Chihuly and Friends Educator Guide

November 23rd, 2013 – April 13th, 2014

Description of Exhibit and What You Will See

The name of the exhibit you will see with your class is *Chihuly and Friends: Highlights from the George R. Stroemple Collection*. The George R. Stroemple Collection is internationally recognized as one of the most significant collections of artwork documenting the studio glass movement in the Pacific Northwest. The exhibit features glass works by Dale Chihuly, Lino Tagliapietra and Vittorio Costantini. Each artist has his own unique style and history. Read the educator guide to learn more about the featured artists and their work.

Learning Goals

After reviewing the *Chihuly and Friends* educator guide and visiting the exhibit, students should be able to:

- Name at least one glass artist and describe a piece which is indicative of their glasswork style.
- Understand what glass is, how it is made, and how it is used as an artistic medium.
- Describe the main steps in the glassblowing process.
- Understand the familial nature of glassblowing teams, and the role each team member plays in the hot shop.
- Create their own drawing or sculpture inspired by the artwork in the exhibit.

Museum Rules

Our goal is to provide a successful learning environment for all students. Clarifying expectations of appropriate behavior helps to create that environment. We ask that you remember the following rules:

- Walk in the museum. No running.
- Use indoor voices.
- Please: no food, drink, candy or gum in the galleries.
- Do not touch the artwork.

Contents:

All works are from the George R. Stroemple Collection, A Stroemple/Stirek Collaboration

PEORIA RIVERFRONT MUSEUM

Dale Chihuly

Biography

Dale Chihuly was born in Tacoma, Washington in 1941. His father, a butcher and union organizer, died of a heart attack when Chihuly was a sophomore in high school. His mother took a job as a waitress to support herself and her son. Chihuly did not plan on continuing his education after high school, but his mother encouraged him. In 1959, he became the first person in his family to attend college. After discovering an interest in art, he transferred to the University of Washington, where he studied interior design and architecture. Distracted by college social life, Chihuly dropped out to study in Italy, France, and the Middle East. In 1963, he returned to the university with new seriousness about his work, and began to experiment with fibers, glass, and color. During this time, he created one of his first installations, a large weaving of fiber and glass. He graduated in 1965 with a B.A. in interior design and went to work for an architectural firm in Seattle.

In the meantime, experimenting with glassblowing in his own basement studio convinced Chihuly that he wanted to become a glass artist. In the 1960s, most people thought of glass as a material for making functional objects, not works of art. The University of Wisconsin had one of the few glass programs in the United States. In 1966, Chihuly obtained a scholarship to the University of Wisconsin-Madison where he studied with Harvey Littleton, founder of the studio glass movement. In 1967, he earned a M.S. degree in sculpture and entered the Master's program at Rhode Island School of Design (RISD), where he would later establish the glass program and teach for more than a decade.

In 1968, Chihuly received a Fulbright Fellowship and moved to Venice, Italy, where he became the first American glassblower to work in the prestigious Venini glass factory on the island of Murano. At Venini, Chihuly watched European glassblowers and realized that their synchronized teamwork was a reflection of their membership in a close-knit community that, in some ways, was like a family. Chihuly observed Italian *maestros* as they carried out large glassblowing projects with teams of assistants. Later, Chihuly applied this understanding to the creation of his own glassblowing teams, and in his civic work as well. In 1971, back in the United States, Chihuly cofounded the Pilchuck Glass School, an international center designed to focus on glass education, which continues to be considered the most comprehensive educational center in the world for glass artists.

1976 marked a turning point in Chihuly's life, when a head-on accident in England caused him to go blind in his left eye and sustain permanent damage to his right ankle and foot. After recovering, Chihuly continued to blow glass until another serious accident involving body surfing caused him to dislocate his shoulder and lose the ability to hold a glass blowing pipe. Remembering his work in Italy, Chihuly assembled a glassblowing team, creating drawings and sketches that would convey his artistic vision for a piece to his crew, who would in turn do the actual glassblowing. With a team, Chihuly was able to create pieces that could never be created by one glass artist alone, not even with an assistant. In a 2006 interview, Chihuly described himself as "more choreographer than dancer, more supervisor than participant, more director than actor," a quote that beautifully captures his role as *maestro*, or "master teacher," reminiscent of the Italian *maestros* in the Venini glass factory.

Chihuly's artwork has transformed over the decades. The 1970s were characterized by his Navajo Blanket series. The 1980s were characterized by his *Seaform*, *Macchia*, *Persian* and *Ikebana* series. The 1990s were characterized by his *Venetian* series, *Nijima* floats and *Chandeliers*. Despite his changing art

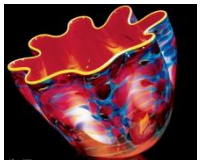
sentiments, one thing reverberates through his entire career—Chihuly's emphasis on the importance of working with the community and encouraging other artists. In 1994, Chihuly helped cofound the Hilltop Artists program in his hometown of Tacoma, Washington. The program works with at-risk youth teaching them the art of glassblowing, while also encouraging the students to work in teams, as part of a community. Chihuly continues to work on various philanthropic projects, as well as create monumental glass installations, with his team today.

Chihuly Glass Forms and Drawings

Chihuly's glass forms have followed different themes over the course of his prolific career. Below is a list of some of Chihuly's most famous glass series.

***Navajo Blanket* Series**: Chihuly studied weaving and textiles as a young man, falling in love with Navajo and Pendleton trade blankets. His appreciation for textiles inspired him to create glass tapestries on glass cylinders of varying sizes.

***Seaform* Series**: The *Seaform* series came about by accident. While experimenting with new ribbed molds for glass baskets, Chihuly noticed that the glass forms began to look like creatures that live in the ocean. Chihuly liked the natural forms and decided to continue creating more glass pieces for the *Seaform* series.



***Macchia* Series**: *Macchia* is the Italian word for "spotted," and Chihuly chose this word for the name of his series since the glass pieces are speckled with various colors. The interior and exterior of the vessels are different colors because a layer of light, opaque glass separates them, not because it is a conscious decision. *Macchia* also typically have a brightly colored lip wrap.

***Persian* Series**: While at the Venini glass factory in Venice, Chihuly saw how the art of glass has been influenced by many cultures, including Persian, Byzantine and Eastern cultures. Chihuly's *Persian* series echoes these different cultural influences by stylistically borrowing from each.

***Ikebana* Series**: A visit to Japan inspired Chihuly to create his *Ikebana* series. Chihuly was particularly intrigued by the Japanese floral arrangements that he saw on his visits to Buddhist temples. The *Ikebana* (left) have elongated stems and blossoms, similar to the gilt lotus blossom (right) that are ubiquitous in the temples.

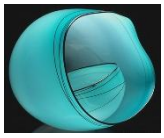
***Venetian* Series**: Chihuly's *Venetian* series was inspired by the Italian art deco movement, known in Italy as *Stile Liberty*. Chihuly originally began the series in 1988, but took a short break, before restarting the series in 1990, this time in a more eccentric form.

***Nijima* Floats**: Two students of Chihuly's Pilchuck Glass School, Osamu and Yumiko Noda, created a seaside glass school on the island of Nijima, Japan. While visiting the school, Chihuly began his *Nijima* series, named for the island and the Japanese fishing floats common there.

Chandeliers: Chihuly's *Chandeliers* started off relatively modest in size, but grew in size to immense glass sculptures that evoke a sense of grandeur. The *Chandeliers* incorporate glass pieces of varying sizes and shapes, including shapes reminiscent of orbs, flowers and snakes.

***Putti*:** *Putti* means "cherub" in Italian. Chihuly partnered with glass artists Pino Signoretto and Lino Tagliapietra to create the *Putti* glass forms. Signoretto created the cherub, while Tagliapietra would blow the glass vessel form. They would then assemble the designs as a team.

Spears: While in Finland in 1995, Chihuly experimented with creating his first *Spears*. *Spears* are made with a team of people. One glassblower holds the "gather" (molten portion of glass) on the blowpipe, climbs into a mechanical lift, and blows into the glass while another person on the ground pulls it from below. The spears vary in size, but some of the larger creations are 10 ft long.



