization, is dependent on Earth's internal and external energy and material resources. (SC.7.E.6)

**Benchmark: 1.** Describe the layers of the solid Earth, including the lithosphere, the hot convecting mantle, and the dense metallic liquid and solid cores. (SC.7.E.6.1)

**Benchmark: 2.** Identify the patterns within the rock cycle and relate them to surface events (weathering and erosion) and sub-surface events (plate tectonics and mountain building). (SC.7.E.6.2)

**Benchmark: 3.** Identify current methods for measuring the age of Earth and its parts, including the law of superposition and radioactive dating. (SC.7.E.6.3)

**Benchmark: 4.** Explain and give examples of how physical evidence supports scientific theories that Earth has evolved over geologic time due to natural processes. (SC.7.E.6.4)

**Benchmark: 5.** Explore the scientific theory of plate tectonics by describing how the movement of Earth's crustal plates causes both slow and rapid changes in Earth's surface, including volcanic eruptions, earthquakes, and mountain building. (SC.7.E.6.5)

**Benchmark: 6.** Identify the impact that humans have had on Earth, such as deforestation, urbanization, desertification, erosion, air and water quality, changing the flow of water. (SC.7.E.6.6)

**Benchmark: 7.** Recognize that heat flow and movement of material within Earth causes earthquakes and volcanic eruptions, and creates mountains and ocean basins. (SC.7.E.6.7)

**Big Idea 10**

**Standard 5:**

A. Energy is involved in all physical processes and is a unifying concept in many areas of science.

B. Energy exists in many forms and has the ability to do work or cause a change. (SC.7.P.10)

**Benchmark: 1.** Illustrate that the sun's energy arrives as radiation with a wide range of wavelengths, including infrared, visible, and ultraviolet, and that white light is made up of a spectrum of many different colors. (SC.7.P.10.1)

**Benchmark: 2.** Observe and explain that light can be reflected, refracted, and/or absorbed. (SC.7.P.10.2)

**Benchmark: 3.** Recognize that light waves, sound waves, and other waves move at different speeds in different materials. (SC.7.P.10.3)

**Big Idea 11**

**Standard 6:**
A. Waves involve a transfer of energy without a transfer of matter.
B. Water and sound waves transfer energy through a material.
C. Light waves can travel through a vacuum and through matter.
D. The Law of Conservation of Energy: Energy is conserved as it transfers from one object to another and from one form to another. (SC.7.P.11)

Benchmark: 1. Recognize that adding heat to or removing heat from a system may result in a temperature change and possibly a change of state. (SC.7.P.11.1)
Benchmark: 2. Investigate and describe the transformation of energy from one form to another. (SC.7.P.11.2)
Benchmark: 3. Cite evidence to explain that energy cannot be created nor destroyed, only changed from one form to another. (SC.7.P.11.3)
Benchmark: 4. Observe and describe that heat flows in predictable ways, moving from warmer objects to cooler ones until they reach the same temperature. (SC.7.P.11.4)

Big Idea 15

Standard 7:

A. The scientific theory of evolution is the organizing principle of life science.
B. The scientific theory of evolution is supported by multiple forms of evidence.
C. Natural Selection is a primary mechanism leading to change over time in organisms. (SC.7.L.15)

Benchmark: 1. Recognize that fossil evidence is consistent with the scientific theory of evolution that living things evolved from earlier species. (SC.7.L.15.1)
Benchmark: 2. Explore the scientific theory of evolution by recognizing and explaining ways in which genetic variation and environmental factors contribute to evolution by natural selection and diversity of organisms. (SC.7.L.15.2)
Benchmark: 3. Explore the scientific theory of evolution by relating how the inability of a species to adapt within a changing environment may contribute to the extinction of that species. (SC.7.L.15.3)

Big Idea 16

Standard 8:

A. Reproduction is characteristic of living things and is essential for the survival of species.
B. Genetic information is passed from generation to generation by DNA; DNA controls the traits of an organism.
C. Changes in the DNA of an organism can cause changes in traits, and manipulation of DNA in organisms has led to genetically modified organisms. (SC.7.L.16)

