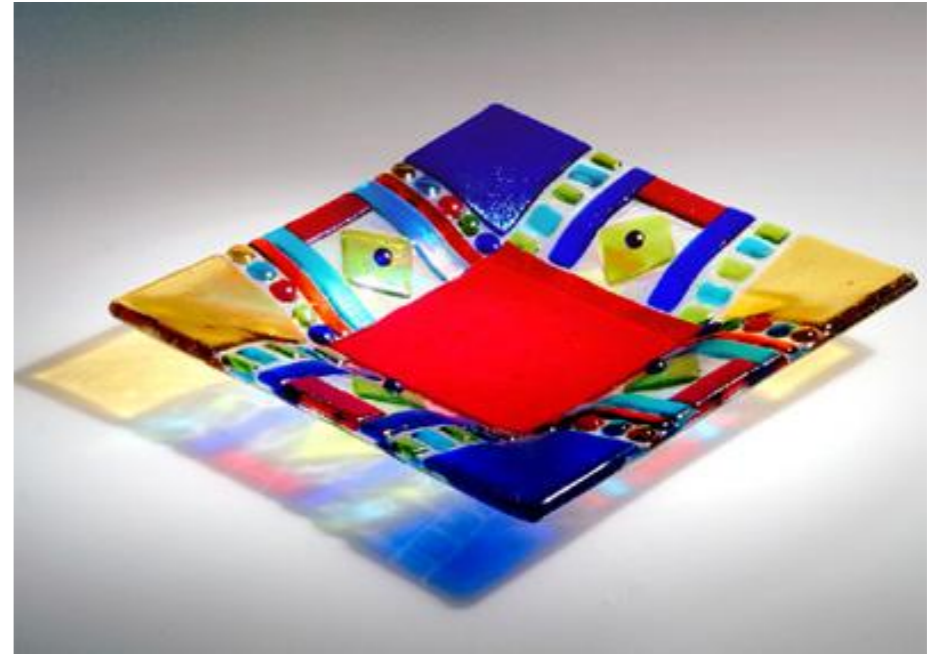


Fused Glass!



What is Fused Glass?

- Warm glass, which is commonly known as glass fusing or slumping.



Fusing Glass

- This is a fascinating technique that enables artists to create unique and gorgeous projects.
- The following fusing rules and firing instructions should provide you with enough information to produce your own glass project.



History of Fused Glass

- Warm glass, which is commonly known as glass fusing or slumping, is an ancient artistic technique.
- It is believed that glassmaking was discovered 4,000 years ago, or more, in *Mesopotamia*.



History of Fused Glass

Ancient Egypt

- Formal techniques of fused glass followed the Mestopantian discoveries in ancient Egypt.
- Initially experimental, this technique quickly proved successful enough to become widespread among Egyptian artisans
- used it to create beads, bottles, bowls, jewellery, and even slightly larger objects such as jars and vases



History of Fused Glass

- Glass mosaics, valued in Greek and Roman civilizations, were considered equal to silver and gold as precious materials. Valuable glass vessels such as tableware, and containers for oil, perfume and medicine.



Period: Early
Imperial

Date: 1st century
A.D.

Culture: Roman

Medium: Glass; cast,
tooled, and cut

The Mediterranean world was a major factor in attracting skilled glass craftsmen to set up workshops in the city



Period: Archaic
Date: ca. 625–600 B.C.
Culture: Probably Phoenician
Medium: Glass; cast and cut



Period: Hellenistic
Date: 1st century B.C.
Culture: Greek
Medium: Glass; cast

GLASS FUSING / SLUMPING HISTORY



Period: Late Hellenistic

Date: mid-2nd–early 1st century B.C.

Culture: Greek, Eastern Mediterranean

Medium: Glass; cast and cut

Dimensions: H.: 2 15/16 x 4 in. (7.5 x 10.2 cm)

- As with every other aspect of craft and industry, however, this technique would eventually be surpassed and replaced by a more advanced alternative with the invention of glass blowing.
- This led to the extinction of the fused glass technique till later in history

Modern Day Fused Glass

- This resurgence took a long time and it was not until the early decades of the twentieth century, within the American craft market, where the technique was rediscovered and once again became quite popular.
- In recent years, fused glass art has experienced something of a comeback.



Glass Compatibility

Different types of glass expand and contract at various temperatures.



Glass Compatibility

- This various temperature change is known as the COE or the Coefficient of Expansion



Glass Compatibility

- What does Coefficient of Expansion mean?
 - It is the fractional change in length or area or volume per unit change in temperature at a given constant pressure
 - simply a measurement of the rate that glass will expand and contract when it is heated and cooled.



Glass Compatibility

- *Glass manufactured specifically for fusing is often "tested compatible," or guaranteed to be a certain COE.*
- *The most popular fusing glasses are either **90 COE** or **96 COE***



Glass Compatibility

- Every piece of glass in your project needs to have the same COE or Coefficient of Expansion.



Potential Glass Fusing Problems

These firings range from 1100 degrees Fahrenheit to about 1700 degrees Fahrenheit- alot of things can go wrong, before, in the middle and after.

Problems to look for....

- Thermal Shock
- 1/4 inch rule
- Air Bubbles

Heating and Cooling Evenly



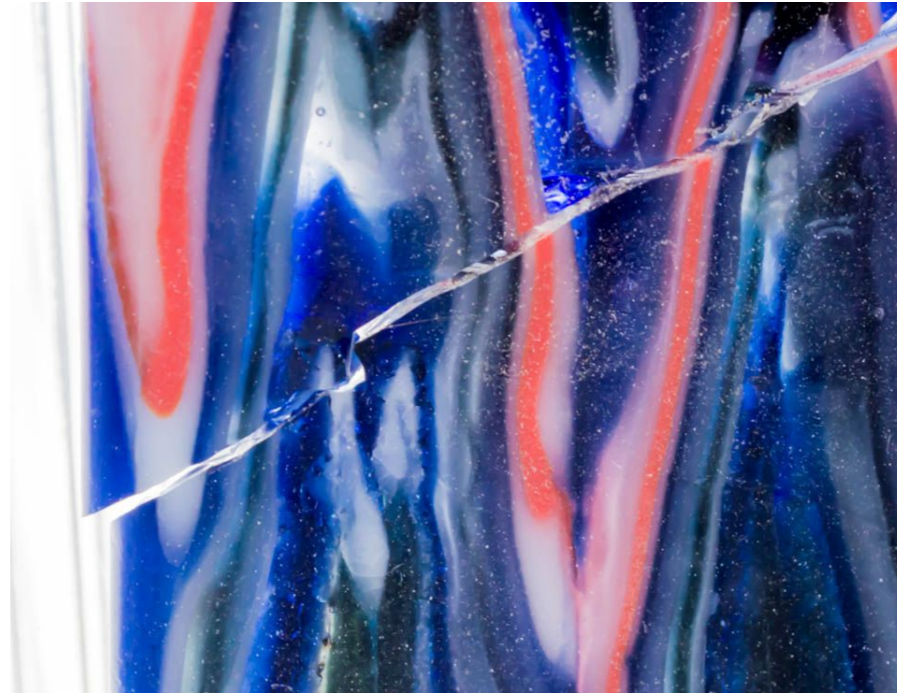
- When glass is heated it expands, when it cools it contracts.