Baskets: While at Pilchuck Glass School, Chihuly began creating glass forms reminiscent of baskets. In the beginning, he would make single *Baskets*. Later on in his career, he began creating baskets of various sizes, nesting them inside each other.

Anemone: *Anemone* glass sculptures usually resemble tentacles, and are created to be mounted on a wall. Chihuly often assembles a grouping of *Anemones* to fit the space in which he is installing the sculpture.

Boats: While in Finland in 1995, Chihuly first experimented with temporary installations in which abandoned boats were filled with glass. Chihuly would re-visit this concept by creating additional installations in which *Boats* were partially submerged with overflowing glass.

Drawings: Changes in Chihuly's physical abilities have lead him to rely on his drawings to convey the overall feel and form he desires to his glass blowing team. He works with large sheets of heavy paper, laying down a base color with a brush or mop. While the base is still wet, he applies layers of acrylic paint directly from the tubes. Chihuly believes his drawings have helped his glass sculptures to progress over time.

Lino Tagliapietra

Biography

Lino Tagliapietra is a Venetian glass artist who was born in 1934 in Murano, Italy. At the age of 12, Tagliapietra apprenticed under internationally known Muranese glass master Archimede Seguso. At first, Tagliapietra was a water carrier, but after two years, he was allowed to participate in glass manufacturing for the first time. By the age of 21, he had mastered the age-old techniques and had worked his way up to the title of *maestro*. For the next 25 years, he worked in some of the best known Muranese glass factories, as both a teacher and mentor. Tagliapietra has played a key role in the international exchange of glassblowing processes and techniques between the principal American centers for glass and his home of Murano, though his influences can be seen across the globe. Dale Chihuly describes Tagliapietra as "perhaps the world's greatest living glassblower."

Throughout the 1960s, Tagliapietra developed his design skills by implementing his own concepts. In the 1970s, he participated in the symposiums of *La Scuola Internazionale del Vetro*, where he interacted with the finest Muranese masters and other great international artists from different disciplines. In the summer of 1979, Tagliapietra traveled to Pilchuck Glass School in Seattle to demonstrate classic Italian glassworking techniques. This trip was a "big deal" for several reasons. First, Tagliapietra spoke absolutely no English, but would be traveling to Pilchuck to teach other artists and students. Second, it was the first time that Tagliapietra would ever ride in an airplane. Third, and most important, Italian *maestros* closely guarded the glassblowing techniques, and many *maestros* were unwilling to share knowledge that had been proprietary for centuries. However, Tagliapietra knew that if glassmaking at its highest level was to survive, it must expand beyond the declining industry in Murano. Defying criticism back home, Tagliapietra never stopped sharing his knowledge.

In the 1980s, he became recognized for his collaborations with other artists and for the translation of their concepts into molten glass. This was also the decade in which he made the transition from traditional Venetian master glassblower and glass designer to independent studio artist. The past three decades have marked a time in Tagliapietra's career as both a teacher and an artist. Tagliapietra has shared his deep understanding, experience and knowledge of Venetian glassblowing, while also branching out and using centuries old techniques to inspire new bursts of creative glassblowing. He has played a huge role in the glass renaissance that has swept the world of studio glassmaking, and has affected the course of glass history by helping to raise the international standards of glass craftsmanship.

Examples of Glasswork

Lino Tagliapietra's glasswork can largely be organized under three categories: 2-dimensional works, 3-dimensional works, and sculpture. Below is a sampling of his glasswork.

(Note: The educator guide includes a sampling of Tagliapietra's art in order to showcase the breadth of his glasswork. However, the exhibit includes only examples of his *Goblets*, a traditional Venetian form taken to a new level.)

Goblets

Dragon Stem Goblet

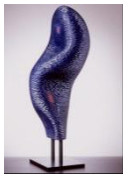
Serpent Stem Goblet

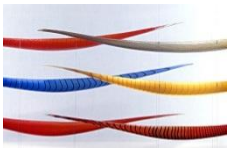
Goblet

Floral Goblet

Sculptures


Natoalos Series


Sveva


Endeavor Series

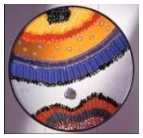

Saturno Series


Ala Series

2-dimensional works


George


Genesis III


Pitagora

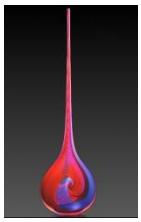

Bisanzio


Central Park


Medusa

3-dimensional works


Bilbao Series


Angel Tear Series

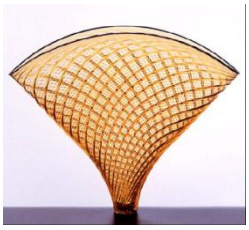

Tholtico Series

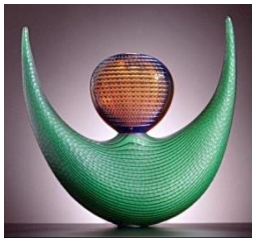

Coinbra Series


Penguino Series


Anatra Series


Gallo Series


Sunda Series


Batman Series


Riverstone Series

Vittorio Costantini

Biography

Vittorio Costantini was born in 1944 on the island of Burano, situated in the lagoon of Venice, Italy. He came from a modest background, living off of the income made by his fisherman father and lace maker mother. Like Lino Tagliapietra, Costantini began apprenticing to be a glass artist at the age of 11, working in a nearby glass factory. He worked very long days in the factory, and retired in the evenings to the hobby he felt most passionate about—lampworking, also known as flameworking or torch working. Lampworking is a type of glasswork where a torch or lamp is primarily used to melt the glass. Once the glass is in a softened state, the glass can be easily manipulated by blowing and shaping dwith tools and hand movements.

Costantini now owns and operates his own workshop in Venice. His passion continues to be lampworking, and he fuses his lampwork mastery, love for art, and appreciation of nature to create beautiful glass insects, birds, fish, and flowers. Costantini is an avid nature observer, scrutinizing the anatomy of his creatures, as well as studying their habitats and life cycles, in order to create incredibly realistic looking creations. In the past few years, Costantini has dedicated his life not only to creating his beautiful glasswork creatures, but also to teaching and demonstrating his craft to others.

Examples of Glasswork

Vittorio Costantini is known for his meticulous study of nature and the creatures that live in it. He uses his research to inform his glass insects, birds, and fish. Below is a sampling of some of his glasswork.

Carduelis

Coleoptera Lucanidae

Praying Mantis

Hermit Crab

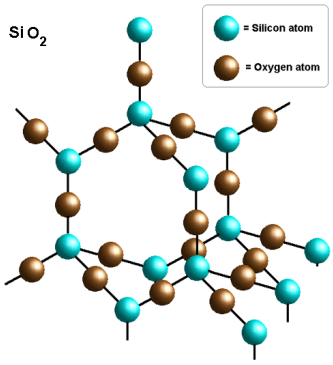
Tropical Fish

Busy Bees

Orchids

Seahorses

The Science of Glass

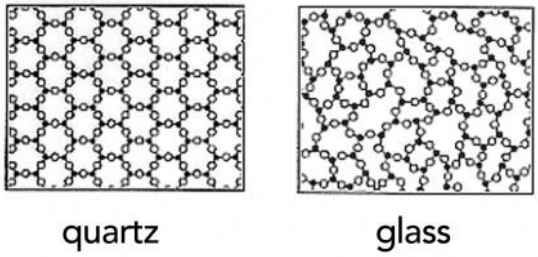


Simplified model of a lattice of silicon dioxide molecules.

There are traditionally three phases of matter: solids, liquids and gases. Glass is a unique substance, in that it is neither a liquid nor a solid, but shares the qualities of both. For this reason, scientists disagree about whether glass should be considered an "amorphous solid," a "super cooled liquid," or a third category of materials.

So, what exactly *is* glass? Glass is a rigid material formed by heating a mixture of dry materials to a viscous state, then cooling the ingredients quickly enough to prevent a regular crystalline structure from forming. As the glass cools, the atoms become locked in a disordered state, like a liquid, before they can form in the perfect crystal arrangement of a solid.