Benchmark: 1. Understand and explain that every organism requires a set of instructions that specifies its traits, that this hereditary information (DNA) contains genes located in the chromosomes of each cell, and that heredity is the passage of these instructions from one generation to another. (SC.7.L.16.1)
Benchmark: 2. Determine the probabilities for genotype and phenotype combinations using Punnett Squares and pedigrees. (SC.7.L.16.2)
Benchmark: 3. Compare and contrast the general processes of sexual reproduction requiring meiosis and asexual reproduction requiring mitosis. (SC.7.L.16.3)
Benchmark: 4. Recognize and explore the impact of biotechnology (cloning, genetic engineering, artificial selection) on the individual, society and the environment. (SC.7.L.16.4)

Big Idea 17

Standard 9:

A. Plants and animals, including humans, interact with and depend upon each other and their environment to satisfy their basic needs.
B. Both human activities and natural events can have major impacts on the environment.
C. Energy flows from the sun through producers to consumers. (SC.7.L.17)

Benchmark: 1. Explain and illustrate the roles of and relationships among producers, consumers, and decomposers in the process of energy transfer in a food web. (SC.7.L.17.1)
Benchmark: 2. Compare and contrast the relationships among organisms such as mutualism, predation, parasitism, competition, and commensalism. (SC.7.L.17.2)
Benchmark: 3. Describe and investigate various limiting factors in the local ecosystem and their impact on native populations, including food, shelter, water, space, disease, parasitism, predation, and nesting sites. (SC.7.L.17.3)

Science 8
Big Idea 1

Standard 1:

A. Scientific inquiry is a multifaceted activity; The processes of science include the formulation of scientifically investigable questions, construction of investigations into those questions, the collection of appropriate data, the evaluation of the meaning of those data, and the communication of this evaluation.
B. The processes of science frequently do not correspond to the traditional portrayal of "the scientific method."
C. Scientific argumentation is a necessary part of scientific inquiry and plays an important role in the generation and validation of scientific knowledge.
D. Scientific knowledge is based on observation and inference; it is important to recognize that these are very different things. Not only does science require creativity in its methods and processes, but also in its questions and explanations. (SC.8.N.1)

Benchmark: 1. Define a problem from the eighth grade curriculum using appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions. (SC.8.N.1.1)

Benchmark: 2. Design and conduct a study using repeated trials and replication. (SC.8.N.1.2)

Benchmark: 3. Use phrases such as "results support" or "fail to support" in science, understanding that science does not offer conclusive 'proof' of a knowledge claim. (SC.8.N.1.3)

Benchmark: 4. Explain how hypotheses are valuable if they lead to further investigations, even if they turn out not to be supported by the data. (SC.8.N.1.4)

Benchmark: 5. Analyze the methods used to develop a scientific explanation as seen in different fields of science. (SC.8.N.1.5)

Benchmark: 6. Understand that scientific investigations involve the collection of relevant empirical evidence, the use of logical reasoning, and the application of imagination in devising hypotheses, predictions, explanations and models to make sense of the collected evidence. (SC.8.N.1.6)

Big Idea 2

Standard 2:

A. Scientific knowledge is based on empirical evidence, and is appropriate for understanding the natural world, but it provides only a limited understanding of the supernatural, aesthetic, or other ways of knowing, such as art, philosophy, or religion.
B. Scientific knowledge is durable and robust, but open to change.
C. Because science is based on empirical evidence it strives for objectivity, but as it is a human endeavor the processes, methods, and knowledge of science include subjectivity, as well as creativity and discovery. (SC.8.N.2)

Benchmark: 1. Distinguish between scientific and pseudoscientific ideas. (SC.8.N.2.1)

Benchmark: 2. Discuss what characterizes science and its methods. (SC.8.N.2.2)

Big Idea 3

Standard 3: The terms that describe examples of scientific knowledge, for example; "theory," "law," "hypothesis," and "model" have very specific meanings and functions within science. (SC.8.N.3)

Benchmark: 1. Select models useful in relating the results of their own investigations. (SC.8.N.3.1)

Benchmark: 2. Explain why theories may be modified but are rarely discarded. (SC.8.N.3.2)

Big Idea 4

Standard 4: As tomorrows citizens, students should be able to identify issues about which society could provide input, formulate scientifically investigable questions about those issues, construct investigations of their questions, collect and evaluate data from their investigations, and develop scientific recommendations based upon their findings. (SC.8.N.4)