Heating and Cooling



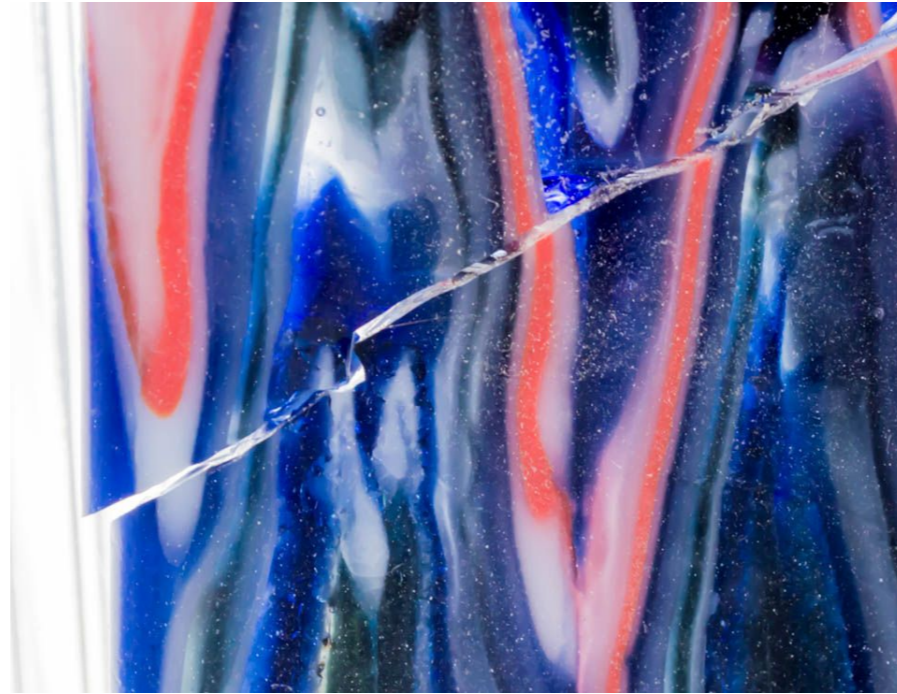
- If fusing two or more pieces of glass together, they need to expand and contract at the same rate
- Otherwise, when the glass cools, one glass will pull on the other and cause the piece to crack along the seam.

Glass Must Heat Up Slowly

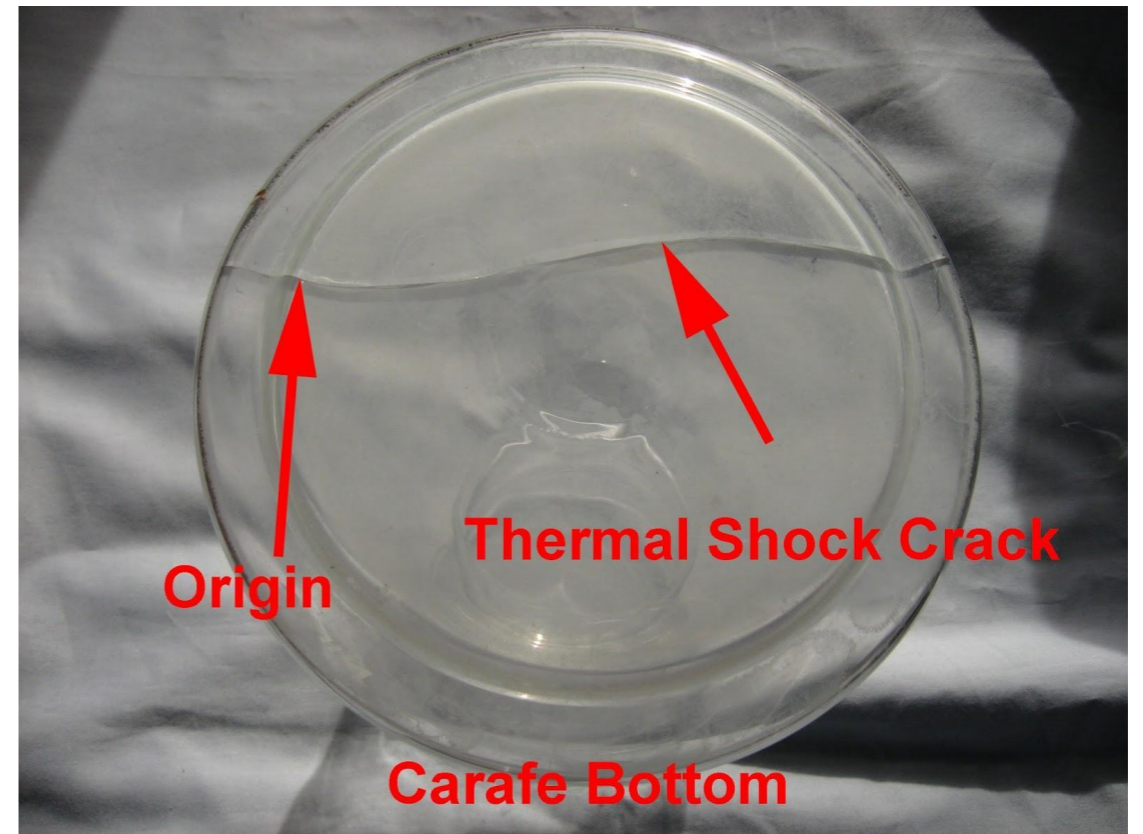


- You can't heat or cool glass too slowly.
- Going too fast can result in cracked glass or Thermal Shock.

What is Thermal Shock?



