



## **Creative Advantage Sample Lesson Plan**

### **Flameworking**

**8 sessions, 2 hours per class, 16 hours total**

**Integrated subject: Science**

### **Course Description:**

Students learn to manipulate hot glass and fire to create beads, marbles, flowers, bugs, burgers and other small sculptural objects. Students will melt rods of glass in a propane-oxygen flame, wrap the molten glass onto a metal mandrel (rod), and use heat and gravity to shape a bead. Safety, creativity, and fun are emphasized!

### **Materials & Space:**

All materials and class space are provided by Pratt Fine Arts Center.

### **Big Idea:**

Self-confidence is developed when success is achieved by learning new skills progressively in a safe and supportive environment. Flameworking requires perseverance and understanding the basic properties of glass.

### **Learning Objective 1:**

Students learn to set up and light torches independently. Students focus on safety and step-by-step process, in order to develop confidence with the equipment.

### **Assessment:**

Students follow safety procedures to light the torch. Students adjust safety glasses to fit. Students identify and select tools and place them in the best order on the work surface for safe use (i.e., student hands will not cross in front of the flame to reach for a tool). Students light torch safely using a striker tool. Students demonstrate knowledge of POOP\* when turning the torch on and off (\*see vocabulary list).

### **Learning Objective 2:**

Students learn to gather glass on a mandrel and form beads. Students practice perseverance, mindfulness, communication, and coordination. Students demonstrate the ability to manipulate the material, making steady improvement and developing increased

**Assessment:** Students select and assemble appropriate glass and tools for the beads they plan to create. Students communicate their creative ideas verbally to instructor. Students are comfortable asking for input if they are struggling to make a bead match their vision. Students demonstrate safe and appropriate use of all tools. Students develop comfort with peers and exchange ideas about how they created their pieces. Students use work time to experiment creatively and practice each of the techniques demonstrated by the instructor.



### **Equipment:**

**Small Torches** – are used for soft glass (beadmaking, marbles, very small sculpture)

**Propane** - Propane fuels the torches at Pratt.

**Oxygen** - Oxygen acts as an accelerant. It allows the fuel (propane) to become hot enough to melt glass. (Propane on its own cannot melt glass.) Pratt uses a liquid oxygen system. Oxygen is stored outside and pumped in through overhead pipes which lead directly to the flameworking table.

**Bead Kilns** – Small kilns programmed to cool soft glass at a temperature and rate which stabilizes the glass structure (about a 4-6 hour cooling time). Work is taken directly from the torch to the kiln.

### **Processes:**

**Flameworking** - Flameworking is the process of heating up glass using a small torch.

**Beadmaking** - Flameworked beads are made by using a gas torch to heat a rod of glass and spinning the resulting thread around a metal rod covered in bead release. When the base bead has been formed, other colors of glass can be added to the surface to create many designs. After this initial stage in the beadmaking process, the bead can be fired in a kiln to make it more durable.

### **Terms:**

**Annealing** - The process of cooling beads over a period of hours in a temperature controlled kiln (oven) so that the glass molecules have a chance to slow down. This reduces stress in the glass, so that it becomes more stable and less breakable.

**Bead Reamer** - A small metal tool used to clean out the bead release from a bead after pulling it off the mandrel.

**Bead Release** - a batter-like solution applied to the mandrel to allow for the release of the glass bead once it has cooled.

**Borosilicate / Boro glass** aka hard glass - Glass in which the flux is boric oxide instead of alkali. It has a low coefficient of expansion and therefore withstands sudden changes of temperature. It is used for things like sculpture, cookware (Pyrex is one brand), glass blowing, lab equipment and more. Used mainly for larger work.

**COE (Coefficient of Expansion)** - A mathematical formula expressing a glass type's response to temperature change. The coefficient of expansion is the relative amount that a material will expand when heated.

**Frits** - Ground glass, ranging in particle size from gravel-like to a fine powder. Frit is sometimes used as a raw material in glass manufacture, and sometimes as a coloring agent or for decorative effect in hot glass crafts like flameworking, blowing and fusing.

**Gather** - The term applied to the glass you have melted on the end of your rod - often right before laying the footprint or pulling a stringer.

**Mandrel** - a rod of stainless steel (usually) used to wind glass on to, in order to make a bead. Usually coated with a bead release of some kind. These come in various lengths and diameters, and can be solid or hollow.

**Opaque** - A term applied to glass which cannot be seen through. Dense, solid color. Oxygen - Mixed with fuel in a torch, this provides combustion and flame.



**POOP** - An abbreviation for the order in which many beadmakers turn on and off their torches - stands for (on)Propane - Oxygen / Oxygen - Propane (off).

**Shocky** - A term applied to glass which has a tendency to explode or shatter when introduced quickly to the flame. Glass which is hand pulled, contains holes or is a larger diameter tends to be shocky.

**Soft Glass** A generic name for glass (e.g., soda-lime glass) with a relatively high coefficient of expansion. Used mainly for smaller work.

**Striker** - A flameless metal tool used to ignite the torch - the preferred tool of many lampworkers because of its safe nature.

**Stringers** – Thin, spaghetti-like glass shapes used as a decorative element in the hot glass arts.

**Thermal Crack** - When a bead is not kept at the right temperature or allowed to cool too quickly, a thermal crack can appear. These cracks are often straight and parallel with the bead's hole along the mandrel.

**Transparent** –Glass that can be seen through

Sample Day 1: Opener Welcome and Introductions: Instructors, Students, Pratt and the Glass Studios Students tour each of the glass studios with a brief introduction to the properties of glass and how each of the different studios use glass (i.e., Fusing Studio: flat sheets of glass are cut, stacked and heated in a kiln then re-heated and shaped with molds; Flameworking Studio: solid rods and hollow tubes of glass are heated using a small tabletop torch and shaped with small metal and graphite hand tools; Glassblowing Studio: glass batch is heated in a furnace to 2100°F, gathered on a punty, and shaped on metal marvering tables; Cold Shop: glass art projects are finished through cutting, polishing and the removal of sharp edges). Students return to the Flameworking Studio to begin activities. Activity title and description • Explanation of safety, proper use of tools • Students learn how to turn on the torch: discussion of combustion • Students heat glass and pull a stringer Closer Review: Studio safety, tools used in class today, heat and combustion, how we tidy up our work area.

Sample Day 2: Daily Goal: First Glass Bead Supporting Activities: Learning about the composition of glass.

Sample Day 3: Daily Goal: Dotted/ Patterned Bead Supporting Activities: What makes colors? Learning about oxides.

Sample Day 4: Daily Goal: Sculpted Beads: Bugs, Flowers and Fish Supporting Discussion: Why is bead release important? Discuss the composition of bead release and why glass does not stick to it. Sample Day 5: Daily Goal: Sculpted Beads: Pancakes, Hamburgers, Fried Eggs Supporting Discussion: Why is annealing important?

Discussing and learning about thermal shock. Sample Day 6: Daily Goal: Marbles Supporting Discussion: What are the different types of glass? Introduction to Borosilicate



glass. Sample Day 7: Daily Goal: Sculpted Beads: Students design, plan and create their own forms. Supporting Discussion: How does stress affect glass. Adding and relieving stress. Sample Day 8: Daily Goal: Finishing Work. Show and tell. Supporting Discussion: Introduction to finishing techniques and tools. Review of materials learned, reflection and supportive critique.