Benchmark: 1. Explain that science is one of the processes that can be used to inform decision making at the community, state, national, and international levels. (SC.8.N.4.1)

Benchmark: 2. Explain how political, social, and economic concerns can affect science, and vice versa. (SC.8.N.4.2)

Big Idea 5

Standard 5: The origin and eventual fate of the Universe still remains one of the greatest questions in science. Gravity and energy influence the formation of galaxies, including our own Milky Way Galaxy, stars, the planetary systems, and Earth. Humankind (SC.8.E.5)
Benchmark: 1. Recognize that there are enormous distances between objects in space and apply our knowledge of light and space travel to understand this distance. (SC.8.E.5.1)

Benchmark: 2. Recognize that the universe contains many billions of galaxies and that each galaxy contains many billions of stars. (SC.8.E.5.2)

Benchmark: 3. Distinguish the hierarchical relationships between planets and other astronomical bodies relative to solar system, galaxy, and universe, including distance, size, and composition. (SC.8.E.5.3)

Benchmark: 4. Explore the Law of Universal Gravitation by explaining the role that gravity plays in the formation of planets, stars, and solar systems and in determining their motions. (SC.8.E.5.4)

Benchmark: 5. Describe and classify specific physical properties of stars: apparent magnitude (brightness), temperature (color), size, and luminosity (absolute brightness). (SC.8.E.5.5)

Benchmark: 6. Create models of solar properties including: rotation, structure of the Sun, convection, sunspots, solar flares, and prominences. (SC.8.E.5.6)

Benchmark: 7. Compare and contrast the properties of objects in the Solar System including the Sun, planets, and moons to those of Earth, such as gravitational force, distance from the Sun, speed, movement, temperature, and atmospheric conditions. (SC.8.E.5.7)

Benchmark: 8. Compare various historical models of the Solar System, including geocentric and heliocentric. (SC.8.E.5.8)

Benchmark: 9. Explain the impact of objects in space on each other including: 1) the Sun on the Earth including seasons and gravitational attraction 2) the Moon on the Earth, including phases, tides, and eclipses, and the relative position of each body. (SC.8.E.5.9)

Benchmark: 10. Assess how technology is essential to science for such purposes as access to outer space and other remote locations, sample collection, measurement, data collection and storage, computation, and communication of information. (SC.8.E.5.10)

Benchmark: 11. Identify and compare characteristics of the electromagnetic spectrum such as wavelength, frequency, use, and hazards and recognize its application to an understanding of planetary images and satellite photographs. (SC.8.E.5.11)

Benchmark: 12. Summarize the effects of space exploration on the economy and culture of Florida. (SC.8.E.5.12)

Big Idea 8

Standard 6:

A. All objects and substances in the world are made of matter. Matter has two fundamental properties: matter takes up space and matter has mass which gives it inertia.

B. Objects and substances can be classified by their physical and chemical properties. Mass is the amount of matter (or "stuff") in an object. Weight, on the other hand, is the measure of force of attraction (gravitational force) between an object and Earth.

The concepts of mass and weight are complicated and potentially confusing to elementary students. Hence, the more familiar term of "weight" is recommended for use to stand for both mass and weight in grades K-5. By grades 6-8, students are expected to understand the distinction between mass and weight, and use them appropriately. (SC.8.P.8)

Benchmark: 1. Explore the scientific theory of atoms (also known as atomic theory) by using models to explain the motion of particles in solids, liquids, and gases. (SC.8.P.8.1)

Benchmark: 2. Differentiate between weight and mass recognizing that weight is the amount of gravitational pull on an object and is distinct from, though proportional to, mass. (SC.8.P.8.2)

Benchmark: 3. Explore and describe the densities of various materials through measurement of their masses and volumes. (SC.8.P.8.3)

Benchmark: 4. Classify and compare substances on the basis of characteristic physical properties that can be demonstrated or measured; for example, density, thermal or electrical conductivity, solubility, magnetic properties, melting and boiling points, and know that these properties are independent of the amount of the sample. (SC.8.P.8.4)

Benchmark: 5. Recognize that there are a finite number of elements and that their atoms combine in a multitude of ways to produce compounds that make up all of the living and nonliving things that we encounter. (SC.8.P.8.5)