The principal ingredient in all types of glass is *silicon dioxide* (SiO_2). Silicon dioxide consists of a central silicon atom bonded with two oxygen atoms. Many solid materials are crystalline. This means that their molecules group together in a regular pattern. Glass is a non-crystalline substance. Its molecules do not group together in regular, repeating patterns. For all practical purposes, glass behaves like a solid at normal temperatures, but its irregular molecular organization is similar to that found in liquids. This irregular or "disorganized" structure gives glass special thermal properties.



Quartz and glass are both made of silicon dioxide. Glasses have the mechanical rigidity of crystals, like quartz, but the random disordered arrangement of molecules that characterizes liquids. Due to the arrangement of the molecules, glass is not as hard as quartz, about 6-7 and 7 on Moh's scale of mineral hardness, respectively.

Crystalline substances melt at specific temperatures. Ice, for example, melts and becomes liquid at 32 °F. It does not soften gradually. Glass, unlike a crystalline material, softens gradually as the temperature is increased. Eventually it can be poured much like a thick liquid. It can even be blown into bubble-like forms using a blowpipe. It is the ability to soften gradually that allows glass to be manipulated in diverse ways and formed into both commercial objects and works of art.

How is Glass Made?

There are many different kinds of glass, some of which are man-made and some of which occur naturally. Obsidian (volcanic silicate glass), fulgurites (sand that has been vitrified by a lightning strike), and moldavites (green glass likely resulting from meteorite impacts) are examples of glass which occur in nature. Some examples of man-made glass are borosilicate glass (e.g. Pyrex), fused quartz, polystyrene, and soda-lime glass, which is the most prevalent type of glass, used for windowpanes and glass containers for beverages, food and some commodity items.

Obsidian

Moldavite

In order to make man-made glass, three raw materials are required: a former, a flux, and a stabilizer. A former is the main component of glass, which has to be heated to a very high temperature to become viscous. Silicon dioxide is the most common former. A flux helps formers melt at lower temperatures. The most common types of flux used is soda ash or potash, which is traditionally made from marine plant ashes or by burning trees. The stabilizer keeps the finished glass from dissolving, crumbling or forming unwanted crystals. A common stabilizer is calcium oxide.

Fulgurite

The raw materials are weighed carefully and mixed together—this is called the "batch,"mostly made of sand with a couple of other chemicals added. Soda ash acts as a flux to lower melting the melting temperature of sand. Lime acts as a stabilizer to make the finish of glass less water soluble. The batch is placed in a furnace at about 2400°F, and takes several hours to melt. Sometimes, broken glass called "cullet" is added to the batch to aid the melting process. After the batch has cooked for a few hours, the chemical reactions are still taking place. One of their byproducts is gas. After an additional 6 hours or so of cooking, chemical reactions finish, de-gassing ceases, and the glass winds up being perfectly bubble free.

If a glass artist desires to change the color of the glass, they can do so by adding metallic oxides to the batch. Depending on which metallic oxides are added to the batch, the glass artist can achieve a whole spectrum of colors. Adding iron to the batch makes the glass green. Copper turns the glass a light blue, while cobalt turns the glass a rich, dark blue. Gold colors the glass a deep red. Manganese dioxide can either de-colorize colored glass, if used in small amounts, or create glass that appears purplish black, if used in higher amounts. A glass artist can also add color to glass by rolling frit (tiny chips of colored glass) on the outside of a piece, painting the glass, or even applying gold leaf to the surface of the glass.

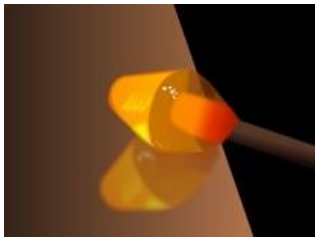
The Hot Shop

Glassblowing artists work as a team, or alone, in a "hot shop," which is an apt name, given that the workshop truly is very hot! A hot shop is the art studio where the glass artists blow glass and create their beautiful pieces. A gaffer serves as the team leader and is the principal glassblower who directs the glassblowing process. To learn more about the glassblowing process, read on!

The Glassblowing Process

Dale Chihuly and Lino Tagliapietra use glassblowing to create their pieces. Glassblowing is an intricate, multi-step process, which begins once the glass is melted in the furnace and de-gassed. Below is a list of the main steps in the glassblowing process:

1. **Gathering**
   A 5 ft blow pipe is inserted into the furnace containing the molten glass. The blowpipe is slowly rotated and molten glass collects on the end of the blowpipe, steadily and evenly. It can be tricky gathering glass, as the molten glass has a honey-like consistency and can easily drip off of the end.



2. **Marvering**
   Once the glass is gathered, it must be formed into a symmetrical, cylinder-like shape on a marver, or steel table. As the glass moves across the marver, heat is transferred from the glass to the table, and the glass cools off slightly. If the glass cools off too much, and the glass becomes too thick at the bottom, it can be transferred to the "glory hole" (an oven that reheats the glass to make it malleable) and go through the marvering process again.

3. <u>Blowing</u>

The glass blower blows into the pipe to create a small air bubble inside the glass. This gather and bubble is called the parison. There is actually a fine art to blowing air into the glass, as too much air will make the piece too thin, while too little air will cause the piece to be too thick. Once a symmetrical bubble is achieved, the glass artist will marver and gather more glass, remembering to constantly rotate the blowpipe as he works. The number of gathers a glass blower takes is dependent on how large he wants the final glasswork to be. Smaller glasswork requires fewer gathers, while larger glassworks require more.

4. <u>Using the Glory Hole</u>

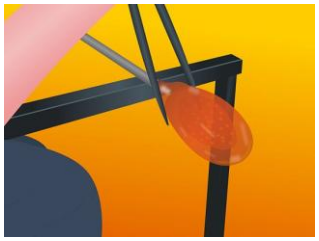
The glory hole is an oven that reheats the glass to make it malleable, and typically stays at about 2200°F. The glory hole is used repeatedly throughout the glass blowing process to reheat a piece in between steps.

5. <u>Coloration</u>

There are several ways that glass is traditionally colored. One way is by wrapping a piece of colored glass, called a bit, around the outside of the piece. Another, more popular, method is to roll the outside of the glass in frit (tiny chips of colored glass). The blowpipe is then re-inserted into the glory hole (a high heat oven used in the glassblowing process), and the frit and glass melt into one object. Sometimes, gold leaf is applied to glass as a surface decoration.

6. <u>Shaping Your Piece Into a Bullet</u>

After several gathers, it is time to shape the glass! At this stage in the process, rather than use a marver, the glass blower will traditionally use either a wooden block soaked in water, or wet folded newspaper to shape hot glass. The glass blower shapes the glass into a bullet, and then re-inserts the parison into the glory hole, remembering to rotate the blowpipe constantly.



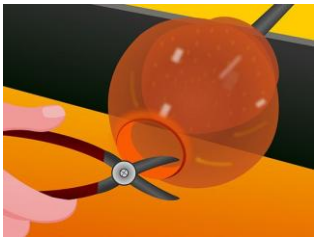
7. <u>Jacking</u>

After the final gather, it is essential that the artist prepares the glass to eventually be removed from the blowpipe. The artist does this by using a pair of jacks (sharp tongs with a flat handle, used for many different glasswork tasks) to create a score line in the neck of the piece.

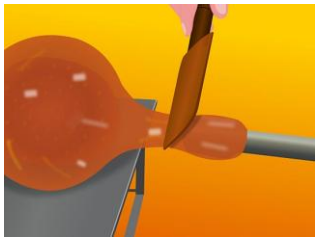
8. <u>Finishing the Piece and Transferring to the Punty</u>

Once the temperature of the glass is even, and the neck is defined, the artist can begin to blow and shape the glass into the desired final shape. Using the flat handle of the jacks, the artist will flatten the bottom of the piece so that it can sit sturdily when completed. To finish the piece, the glasswork must be transferred to a punty (a thin, solid, steel rod) so that the artist can work on

the lip of the piece. A small gather is taken on the punty, and then the gather is marvered. This gather acts as a joiner for the punty and the glasswork. Once the punty is attached to the piece, the glasswork will have two rods attached to it, on either end of the piece. To remove the glass from the blowpipe, the artist dips a file in water, and then etches a line around the neck of the piece, making the glass brittle and easy to remove from the blowpipe.