The uneven expansion creates a lot of stress inside the glass. If the stress is strong enough the glass will break. That is thermal shock



- Breaks from thermal shock usually go straight across the piece and have a little hook near the edge.
- They can usually be repaired by refiring.

Heating & Cooling of Glass

THIS END IS NOT
EXPANDING

GLASS

THIS END IS
EXPANDING

When glass is heated unevenly it expands unevenly.

Since glass cannot stretch, this change can cause the glass to break.

This is also true of glass that cools, and contracts, unevenly.





Fused Glass Thickness Rules

- Fused glass thickness is one of the most important laws of glass fusing.
- Fully fused glass will always want to be about 1/4 inch thick.



Fused Glass Thickness Rules

Glass Likes To Be 1/4" Thick

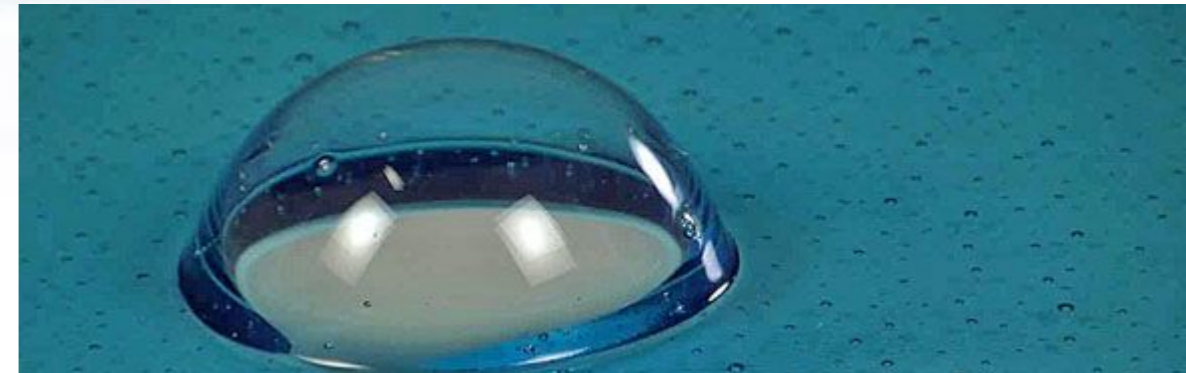
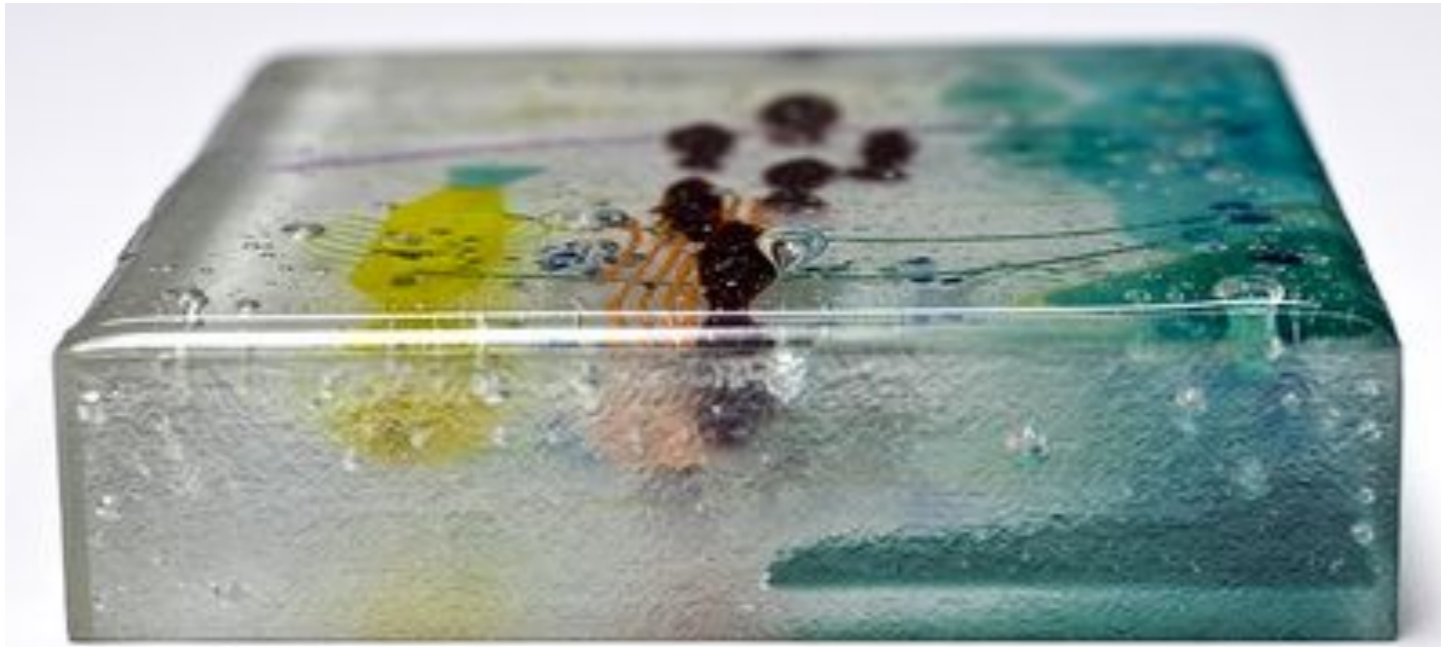
If you fully fuse one piece of thick 1/8 inch glass it will contract and the edges will pull as it attempts to be a 1/4" thickness resulting in a misshapen piece of glass.

Fused Glass Thickness Rules

Firing two glass layers in a warm glass kiln should result in a fully fused piece with nicely rounded edges and smooth top surface.



Air Bubbles



Too thick of glass will run over the edges of the mould or have tiny air bubbles in it. This is a fault in fused glass.

Why Air Bubbles?

If your pieces are heated too quickly, the outside edges of your glass can soften and fuse before the inside glass does.

This will result in trapped bubbles.

Pay close attention to where your pieces are on the kiln shelf.

If they are too close to the heating elements, the direct heat can cause the edges to seal up and thus cause bubbles.

Why Air Bubbles?

Sometimes air will become trapped inside the waves or texture of a piece.

Stacking can also cause bubbles.

Examine how you stack your pieces; be aware of any places where air might be trapped.



Place some frit around the inside edge of this sandwiched piece and you could avoid bubbles.