Benchmark: 6. Recognize that elements are grouped in the periodic table according to similarities of their properties. (SC.8.P.8.6)

Benchmark: 7. Explore the scientific theory of atoms (also known as atomic theory) by recognizing that atoms are the smallest unit of an element and are composed of sub-atomic particles (electrons surrounding a nucleus containing protons and neutrons). (SC.8.P.8.7)

Benchmark: 8. Identify basic examples of and compare and classify the properties of compounds, including acids, bases, and salts. (SC.8.P.8.8)

Benchmark: 9. Distinguish among mixtures (including solutions) and pure substances. (SC.8.P.8.9)

Big Idea 9

Standard 7:

A. Matter can undergo a variety of changes.

B. When matter is changed physically, generally no changes occur in the structure of the atoms or molecules composing the matter.
C. When matter changes chemically, a rearrangement of bonds between the atoms occurs. This results in new substances with new properties. (SC.8.P.9)

**Benchmark:** 1. Explore the Law of Conservation of Mass by demonstrating and concluding that mass is conserved when substances undergo physical and chemical changes. (SC.8.P.9.1)

**Benchmark:** 2. Differentiate between physical changes and chemical changes. (SC.8.P.9.2)

**Benchmark:** 3. Investigate and describe how temperature influences chemical changes. (SC.8.P.9.3)

**Big Idea 18**

**Standard 8:**

A. Living things all share basic needs for life.

B. Living organisms acquire the energy they need for life processes through various metabolic pathways (photosynthesis and cellular respiration).

C. Matter and energy are recycled through cycles such as the carbon cycle. (SC.8.L.18)

**Benchmark:** 1. Describe and investigate the process of photosynthesis, such as the roles of light, carbon dioxide, water and chlorophyll; production of food; release of oxygen. (SC.8.L.18.1)

**Benchmark:** 2. Describe and investigate how cellular respiration breaks down food to provide energy and releases carbon dioxide. (SC.8.L.18.2)

**Benchmark:** 3. Construct a scientific model of the carbon cycle to show how matter and energy are continuously transferred within and between organisms and their physical environment. (SC.8.L.18.3)

**Benchmark:** 4. Cite evidence that living systems follow the Laws of Conservation of Mass and Energy. (SC.8.L.18.4)

**Arts: Visual Art 6-8**

**Big Idea: CRITICAL THINKING AND REFLECTION**

**Enduring Understanding 1:** Cognition and reflection are required to appreciate, interpret, and create with artistic intent. (VA.68.C.1)

**Benchmark:** 1. Apply a range of interests and contextual connections to influence the art-making and self-reflection processes. (VA.68.C.1.1)

**Benchmark:** 2. Use visual evidence and prior knowledge to reflect on multiple interpretations of works of art. (VA.68.C.1.2)

**Benchmark:** 3. Identify qualities of exemplary artworks that are evident and transferable to the judgment of personal work. (VA.68.C.1.3)

**Enduring Understanding 2:** Assessing our own and others' artistic work, using critical-thinking, problem-solving, and decision-making skills, is central to artistic growth. (VA.68.C.2)

**Benchmark:** 1. Assess personal artwork during production to determine areas of success and needed change for achieving self-directed or specified goals. (VA.68.C.2.1)

**Benchmark:** 2. Evaluate artwork objectively during group assessment to determine areas for refinement. (VA.68.C.2.2)

**Benchmark:** 3. Examine artworks to form ideas and criteria by which to judge/assess and inspire personal works and artistic growth. (VA.68.C.2.3)

**Benchmark:** 4. Use constructive criticism as a purposeful tool for artistic growth. (VA.68.C.2.4)

**Enduring Understanding 3:** The processes of critiquing works of art lead to development of critical-thinking skills transferable to other contexts. (VA.68.C.3)

**Benchmark:** 1. Incorporate accurate art vocabulary during the analysis process to describe the structural elements of art and organizational principles of design. (VA.68.C.3.1)

**Benchmark:** 2. Examine and compare the qualities of artworks and utilitarian objects to determine their aesthetic significance. (VA.68.C.3.2)