9. **<u>On the Punty</u>**
   The artist can now reheat the glass in the glory hole, to soften it up a bit, and trim the lip with shears. At this stage, the artist can also manipulate the opening of the piece and create their desired shape and design.



10. **<u>Knocking off the Piece</u>**
    The glasswork can now be removed from the punty rod by using a wooden block to tap the seam between the punty rod and the bottom of the glasswork, causing the piece to fall off.

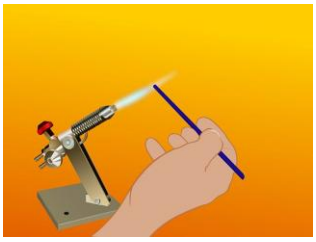
11. **<u>In the Annealer</u>**
    The final step in the glassblowing process is to allow the piece to cool at a controlled rate in an annealer. An annealer is an electric oven that sits at around 900°F, keeping the piece from cooling too quickly. After a few hours, the annealer begins to slowly decrease its temperature, until the glass is stable enough to sit in a normal room environment.

Lampworking

Vittorio Costantini uses a different method to create and shape his glass insects: lampworking. Lampworking is a process by which small glass creations are manipulated over a small torch. Below are the main steps in the lampworking process:

1. Turning on the Torch and Heating the Mandrel

There are different kinds of table top torches, though the most commonly used ones for glasswork are oxygen and propane fed torches. A bench burner is a torch that is fixed to the bench and provides a stationary flame. A hand torch allows for more maneuverability of the flame and is more commonly used. The mandrel is a specially-coated steel tool which holds molten glass.

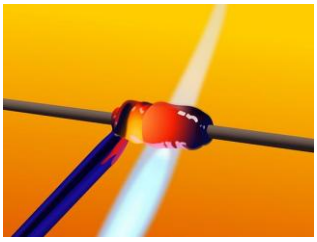


2. Priming the Glass

The glass is "flashed" for about 30 seconds, a process which prevents the glass from going into shock and shattering.

3. Glass Meets Flame

Once the glass has been primed, the glass artist introduces the glass slowly to the heart of the flame. A bright orange ball forms on the tip of the glass. The glass artist is careful to keep rotating the glass so that the orange ball maintains its round shape.



4. Attaching Glass to the Mandrel

When the glass is molten, it can easily be gathered on the mandrel. The glass artist coats the mandrel with glass, removing the glass from the mandrel by inserting both the glass and the mandrel into the flame and cutting the glass away.

5. Removing the Mandrel and Shaping the Piece

Using a graphite paddle, the glass artist shapes the glass he has gathered on the mandrel. The paddle is used to manipulate the glass into many shapes.

6. Cool

The glass artist allows the glass to cool on the mandrel before placing it in the annealer to cool off uniformly.

Key Vocabulary

Below is a list of terms which will be useful for your students to know prior to visiting the exhibit:

Annealer – an electric oven that keeps glass pieces from cooling too quickly.

Armature – metal structure, often steel, on which glass pieces are hung.

Batch - carefully weighed and mixed raw materials which are melted to create molten glass. The batch usually consists of sand with a couple of other chemicals added to it.

Blow Pipe - a long tube by means of which molten glass is blown into the desired shape.

Cullet – broken glass which is added to a batch to aid the melting process.

Flux – helps formers melt at lower temperatures. The most common type is soda ash or potash.

Former – the main component of glass, which has to be heated to a very high temperature to become viscous. The most common type of former is silicon dioxide.

Frit – tiny bits of colored glass which are applied to the outside of a piece of glass by rolling.

Gaffer – the team leader and principal glass blower in a hot shop.

Gathering - the process of collecting molten glass onto the end of a blowpipe.

Glass – a hard, brittle substance, typically transparent or translucent, made by fusing sand with soda, lime, and sometimes other ingredients. The main ingredient in glass is silicon dioxide.

Glory Hole – an oven that reheats the glass to make it malleable, and typically stays at about 2200 ° F.

Goblet – a drinking glass with a foot and stem.

Hot shop - the studio workshop where glass blowers create their artistic pieces.

Jack – sharp tongs with a flat handle that are used for shaping, opening the lip, and applying bits on glass, among various other activities.

Macchia – means “spotted” in Italian and refers to a particular glass form designed by Dale Chihuly. The interior and exterior of the vessels are typically different colors, with the outside usually being spotted. The lip of the form is often a bright, contrasting color.

Maestro – name given to the Italian glass “masters.”

Mandrel – specially coated steel tool which holds molten glass in the lampworking process.

Marver – a tool used in glassblowing, generally made of a polished steel surface.

Marvering – the process of creating a smooth and even cylinder-like shape of glass, as well as cooling the outside skin of the glass, by rolling the glass on top of a steel table.

***Metallic Oxides* –** metal ores used to color glass. Common metallic oxides are copper, iron, and gold.

***Parison* –** an unshaped mass of glass, before it is molded into its final form.

***Pontil Mark* –** or "punt mark," is the scar where the punty was broken from a work of blown glass.

***Punty Rod* -** a solid metal rod used to transfer and hold glass when working with a glory hole.

***Putti* –** (singular "putto") is a figure in a work of art depicted as a chubby male child, usually nude and sometimes winged. Putti are distinct from cherubim. While cherubs represent the second order of angels, putti are secular and present a non-religious passion.

***Stabilizer* -** keeps the finished glass from dissolving, crumbling or forming unwanted crystals.

***Venetian* –** refers to a type of glass object made in Venice, Italy, primarily on the island of Murano. It is world renowned for being colorful, elaborate, and skillfully made.

Class Project Ideas

Below are a sampling of pre and post visit project ideas to facilitate with your class in order to aid their understanding of the exhibit, the glassblowing process, and the artistry of the glass pieces by Chihuly, Tagliapietra and Costantini.

Pre Visit Ideas

Collecting Like Chihuly

Description:

Chihuly is an avid art collector, collecting many different kinds of objects for his personal art collection, from birdhouses and canoes to musical instruments and motorcycles. Chihuly is particularly fond of Native American art, and his own glasswork has been influenced by Native American design elements. In this activity, students will share their own collections with their peers, and create a drawing inspired by their collection.

Materials:

Sketch pad
Pencils
Student collections
Long table

Instructions:

1. Tell the students that you will have a "show-and-tell" day. Students are encouraged to bring in their collections and share information about their possessions with the class.
2. During the show-and-tell portion of class, students should focus on the following:
   - Describe your collection to the class.
   - Why is your collection important to you?
   - What does your collection reveal about your personality and individual interests?
3. After all of the students have had a chance to share their collections with the class, have them display their collections on a long display table, which will be on display for the rest of the week[1]. Tell the students that the table represents their class "museum," since a museum is just a place where objects of historical, scientific, cultural or artistic interests are stored and exhibited. Have the students write a label for their displays, making sure to include the following information:
   - Name of Collection
   - Student Name
   - Year Collection Created
   - Description of Collection
4. Tell the students that museums are places that inspire people. Using your class "museum," you will create a drawing inspired by the collections on display, similar to how Chihuly uses his personal collection to inspire his glasswork. Give each student a sketch pad and pencil, and have them draw a picture inspired by either their own collection or one of their peers. Here are some examples you can share with the students, to help give them some ideas of what to draw:
   - A collection of seashells could translate to a drawing of a seashell necklace or a landscape of the seashore.

[1] Note: If a collection is valuable it should be displayed photographically.

- A collection of baseball cards could translate to a drawing of a unique team uniform or a day at the ballpark.
- A collection of teddy bears could translate to a portrait of a real bear in its natural environment.