Basic Supplies



Basic Supplies

SAFETY GLASSES

Always wear safety glasses so that glass particles do not get in your eyes.



Basic Supplies



Glass Cutter

You might need to cut a shape of glass for your design

The cutter has a tiny wheel on it that scores the glass.

The scored glass will break in only one direction.

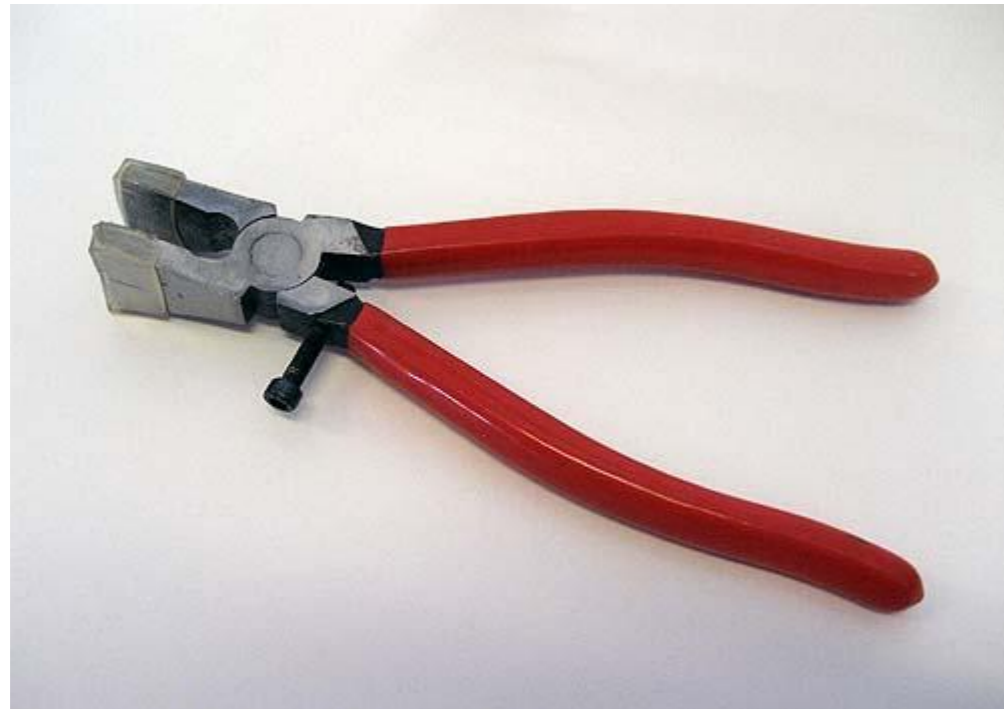
Basic Supplies

GLASS CUTTER OIL



BEFORE YOU CUT
Dip the cutter in oil
This helps the blade score the
glass better

Basic Supplies



Glass Pliers

Are used to break the scored glass in one direction

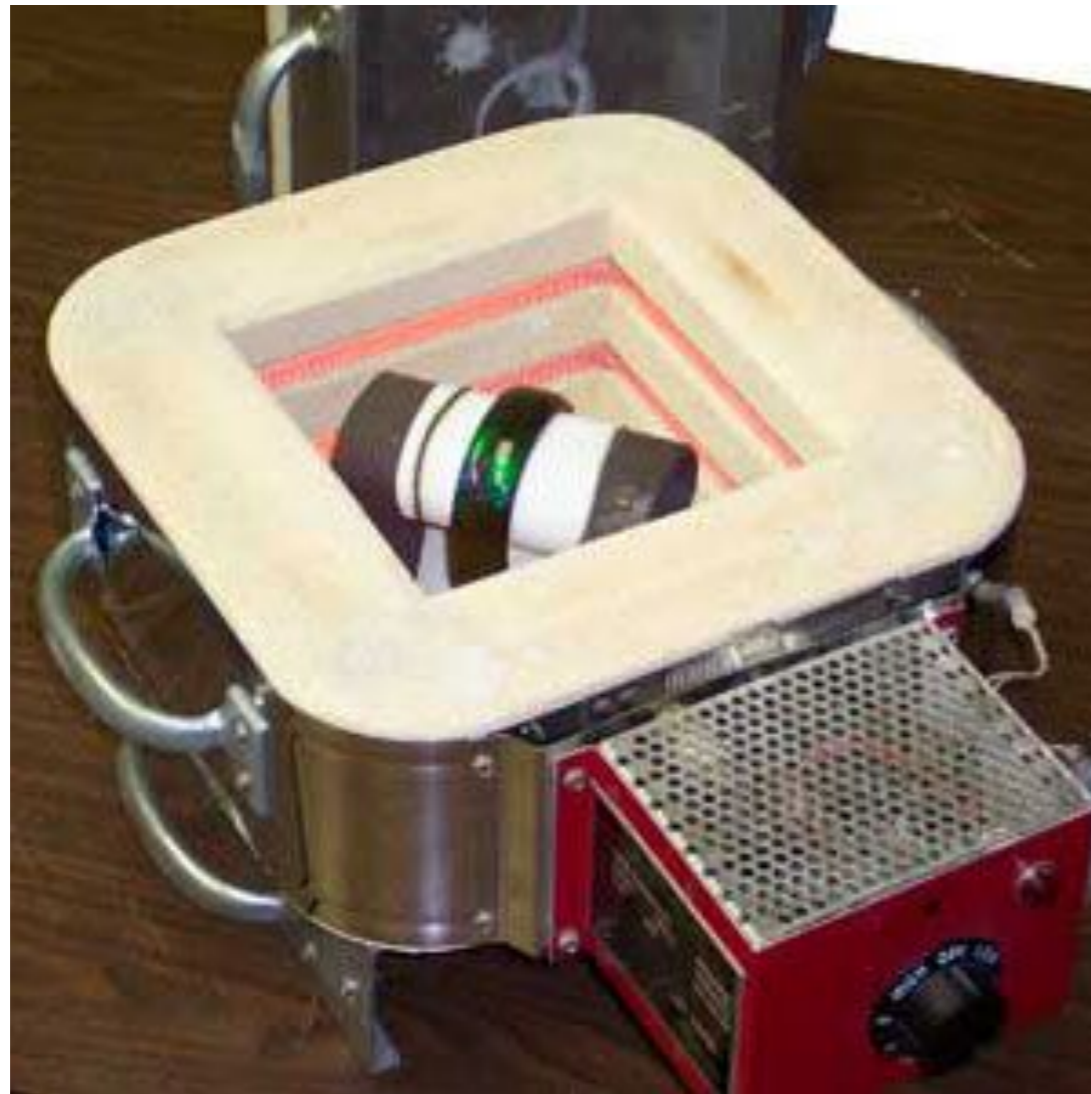
Watch video on Cutting glass

Video on how to cut and break glass

<https://www.youtube.com/watch?v=fNYo2X9dlq8>

Basic Supplies

KILN



A kiln is used to make the glass molten and to join two or more pieces of glass.