**Benchmark:** 3. Use analytical skills to understand meaning and explain connections with other contexts. (VA.68.C.3.3)

**Benchmark:** 4. Compare the uses for artwork and utilitarian objects to determine their significance in society. (VA.68.C.3.4)

**Big Idea: SKILLS, TECHNIQUES, AND PROCESSES**

**Enduring Understanding 1:** The arts are inherently experiential and actively engage learners in the processes of creating, interpreting, and responding to art. (VA.68.S.1)
Benchmark: 1. Manipulate content, media, techniques, and processes to achieve communication with artistic intent. (VA.68.S.1.1)
Benchmark: 2. Use media, technology, and other resources to derive ideas for personal art-making. (VA.68.S.1.2)
Benchmark: 3. Use ideas from cultural, historical, and artistic references to create personal responses in personal artwork. (VA.68.S.1.3)
Benchmark: 4. Use accurate art vocabulary to explain the creative and art-making processes. (VA.68.S.1.4)
Benchmark: 5. Explore various subject matter, themes, and historical or cultural events to develop an image that communicates artistic intent. (VA.68.S.1.5)

**Enduring Understanding 2:** Development of skills, techniques, and processes in the arts strengthens our ability to remember, focus on, process, and sequence information. (VA.68.S.2)

Benchmark: 1. Organize the structural elements of art to achieve artistic goals when producing personal works of art. (VA.68.S.2.1)
Benchmark: 2. Create artwork requiring sequentially ordered procedures and specified media to achieve intended results. (VA.68.S.2.2)
Benchmark: 3. Use visual-thinking and problem-solving skills in a sketchbook or journal to identify, practice, develop ideas, and resolve challenges in the creative process. (VA.68.S.2.3)

**Enduring Understanding 3:** Through purposeful practice, artists learn to manage, master, and refine simple, then complex, skills and techniques. (VA.68.S.3)

Benchmark: 1. Use two-dimensional or three-dimensional art materials and tools to understand the potential and limitations of each. (VA.68.S.3.1)
Benchmark: 2. Develop spontaneity and visual unity in artwork through repeated practice and refined craftsmanship. (VA.68.S.3.2)
Benchmark: 3. Demonstrate understanding of safety protocols for media, tools, processes, and techniques. (VA.68.S.3.3)
Benchmark: 4. Demonstrate respect for copyright laws and intellectual property ownership when creating and producing works of art. (VA.68.S.3.4)
Benchmark: 5. Apply two-dimensional techniques and media to create or enhance three-dimensional artwork. (VA.68.S.3.5)

**Big Idea: ORGANIZATIONAL STRUCTURE**

**Enduring Understanding 1:** Understanding the organizational structure of an art form provides a foundation for appreciation of artistic works and respect for the creative process. (VA.68.O.1)

Benchmark: 1. Make connections between the structural elements of art and the organizational principles of design to understand how artwork is unified. (VA.68.O.1.1)
Benchmark: 2. Identify the function of structural elements of art and organizational principles of design to create and reflect on artwork. (VA.68.O.1.2)
Benchmark: 3. Combine creative and technical knowledge to produce visually strong works of art. (VA.68.O.1.3)
Benchmark: 4. Create artworks that demonstrate skilled use of media to convey personal vision. (VA.68.O.1.4)

**Enduring Understanding 2:** The structural rules and conventions of an art form serve as both a foundation and departure point for creativity. (VA.68.O.2)

Benchmark: 1. Create new meaning in artworks through shared language, expressive content, and ideation. (VA.68.O.2.1)
Benchmark: 2. Investigate the problem-solving qualities of divergent thinking as a source for new visual symbols and images. (VA.68.O.2.2)
Benchmark: 3. Create a work of personal art using various media to solve an open-ended artistic problem. (VA.68.O.2.3)
Benchmark: 4. Select various media and techniques to communicate personal symbols and ideas through the organization of the structural elements of art. (VA.68.O.2.4)

**Enduring Understanding 3:** Every art form uses its own unique language, verbal and non-verbal, to document and communicate with the world. (VA.68.O.3)

Benchmark: 1. Select and use the structural elements of art and organizational principles of design to document images in various formats for public audiences. (VA.68.O.3.1)
Benchmark: 2. Discuss the communicative differences between specific two- and three-dimensional works of art. (VA.68.O.3.2)