5. Once the students have finished their drawings, have them share the drawings with the class.

Museum Connection:
When the students visit the *Chihuly and Friends* exhibit at the museum, they will notice outside influences that have informed and shaped the artists' glasswork. For example, Chihuly's love of the sea is manifest in the sea life glass forms present in the *Laguna Murano Chandelier*. Have the students search for other such examples in the exhibit.

Laguna Murano Chandelier

Detail: *Laguna Murano Chandelier*

Painting Like Chihuly

Description:
Drawing and painting are an important part of the artistic process for Chihuly. Before beginning a glass piece, Chihuly draws a design which helps communicate his artistic vision for a piece to his glassblowing team. Chihuly is also an advocate of "action painting," which was popularized by the artist Jackson Pollock. In action painting, an artist spontaneously dribbles, smashes and smears paint onto a canvas, rather than carefully apply the paint. These paintings help Chihuly to lose himself in artistic thought and brainstorm new potential forms for glass. In this activity, students will create their own action paintings, mimicking the technique Chihuly uses to create his colorful paintings.

Materials:
Dropcloth
Large sheets of paper
Brayers (rollers)
Tempera paint
Containers for holding paint
Straw Broom
Paint Brushes
Puffy Paint (see recipe below)
Squeeze bottles (to store puffy paint)

Puffy Paint Recipe:
Combine equal parts salt, flour and hot water. Stir until combined. Add enough powder tempera to the mixture to create a thick, paint-like consistency. Add more water if the mixture is too thick, or more salt and flour if the mixture is too thin. Pour the mixture into squeeze bottles.

Instructions:

1. Cover your work surface with a drop cloth. This activity will be messy, so you will want to make sure that you protect the surface you are working on.
2. Give each child a large piece of paper, brayer and tempera paint. Have the students apply a thin layer of tempera paint all over the surface of the paper.

3. The students will now apply a second layer of paint onto the first layer. However, instead of using a brayer, they will use a straw broom to apply the second layer.

A student applies the second layer of paint using a straw broom.

Chihuly using a straw broom to apply paint to one of his paintings.

4. The students will then apply a third layer of painting using a "splatter" technique. The students can dip a paintbrush in paint, then flick their wrist to make splatters of paint on the surface of their paper.

5. The fourth layer of paint will be the "puffy paint," applied directly from the squeeze bottles. Once the students are satisfied with their piece, allow the paintings to dry overnight.

Examples:

Chihuly's paintings

Student samples

Museum Connection:
Some of Chihuly's drawings will be on display in the *Chihuly and Friends* exhibit. Encourage the students to analyze the drawings. Do any of the glass pieces remind them of the subjects in the drawings? How can you use drawing as a precursor to actually designing a three-dimensional piece of art?

Chocolate Art

Description:
We all have experience with the states of matter: liquid, solid, and gas. One of the reasons that glass works well as a sculptural medium is that it can be made into many different forms. Glass can be solid when cool or liquid when hot. Students will gain an understanding of how glass can be melted, shaped and cooled to a final form, by drawing a loose comparison with the process of melting chocolate and creating a sculptural form with candy molds.

Materials:
Microwave
Microwavable bowl
Heat proof rubber spatula
Chocolate chips
Candy molds
Thermometer
Popsicle Sticks

Honey Gathering!
Molten glass has a honey-like consistency and can easily drip off the end of a blow pipe. Mimic the glass gathering process by gathering honey on a honey dipper. Challenge students to slowly rotate the honey dipper and not let any fall!

Instructions:

1. Review the states of matter with the students. One of the most familiar, and easy to understand example of the phases of matter is water. Water is generally liquid when at a temperature between 33 °F and 211 °F . If the students have ever gone swimming, drunk lemonade, or been caught in a rainstorm, they have experienced water in its liquid state. However, if water falls below 33 °F, it will change from liquid water to solid water, or ice. If water goes above 211 °F, it will change from liquid water to water vapor, or a gas. If the students have ever seen what appears to be "smoke" coming off of the top of a boiling pot of water or tea kettle, they are actually looking at tiny liquid droplets.
2. After reviewing the states of matter, talk with the students about how glass can change from a solid to a liquid as well (though arguably an "amorphous," or non-crystalline solid). When glass is melted in the furnace, it turns into a honey-like, viscous liquid. As the molten glass cools, it becomes solid. Chocolate acts in a similar way when heated. The melting point of chocolate is between 86 °F and 90 °F. When chocolate is heated to this temperature range, it will turn from solid chocolate to liquid chocolate. When allowed to cool, the chocolate will return to a solid shape.
3. Help students investigate what happens when chocolate chips that appear solid at room temperature are heated. Have them use thermometers to record temperatures of the chocolate as it melts and record their observations. Pour the chocolate into molds and insert popsicle sticks as it hardens. Students can eat the outcomes of their investigation!
4. Draw a parallel between the chocolate mold making process and the glass making process. Some glass artists actually use molds specially made for molten glass, to create their artistic creations.

Example:


Liquid chocolate


Star candy mold


Solid star shaped chocolates

Post Visit Ideas

Sculpture inspired by the *Laguna Murano Chandelier*

Description:

The largest glass blown work on display in the exhibit is the *Laguna Murano Chandelier*. It is a Neo-baroque design of individually blown and sculpted glass elements. It was created by the artist Dale Chihuly in collaboration with Pino Signoretto and Lino Tagliapietra. The work is approximately 1,500 square feet and includes five separate elements – two suspended from the ceiling and three which rise from the floor. The chandelier is made of Chihuly's trademark anemone shaped glass pieces and fantastical sea creatures, foliate masses, mermaids and kings, all made in glass. In this activity, students will have the chance to create their own sculptures, inspired by the *Laguno Murano Chandelier*.

Materials:

Model Magic
Small plates
Silly straws in assorted colors
Small bowls (for holding the straws)

Watch the installation of "Laguna Murano!" http://www.youtube.com/watch?v=t-pjrh1FQJM

Instructions:

1. Show the students pictures of the *Laguna Murano Chandelier*, as well as some images of other Chihuly sculptures that have anemone shaped blown glass. Some examples are below:

Dale Chihuly's *Laguna Murano Chandelier*

Dale Chihuly's *Fireworks of Glass*

Dale Chihuly's *Anemone Wall*

2. Tell the students that they are going to create their own sculpture, inspired by Chihuly's *Laguno Murano Chandelier*. The chandelier has many anemone shaped "arms" which resemble tentacles. The students will not work with actual glass, but rather silly straws in assorted colors, that have a similar aesthetic to Chihuly's glass anemones. Cut the straws into various lengths, and sort them in bowls by color.

3. Give the students a plate and a lump of Model Magic. Have the students roll the play dough into a ball, and place the ball on top of the plate. Instruct the students to insert straw pieces into the play dough. They can use as many pieces as they wish, and arrange the straws in any configuration that is visually appealing to them. Explain to the students that when Dale Chihuly creates similar works of art, he uses metal armature with rods coming off of it. After the students complete their sculptures, allow the Model Magic to air dry, and then have the students share their creations with the class. You can even create your own Chihuly inspired exhibit for the whole school to enjoy!

Glass team installing *Fireworks of Glass* on steel armature

Completed installation

Examples:

Nested Baskets

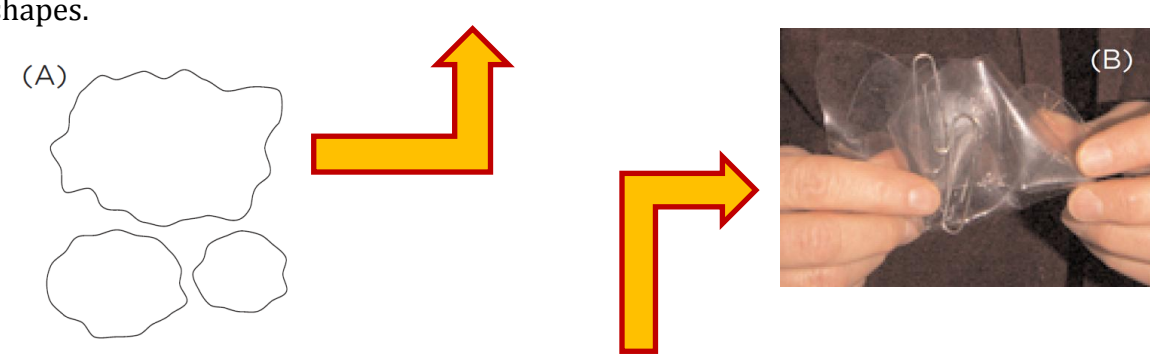
Description:
While at Pilchuck Glass School, Dale Chihuly began creating glass forms in basket shapes. In the beginning, he would make single baskets. Later on in his career, he began creating baskets of various sizes, nesting them inside each other. In this activity, students will create a piece of art which resembles Chihuly's *Baskets*, though instead of using glass, they will use a material called "dura-lar."