This process is also known as kiln-forming

Basic Supplies

Ceramic Fusing Molds

Are great for making your glass bend into three dimensional shapes.



These molds are made out of pottery clay.



Molds will break if dropped or not coated with kiln wash.

Now you know the
tools

We can learn about the
types of glass and what
to do with it.....

Types of Glass



You can combine different types of glass as long as its all the same COE.

Always consider color scheme and transparency when blending glass .

Types of Glass: FRIT

Frit is glass that has been broken or crushed into smaller pieces.

Types of Glass: FRIT



Fine



Medium



Large



Coarse

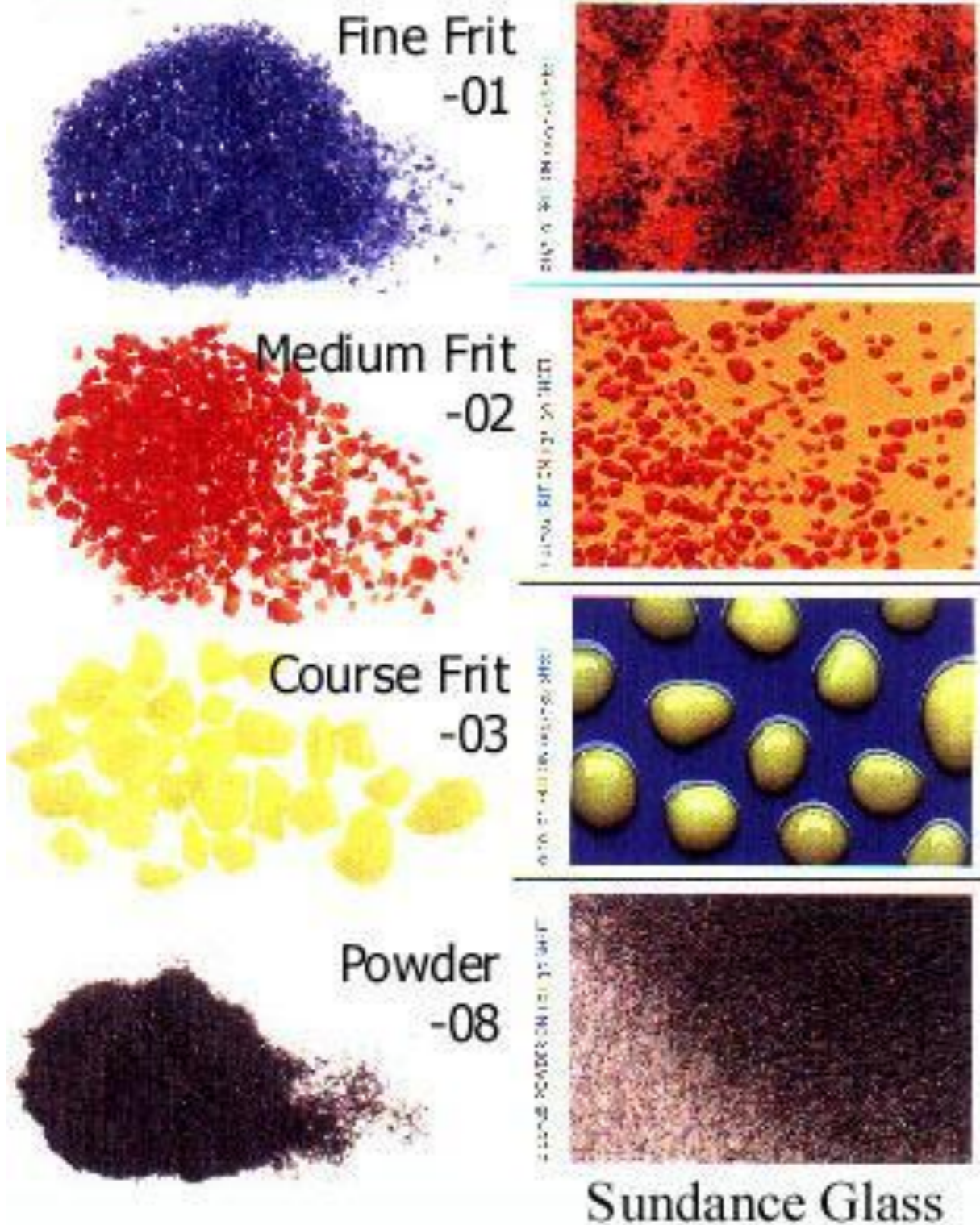


Extra Coarse

Types of Glass: FRIT

Bullseye Frit and Powder

for Fusing, Casting, Glassblowing, Lampworking, Beadmaking



Generally the sizes range from Coarse, Medium and fine or powder

Types of Glass: FRIT

Coarse – This is the largest of the pieces.

Place on the kiln shelf to make dots or small blobs.

Placed along the edges of glass to keep them from sealing up and allowing air to escape. Add on top as Embellishments

Medium – Not as large as the coarse chunks, but not as fine as the glass powder.

Mixed with glass powder when filling larger molds.

Used to fill in smaller gaps in areas

Fine - Glass Powder

Mixed with a medium for glass painting

Poured into a stencil to make fine details

The Glass: Confetti

Fusible glass confetti is fragile thin shards or flakes of glass.



The Glass: Confetti

These delicate paper thin flakes can be purchased in a variety of colors, or can be made from compatible glass.

It is used for layering, shading, and dimension to your warm glass pieces.



The Glass Rods & Stringers

Rods & Stringers come in a sophisticated palette of colors They can be used by themselves or with other fusing embellishments. This spaghetti size glass pieces are easy to snap and break into smaller pieces or use for line work.



The Glass Millefiori

The name millefiori is a mixture of two Italian words. "Mille" means thousand and "fiori" stands for flowers.

This is fitting as most of the pieces look like tiny round glass flowers.