**Big Idea: HISTORICAL AND GLOBAL CONNECTIONS**

**Enduring Understanding 1:** Through study in the arts, we learn about and honor others and the worlds in which they live(d). (VA.68.H.1)

Benchmark: 1. Describe social, ecological, economic, religious, and/or political conditions reflected in works of art. (VA.68.H.1.1)
Benchmark: 2. Identify suitable audience behavior needed to view or experience artworks found in school, art exhibits, museums, and/or community cultural venues. (VA.68.H.1.2)
Benchmark: 3. Analyze and describe the significance of artwork from a selected group or culture to explain its importance to the population. (VA.68.H.1.3)

Benchmark: 4. Explain the significance of personal artwork, noting the connections between the creative process, the artist, and the artist's own history. (VA.68.H.1.4)

Enduring Understanding 2: The arts reflect and document cultural trends and historical events, and help explain how new directions in the arts have emerged. (VA.68.H.2)

Benchmark: 1. Describe how previous cultural trends have led to the development of new art styles. (VA.68.H.2.1)
Benchmark: 2. Explain the impact artwork and utilitarian objects have on the human experience. (VA.68.H.2.2)
Benchmark: 3. Describe the rationale for creating, collecting, exhibiting, and owning works of art. (VA.68.H.2.3)
Benchmark: 4. Explain the purpose of public art in the community. (VA.68.H.2.4)

Enduring Understanding 3: Connections among the arts and other disciplines strengthen learning and the ability to transfer knowledge and skills to and from other fields. (VA.68.H.3)

Benchmark: 1. Discuss how knowledge and skills learned through the art-making and analysis processes are used to solve problems in non-art contexts. (VA.68.H.3.1)
Benchmark: 2. Discuss the use of background knowledge and critical-thinking skills, learned in the visual arts, to understand varying concepts, viewpoints, and solutions. (VA.68.H.3.2)
Benchmark: 3. Create imaginative works to include background knowledge or information from other subjects. (VA.68.H.3.3)

Big Idea: INNOVATION, TECHNOLOGY, AND THE FUTURE

Enduring Understanding 1: Creating, interpreting, and responding in the arts stimulate the imagination and encourage innovation and creative risk-taking. (VA.68.F.1)

Benchmark: 1. Use non-traditional thinking and various techniques to create two-, three-, and/or four-dimensional artworks. (VA.68.F.1.1)
Benchmark: 2. Use creative risk-taking strategies learned from artists' works to incorporate artistic solutions in the creation of new personal artworks. (VA.68.F.1.2)
Benchmark: 3. Investigate and describe how technology inspires and affects new applications and adaptations in art. (VA.68.F.1.3)
Benchmark: 4. Use technology skills to create an imaginative and unique work of art. (VA.68.F.1.4)

Enduring Understanding 2: Careers in and related to the arts significantly and positively impact local and global economies. (VA.68.F.2)

Benchmark: 1. Investigate career opportunities available in the visual arts to determine requisite skills and qualifications for each field. (VA.68.F.2.1)
Benchmark: 2. Identify careers in support industries related to the art-making process, industrial design, digital media, and/or graphic design. (VA.68.F.2.2)
Benchmark: 3. Identify art careers that have a financial impact on local communities. (VA.68.F.2.3)
Benchmark: 4. Present research on the works of local artists and designers to understand the significance of art in the community. (VA.68.F.2.4)
Benchmark: 5. Create an artist statement to reflect on personal artwork for a portfolio or exhibition. (VA.68.F.2.5)

Enduring Understanding 3: The 21st-century skills necessary for success as citizens, workers, and leaders in a global economy are embedded in the study of the arts. (VA.68.F.3)

Benchmark: 1. Use technology applications through the art-making process to express community or global concerns. (VA.68.F.3.1)
Benchmark: 2. Analyze the procedural and divergent thinking skills developed in visual art to identify a purpose for the communication of art ideas. (VA.68.F.3.2)
Benchmark: 3. Collaborate with peers to complete an art task and develop leadership skills. (VA.68.F.3.3)
Benchmark: 4. Follow directions and complete art tasks in a timely manner to show development of 21st-century skills. (VA.68.F.3.4)
Observations and Notes:

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