Materials:
Dura-Lar clear polyester film (0.015" thick, extra heavy, 18" x 24" sheets)
Porcelain paint (such as "Pebeo Porcelaine 150 paint) in assorted colors
Sharpie oil-based paint markers
Paint brushes
Scissors, craft knife or paper cutter
Hot plate
Stock pot
Hot water
Paperclips
Waterproof heat safe gloves
Tongs

Watch a tutorial for this project:
http://www.youtube.com/watch?v=nNWolQWLrAA

Instructions:

1. Cut the Dura-Lar into pieces that are approximately 5" x 7" long. Cut enough pieces of Dura-Lar so that each student can have two pieces.
2. Fill a stock pot half way with water, and place on a hot plate. Bring the water to a temperature of about 200 ° F, but be careful not to allow the water to get to boiling, as boiling water can melt the Dura-Lar and release harmful fumes.
3. Have the students cut their Dura-Lar into three irregularly shaped pieces, as pictured below (A). Instruct the students to use one whole 5" x 7" sheet of Dura-Lar to create the largest irregular shape, and their second piece of Dura-Lar to create two smaller irregular shapes.

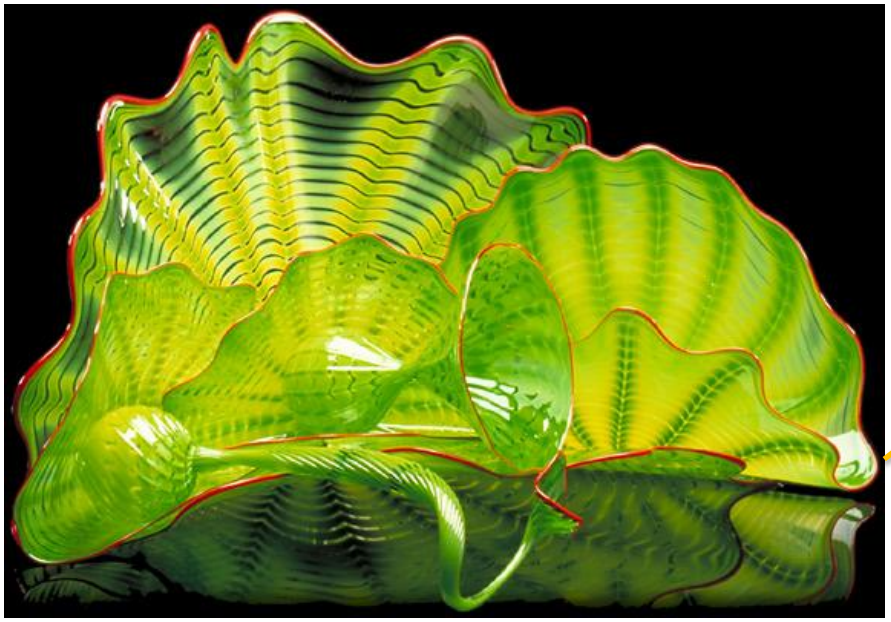


4. Have the students fold their Dura-Lar pieces into conical shapes and secure them with paperclips (B). Place the Dura-Lar pieces into the hot water for 30-45 seconds and remove them using heat safe gloves and a pair of tongs. Allow the water to drain completely from the Dura-Lar.
5. Remove the paperclips from the Dura-Lar sheets. Open the Dura-Lar form, and if it is too tightly closed, dip the bottom of the piece into the hot water to create a bowl shape (C).
6. Paint the back surface of the Dura-Lar baskets with the porcelain paint. You want to paint the back side since it will make the basket appear glossy from a top view. Once the

PEORIA RIVERFRONT MUSEUM

paint has dried, carefully define the shape by running a sharpie marker along the edge of the piece. Nest the baskets inside of each other, to mimic Chihuly's nested baskets.

Examples:



Nested baskets from Chihuly's *Persian* series.

Student art samples .

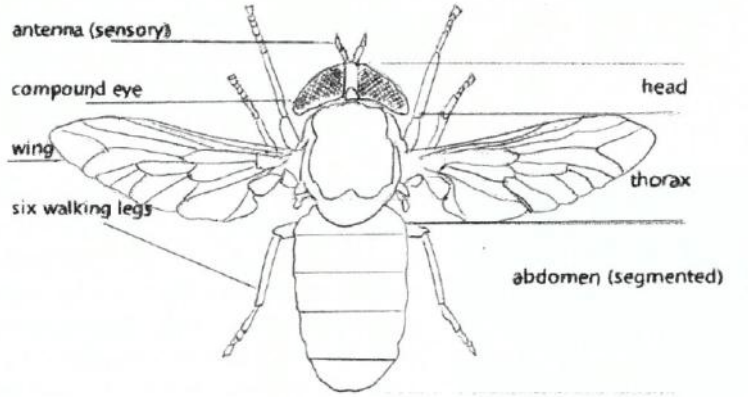
Clay Insects

Description:
After seeing Vittorio Costantini's magnificent glass insect collection in the exhibit, the students can try their hand at creating insect sculptures in miniature. Lampworking requires great attention to detail, and the students will create an insect sculpture which gives them a little insight into how challenging it would be to create realistic looking sculptures on a small scale. While Costantini uses glass, the students will use air dry clay.

Materials:
Air-dry clay or Fimo ® polymer clay
Toothpicks
Small plates
Images of insects as a guide

Instructions:

1. Review the parts of an insect with the students. To be considered an insect, it must have a head, thorax, abdomen, compound eye, two antennae, and three pairs of jointed legs attached to the thorax. Insects are part of the animal kingdom, and there are more than a million species of insects that we know of. Insects make up half of all known living animals!



2. Give each student a plate, air-dry clay in assorted colors, and a toothpick. Instruct the students to select an image of an insect they would like to re-create. Help the students assemble their insect using the different colors of clay. The toothpick might prove helpful in developing small parts of the insect in clay, such as the antennae or legs.
3. For a creative spin on the insect design, students can even create their own insect, as long as they make sure to have the requisite parts of an insect. Allow their final creation to air dry, and then have the students share their creations with their class.
4. Engage the students in a post project discussion comparing their clay insects with Vittorio Costantini's glass insects. How do their creations compare and contrast with those of Costantini's? What are the challenges of working in miniature? Is it difficult to achieve a life-like insect? *(Note: Not all of Costantini's insects have the legs coming out of the thorax!)*

Examples:


A glass beetle made by Costantini


Student clay insect examples


Student clay insect examples

Resources

Recommended Books:

Book	Description
A Day in the Life of a Colonial Glassblower by J.L. Branse	Details the intricate and ancient process of glassblowing and its importance in colonial America. The story follows Karl and Fritz as they create finely blown glass. Ages 5 and up.
Elena's Serenade by Campbell Geeslin	Who ever heard of a girl glassblower? In Mexico, where the sun is called *el sol* and the moon is called *la luna*, a little girl called Elena wants to blow into a long pipe and make bottles appear, like magic. Join Elena on her fantastic journey to Monterrey, home of many great glassblowers, in an enchanting story filled with magical realism. Ages 3 – 7.
Glass by Steve Parker	A study of glass, examining where it comes from, and how it is extracted, purified, designed, manufactured and recycled. It explores the properties of glass and the technologies used to shape it into products used in everyday life. Ages 7 and up.
Chihuly Art Kit Activity Book by Dale Chihuly	Young readers will learn how glass master Dale Chihuly and his team create amazing pieces of art. They will get a chance to follow along to learn about the inspiration for some of his ideas. Then they can try the activities and put these ideas into action. Ages 9 and up.
The Essential Dale Chihuly by William Warmus	This book offers a succinct, hip, and panoramic view of Dale Chihuly's work, focusing on the artist's life and work. The book includes fresh anecdotes, both professional and personal, and concise sidebars on major players and cultural movements that shaped Chihuly's glass. Ages 9 and up.
Materials: Glass by Cassie Mayer	This books teaches very early readers about glass. It will introduce children to this exciting material, using simple, repetitive text. Readers will learn how glass is made, what it is made of, and how it is used. Different objects made of glass are discussed, and readers learn that class can be recycled. Ages 3 and up.
Looking at Glass Through the Ages by Bruce Koscielniak	Glass is everywhere: the mirror where you brush your teeth in the morning, the test tube in your science class, and your cup of juice on the dinner table. But what do you really know about it? This book travels all the way back to ancient Egypt, where glass was first used, and spans the globe and thousands of years to see glass's use expand from small pots, to bottles, cathedral stained-glass windows, telescope lenses and much more! Ages 7 and up.

Recommend Websites:
Want to learn even more about glass and glass artists? Explore the glass world on-line!

Website URL	Description
http://www.chihuly.com/	Dale Chihuly's official website, containing an artist biography, detailed information about his glass series, drawings, and installations.
http://www.linotagliapietra.com/	Lino Tagliapietra's official website, containing an artist biography, images of selected works, personal photographs and an exhibition schedule.
http://www.cmog.org/bio/lino-tagliapietra	Videos and images of Lino Tagliapietra at work in the Corning Museum of Glass.
http://www.vittoriocostantini.com/	Vittorio Costantini's official website, containing an artist biography, virtual gallery of selected works, videos, and information about upcoming events.
http://www.cmog.org/bio/vittorio-costantini	Videos and images of Vittorio Costantini at work in the Corning Museum of Glass.
http://www.wikihow.com/Blow-Glass	"Wiki How" page offering detailed steps, with images, of how to blow glass and do lampworking.
http://www.glassblowing.com/hotglass/index.php4	Detailed information about the history of glassblowing and the glassblowing process.
http://www.childrensmuseum.org/themuseum/fireworks_ofglass/games/glass_blowing/index.html	Created by the Children's Museum of Indianapolis, this virtual game teaches students about the glassblowing process and allows them to create their own virtual glass piece.
http://www.childrensmuseum.org/themuseum/fireworks_ofglass/games/hotshopForWeb/index.html	Created by the Children's Museum of Indianapolis, this virtual game allows students to explore an actual hot shop, and learn about the tools used by the glass blowing team.
http://www.cmog.org/article/what-is-glass	The Corning Museum of Glass, one of the nation's premier glass art museums, offers a variety of resources to understand the science of glass, how glass is made, a glass dictionary, and much more!

Academic Standards Supported by Exhibit

Illinois Learning Standards for Fine Arts:

Grade	Standard	Example of how to relate to exhibit
Early elementary	25.A.1d – Identify the elements of line, shape, space, color and texture; the principles of repetition and pattern; and the expressive qualities of mood, emotion and pictorial representation.	Using the language of the arts, talk about the glass forms and drawings on display. Do the colors of the glass pieces evoke any specific emotions?
Early elementary	26.A.1e – Identify media and tools and how to use them in a safe and responsible manner when painting, drawing, and constructing.	Prior to visiting the exhibit, review the educator guide with your students. What special tools do glass artists use to create their artwork? What dangers exist in a hot shop?

Early elementary	26.B.1d – Demonstrate knowledge and skills to create visual works of art using manipulation, eye-hand coordination, building and imagination.	Conduct one or more of the post visit activities from the educator guide. What do you learn about the glassmaking process by creating your own pieces of art inspired by the works on display?
Late elementary	25.A.2d – Identify and describe the elements of 2- and 3-dimensional space, figure ground, value and form; the principles of rhythm, size, proportion and composition; and the expressive qualities of the symbol and story.	Use the language of the arts to compare/contrast the 2- and 3-dimensional art in the exhibit.
Late elementary	25.B.2 – Understand how elements and principles combine within an art form to express ideas.	Analyze how Dale Chihuly, Lino Tagliapietra, and Vittorio Costantini used their art to convey a message or idea.
Late elementary	26.B.2d – Demonstrate knowledge and skills to create works of visual art using problem solving, observing, designing, sketching and constructing.	Conduct one or more of the post visit activities from the educator guide. What did you learn about the glassmaking process by creating your own pieces of art inspired by the works on display?
Middle/Junior high school	25.A.3d – Identify and describe the elements of value, perspective and color schemes; the principles of contrast, emphasis and unity; and the expressive qualities of thematic development and sequence.	Use the language of the arts to discuss and analyze the 2- and 3-dimensional works on display in the exhibit.
Middle/Junior high school	25.B.3 – Compare and contrast the elements and principles in two or more art works that share similar themes.	Compare and contrast groupings of artwork in the exhibit. For example, first discuss the *macchia*, then move on to *Venetians*, and finally, discuss the *goblets.* Discuss what the groupings have in common.
Middle/Junior high school	26.A.3e – Describe how the choices of tools/technologies and processes are used to create specific effects in the arts.	Compare and contrast the artistic styles of Dale Chihuly, Lino Tagliapietra, and Vittorio Costantini. What tools and technologies did the artists use for their particular artwork, and what defining features result?
Middle/Junior high school	26.B.3d – Demonstrate knowledge and skills to create 2- and 3-dimensional works and time arts (e.g., film, animation, video) that are realistic, abstract, functional and decorative.	Conduct one or more of the post visit activities from the educator guide. What did you learn about the glassmaking process by creating your own pieces of art inspired by the works on display?
Middle/Junior high school	27.A.3a – Identify and describe careers and jobs in and among the arts and how they contribute to the world of work.	Review the educator guide with your students. What distinct jobs are there in a hot shop?
Early high school	25.A.4 – Analyze and evaluate the effective use of elements, principles and expressive qualities in a composition/performance in dance, drama, music and visual arts.	Use the language of the arts to discuss and evaluate the 2- and 3-dimensional artwork on display.

Early high school	26.B.4d – Demonstrate knowledge and skills that communicate clear and focused ideas based on planning, research and problem solving.	How do glass artists use problem solving skills to plan and construct a piece? How did Dale Chihuly overcome his physical limitations to continue creating glass pieces?
Early high school	27.B.4a – Analyze and classify the distinguishing characteristics of historical and contemporary art works by style, period and culture.	What defining features characterize the various glass series on display in the exhibit? How do the series compare and contrast?
Late high school	25.A.5 – Analyze and evaluate student and professional works for how aesthetic qualities are used to convey intent, expressive ideas and/or meaning.	Conduct one or more post visit activities from the educator guide. How did the students imbue their own meaning in their creations? What emotions, ideas and meaning do the professional glass artists' work convey? What shaped your inferences?
Late high school	27.A.5 – Analyze how careers in the arts are expanding based on new technologies and societal changes.	Review the educator guide with your students. How have Dale Chihuly, Lino Tagliapietra, and Vittorio Costantini used changing technologies to create their artwork? Was glass art always such a popular art form?

Next Generation Science Standards:

Grade	Standard	Examples of how to relate to exhibit
2	2-PS1-1 – Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.	Investigate the different art forms in the exhibit. How do the glass pieces compare/contrast with Chihuly's drawings? What observable characteristics reveal that the sculptural forms are made of glass?
2	2-PS1-4 – Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.	Before visiting the museum, conduct the "Chocolate Art" activity in this educator guide. Can the chocolate change from solid to liquid to solid? Can you think of any substances that do not share this quality?
5	5-PS1-3 – Make observations and measurements to identify materials based on their properties.	Have students observe the glass forms in the exhibit. What properties do all of the glass forms have in common?
5	5-PS1-4 – Conduct an investigation to determine whether the mixing of two or more substances results in new substances.	Have students review the glass making process, particularly the creation of molten glass using a former, stabilizer and flux. How does the resulting man-made glass differ from the individual ingredients?