**NOW YOU CAN
START TO DESIGN &
SELECT YOUR
COLORS & TYPES OF
GLASS!**

Getting Started

Selecting Shape & Preparing the Mold



Step One: Preparing the Mold

CHOOSING A SHAPE



Molds: You have 4 shapes to choose from:

- tear drop, oval, circle and square.**

Step One: Preparing the Mold

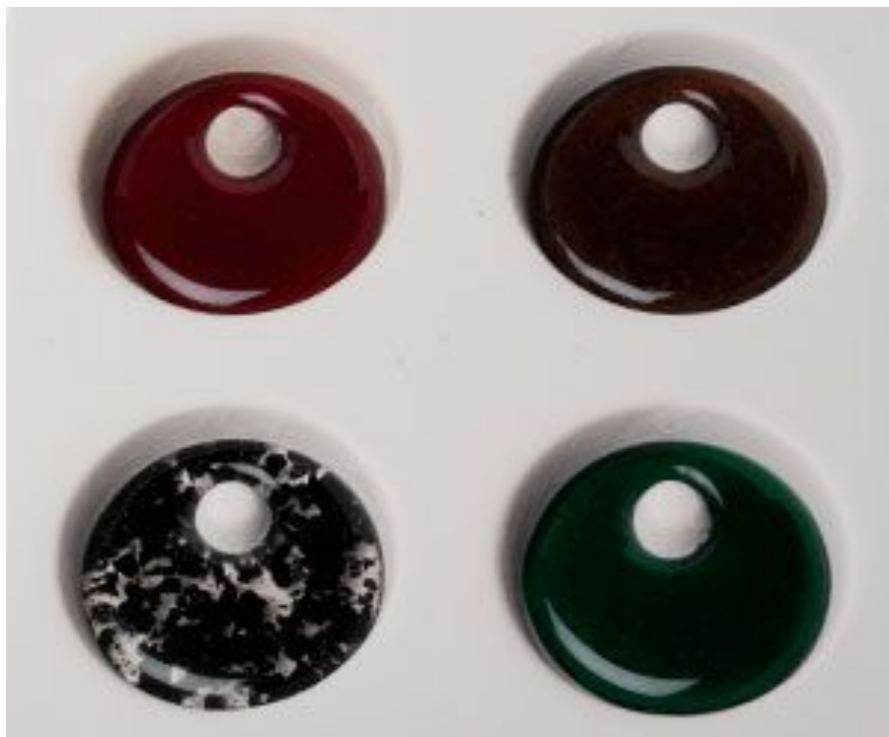
CHOOSING A SHAPE



Molds: tear drop & oval

Step One: Preparing the Mold

CHOOSING A SHAPE



Molds: circle and square.

Step One: Preparing the Mold

KILN WASH



Prepare your kiln by applying kiln wash to the molds

Kiln wash prevents the glass from sticking to the kiln during firing.

Step One: Preparing the Mold KILN WASH



We have two types of kiln wash. One is a spray. But it is expensive. Runs \$27.00 a can.

The other is cheaper and brushes on like paint -



Both have the same release results with pendants due to the shape of the mold.

Step One: Preparing the Mold

CHOOSE WHICH KIND OF KILN WASH

Hi-Temp 1800 mold release agent is a spray

It contains Boron Nitride which acts as a primer for slumping and fusing molds.

On ceramic molds apply one coat thoroughly and let dry overnight Holds up well for multiple firings.



Step One: Preparing the Mold

KILN WASH

- If it is not applied correctly your project will be covered with kiln wash after it is fired.
- If your mold has flakes of old kiln wash on it - you will need to sand the mold down first.
- Use fine steel wool to remove any old kiln wash-NOT SANDPAPER scratches in the mold will show up on your design.

Step One: Preparing the Mold

CHOOSE WHICH KIND OF KILN WASH

Apply one coat
thoroughly and let
dry overnight



Step Two: Filling the Mold

Once you know the colors you will use- use a small spoon to put the glass in the mold.



Step Two: Filling the Mold

If the design has a "bump" in the mold for creating a hole in the fused design,
creating a hole in the fused design,
Be sure to leave the area clear.



Step Two: Filling the Mold

Be sure to leave the area clear.

And don't go above the mold.

Use a paint brush to sweep off stray fragments



Step Two: Filling the Mold

Before: The hole is almost covered by frit

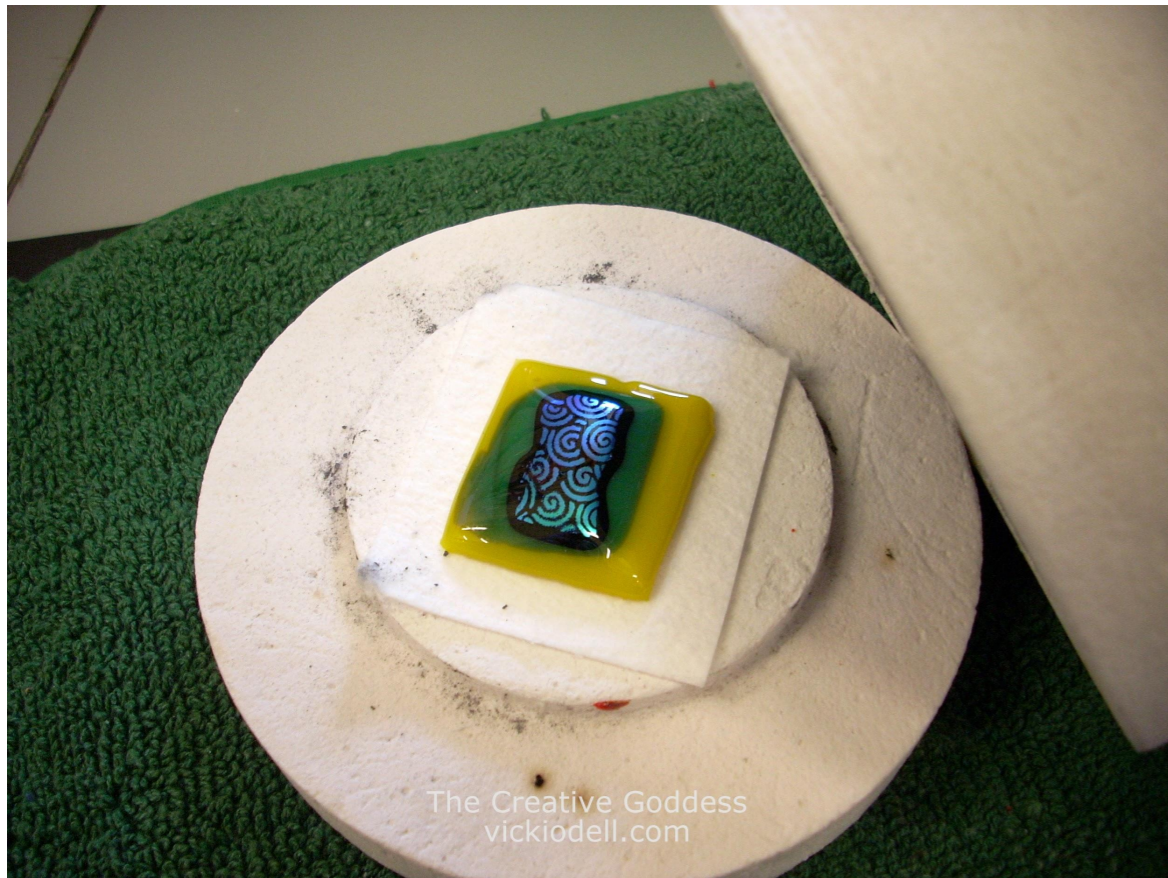


Notice how the frit melted the hole is rough and jagged.



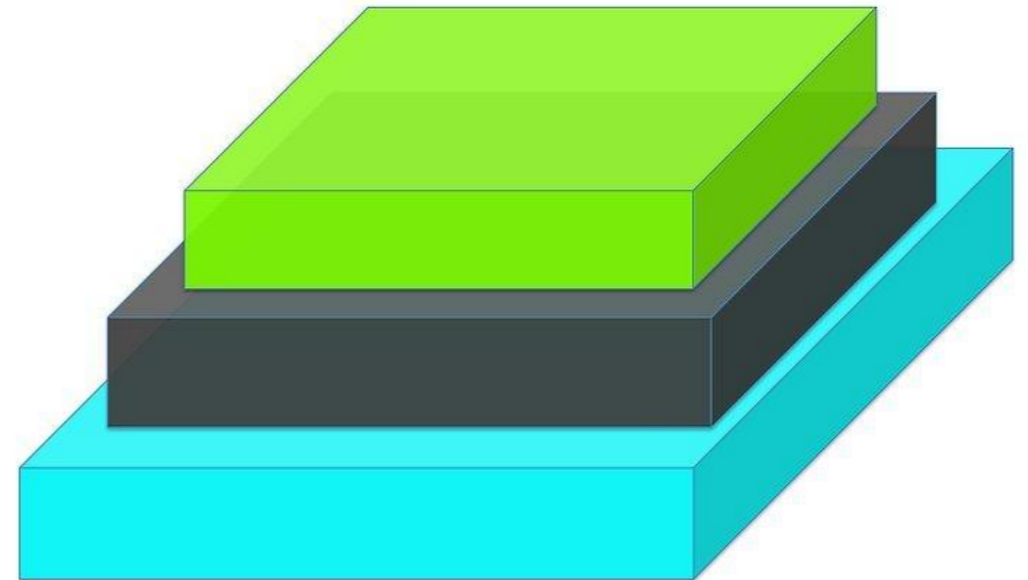
You will have to use a special tool or dremel to remove the sharp areas. Wear safety glasses when sanding glass.

What if I don't want to use a mold?

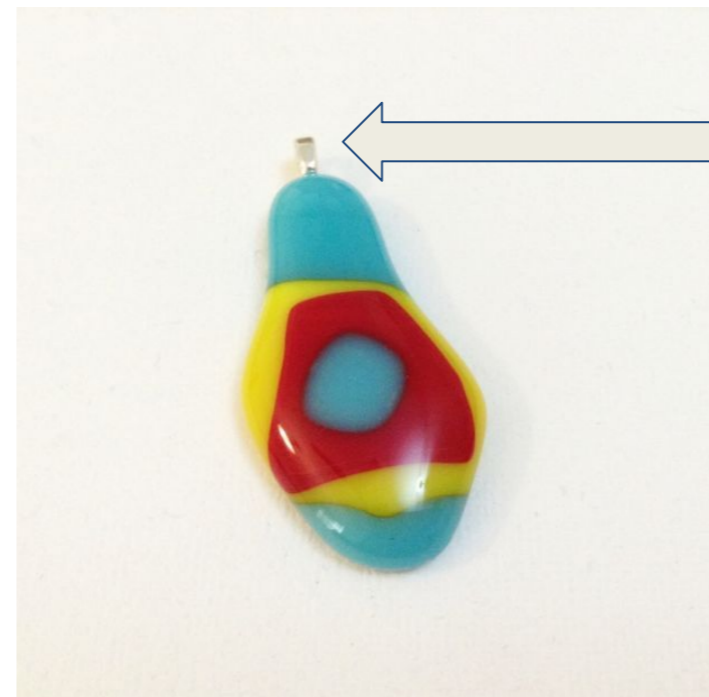


Free Form

1. Follow this 3 layer rule
2. Coat the mold with kiln wash- the mold is a flat square tile. Build your work in the center of the tile. Kiln shelf paper can also be used under the project (if we have any)
3. You can stack up to 3 layers.
4. Put the larger cut piece on the bottom as a base
 - i. Add a little glass glue to hold pieces together
5. Stack rods, stringers or another smaller piece of cut glass in the middle
 - i. DON'T use FRIT between free form pieces
 - ii. Add a little glass glue to hold pieces together
6. Stack a smaller yet piece on the top, this could be millefiori, confetti, stringers, rods, large coarse frit pieces or another smaller piece of cut glass.
7. Carefully set into the kiln