Common Core Standards:

A. Mathematics

Grade	Standard	Examples of how to relate to exhibit
K	CCSS.Math.Content.K.MD.A.1 – Describe measurable attributes of objects, such as length or weight. Describe measureable	Discuss the size of the various glass pieces. Estimate the length and weight of glass pieces by comparing them to familiar objects.

	attributes of a single object.	
K	CCSS.Math.Content.K.MD.A.2 – Directly compare two objects with a measureable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference.	Compare and contrast the sizes of various glass pieces. Some glasswork is large in size (such as the *Laguno Murano Chandelier*), while others are very tiny (such as the glass insects).
K	CCSS.Math.Content.K.MD.B.3 – Classify objects into given categories; count the numbers of objects in each category and sort the categories by count.	Have students classify "like" objects together. Identify similar characteristics of goblets versus *macchias* versus glass insects. Count the number of insects on display.
K	CCSS.Math.Content.K.G.A.1 – Describe objects in the environment using names of shapes, and describe the relative positions of these objects using terms such as above, below, beside, in front of, behind, and next to.	Have students identify shapes in the various glass forms on display. Can they find circular, triangular, and rectangular shapes in the glass? Have students describe where they see these shapes in relation to other shapes.
K	CCSS.Math.Content.K.G.A.2 – Correctly name shapes regardless of their orientations or overall size.	Have students identify shapes in the various glass forms on display.
K	CCSS.Math.Content.K.G.A.3 – Identify shapes as two-dimensional (lying in a plane, "flat") or three-dimensional ("solid").	Compare and contrast Chihuly's two-dimensional drawings and three-dimensional glass sculptures. Describe the characteristics of each art form.
K	CCSS.Math.Content.K.G.B.4 – Analyze and compare two- and three-dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts (e.g., number of sides and vertices/ "corners") and other attributes (e.g., having sides of equal length).	Compare and contrast Chihuly's two-dimensional drawings and three-dimensional glass sculptures. Describe the characteristics of each art form. Pay special attention to the size, shape, and orientation of each artwork. How many glass forms does it take to make the *Laguno Murano Chandelier*? Are they all the same size?
1	CCSS.Math.Content.1.NBT.A.1 – Count to 120, starting at any number less than 120. In this range, read and write numerals and represent a number of objects with a written numeral.	The exhibit displays several hundred of Vittorio Costantini's glass insects. Have the students practice counting the number of insects on display. How many *macchia* and *goblets* are on display? Which do we have more of?
1	CCSS.Math.Content.1.G.A.1 – Distinguish between defining attributes (e.g., triangles are closed and three-sided) versus non-defining attributes (e.g., color, orientation, overall size); build and draw shapes to possess defining attributes.	Have students identify shapes in the various glass forms on display. What do all of the circular shapes have in common? Is it possible to have a circle that is not round? Is it possible to have a green circle? What about a red circle?
1	Compose two-dimensional shapes (rectangles, squares, trapezoids, triangles, half-circles, and quarter-circles) or three-dimensional shapes (cubes, right rectangular prisms, right circular cones, and right circular	Visually examine the artwork on display. Explain to the students that just as a triangle placed on top of a square creates the shape of a house*, artists often combine shapes to create new composite shapes. What shapes are used to create Chihuly's 

	cylinders) to create a composite shape, and compose new shapes from the composite shape.	drawings? What shapes can you combine to create a *goblet*?
2	CCSS.Math.2.OA.C.3 – Determine whether a group of objects (up to 20) has an odd or even number of members, e.g., by pairing objects or counting them by 2s; write an equation to express an even number as a sum of two equal addends.	Counting by 2s and by 5s, identify the number of *macchia*, *goblets*, and glass insects on display. Are there an even or odd number of artwork under each category?
2	CCSS.Math.Content.2.G.A.1 – Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces. Identify triangles, quadrilaterals, pentagons, hexagons, and cubes.	Have students identify shapes in the various glass forms on display. Can they find any triangles, quadrilaterals, pentagons, hexagons, or cubes in the glass forms?
3	CCSS.Math.Content.2.G.A.1 – Understand that shapes in different categories (e.g., rhombuses, rectangles, and others) may share attributes (e.g. having four sides), and that the shared attributes can define a larger category (e.g. quadrilaterals). Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories.	Challenge students to find shapes in different categories (e.g. rectangles or triangles) in the glass forms. What attributes do shapes of the same category share? Compare and contrast shapes of different categories in the glass forms.
6	CCSS.Math.Content.6.RP.A.1 – Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.	Visually examine Vitorrio Costantini's glass inects. What is the ratio of insect legs to the whole insect? (6:1)

B. English Language Arts Standards - Literature

Grade	Standard	Examples of how to relate to exhibit
K	CCSS.ELA-Literacy.RL.K.1 – With prompting and support, ask and answer questions about key details in a text.	Explain to the students what an exhibit label is. Have the students choose a favorite artwork, and as a class, read the label out loud. What do we learn about the artwork or the artist from the information on the label?
K	CCSS.ELA-Literacy.RL.K.4 Ask and answer questions about unknown words in a text.	After reading the exhibit label, ask the students if there were any words that were unfamiliar to them. Explain what the words mean.
1	CCSS.ELA-Literacy.RL.1.1 – Ask and answer questions about key details in a text.	Explain to the students what an exhibit label is. Have the students choose a favorite artwork, and as a class, read the label out loud. What do we learn about the artwork or artist from the information on the label?
1	CCSS.ELA-Literacy.RL.1.2 – Retell stories, including key details, and demonstrate	After reading the label, ask students to paraphrase the label in their own words. What

	understanding of their central message or lesson.	was the main message of the label? What does it teach us about the artist and his or her artwork?
1	CCSS.ELA-Literacy.RL.1.5 – Explain major differences between books that tell stories and books that give information, drawing on a wide reading of a range of text types.	Though a label is not a "book," you can explain to the students that a label gives information about the artwork on display in a museum. Compare and contrast a museum label to a favorite childhood book.
2	CCSS.ELA-Literacy.RI.2.2 – Identify the main topic of a multiparagraph text as well as the focus of specific paragraphs within the text.	Explain to the students what an exhibit label is. Have the students choose a favorite artwork, and as a class, read the label out loud. What do we learn about the artwork or the artist from the information on the label? What specific information is revealed in the distinct paragraphs?
2	CCSS.ELA-Literacy.RI.2.5 – Know and use various text features (e.g., captions, bold print, subheadings, glossaries, indexes, electronic menus, icons) to locate key facts or information in a text efficiently.	After reading the exhibit label, identify text features which locate key facts. In particular, see if you can find the title of the artwork, name of the artist, year the artwork was made, and material of the artwork.
2	CCSS.ELA-Literacy.RI.2.6 Identify the main purpose of a text, including what the author wants to answer, explain, or describe.	After reading the exhibit label, determine the key points about the artwork or the artist.
3	CCSS.ELA-Literacy.RI.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.	After reading the exhibit label, ask questions regarding the label's content in order to assess the students' understanding.
4	CCSS.ELA-Literacy.RL.4.1 – Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.	Explain to the students what an exhibit label is. Have the students choose a favorite artwork, and as a class, read the label out loud. What do we learn about the artwork or artist from the information on the label?
4	CCSS.ELA-Literacy.RL.4.2 – Determine a theme of a story, drama, or poem from details in the text; summarize the text.	What is the main message of the exhibit label? Have students summarize the key points of the label and share with their peers.
5	CCSS.ELA-Literacy.RL.5.4 – Determine the meaning of words and phrases as they are used in a text, including figurative language such as metaphors and similes.	Have students read the exhibit labels and use context clues to figure out the meaning of key words and phrases. What does the text reveal about the artwork on display or the artist who created the work?

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