wikiHow to Make a Stacked Fused Glass Pendant

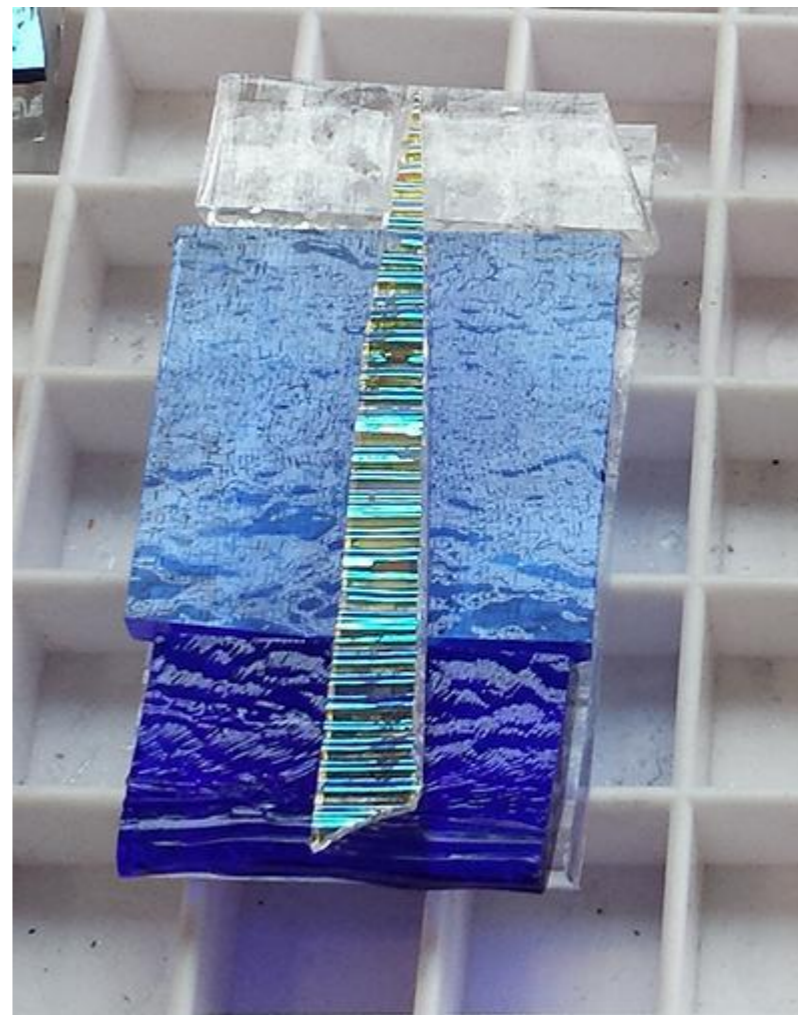


Free Form & Not using the Mold



Some small pieces of glass will have to be set and glued.

Bring in tweezers from home and use glass glue to hold them in place



Video on what if I don't want to use a mold?



Pros-

- You can be core creative unique designs
- You can work by yourself

Cons-

- Takes longer you can only fire one piece at a time
- You don't know how it is really going to turn out

How to finish your fused glass project

Removing Kiln Wash From Fused Glass

- When fusing glass in your kiln, if your kiln wash is not properly applied and sanded before firing, your pieces will come out of the kiln with a coating of kiln wash on the back of them that is nearly impossible to scrub off with soap and water.
- Trying to remove baked on kiln wash from the underside of a glass piece can be one of the most frustrating experiences for the warm glass artist

How to finish your fused glass project

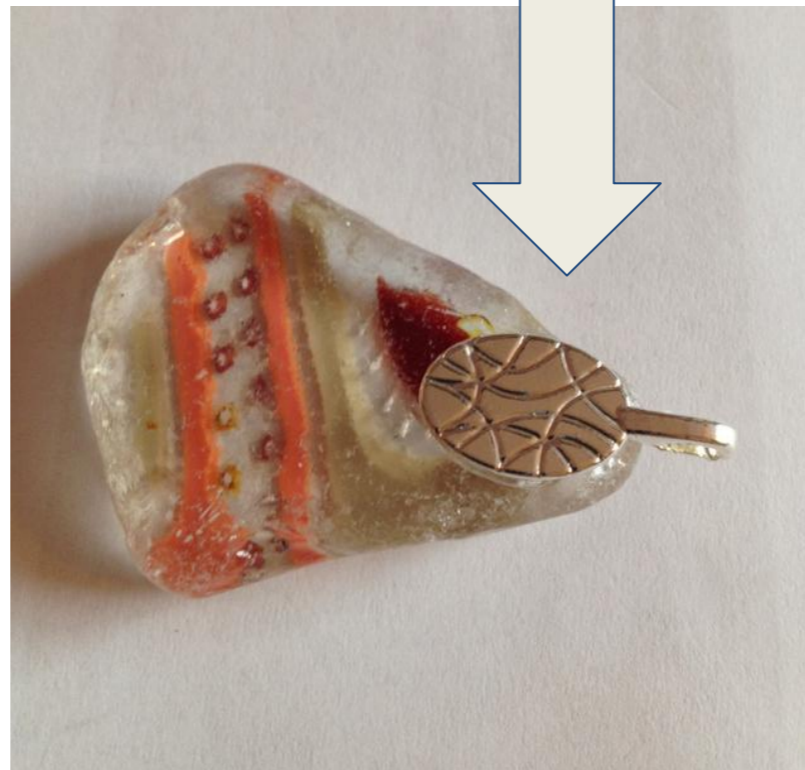
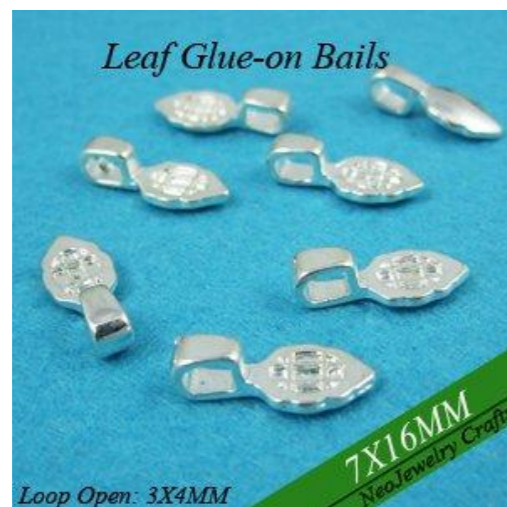
Removing Kiln Wash From Fused Glass

1. Vinegar. Soaking the glass in distilled white vinegar (a mild acid) overnight will often help the kiln wash come off with a minimum of scrubbing.
2. After soaking use sandpaper, steel wool or a metal brush to remove any remaining kiln wash.
3. Worst case scenario you will have to use the dremel or glass grinder to remove the kiln wash.

How to finish your fused glass project

Getting it ready to put on necklace

1. Once the glass is clean, you may have to glue a bail onto the back.
2. You can make one with wire
3. One of the prefabbed ones.
4. Glue will need to dry overnight.
5. Glue is kept on my computer desk.



No matter what project you choose to create
You will be graded on

Elements of Design:

1. Color
2. Shape
3. Line

Principles of Design:

1. Variety
2. Pattern
3. Movement