

# LIQUID NITROGEN ICE CREAM

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## Materials Needed

### Ice Cream materials:

4 cups milk

6 cups heavy cream (Note: half-and-half is an acceptable substitute for the milk and heavy cream)

1 cup granulated sugar (if a sweeter ice cream is desired, add additional sugar)

2 Tbs. Vanilla extract

### Optional:

Egg beaters. Add one 4 oz container (from a standard 3-pack) of Egg Beaters to the ice cream mix. This acts as an emulsifier to prevent separation of components.

For chocolate ice cream: add 1 cup cocoa powder and ½ cup additional sugar.

(Omit the extra sugar for a bittersweet chocolate ice cream)

For chocolate chip ice cream: add 12 ounces (one bag) of chocolate chips (mini chocolate chips or chocolate flakes can be used).

For fruit flavors: add 1 cup chopped fruit or fruit preserves of your choice to the ice cream mix.

Other additives can include crushed candy bars (toffee bars, Twix, etc.), crushed cookies (Oreos, chocolate wafers, etc.) or pieces of fresh or frozen cookie dough.

### Chemicals:

Liquid nitrogen, at least 4 liters

### Equipment:

Large Dewar flask to hold the liquid nitrogen. (Note: This container should only be used for fresh liquid nitrogen. Never return any liquid nitrogen to this container from any source.)

Stainless steel mixing bowl, 5 quart or larger (Do not use plastic, glass, or ceramic bowls)

Large wood spoon

Gloves (Important! This gets cold.) Cryogenic gloves preferred, but heavy insulated gloves will work

Goggles

Large spoon or scoop for serving the ice cream

Plastic spoons for tasting

Paper or plastic cups or bowls for serving (Optional: ice cream cones.)

Napkins or paper towels

## Safety

Liquid nitrogen is extremely cold,  $-196^{\circ}\text{C}$  ( $-320^{\circ}\text{F}$ ). It should never be used by anyone without some instruction in the safe handling and use of a cryogenic fluid.

Liquid nitrogen should be stored in a large Dewar flask. Under no circumstances should the liquid nitrogen container be tightly sealed. Vented tops or covers must be used. If a large cork or stopper is used, there should be a hole drilled through the center of the stopper. Vaporizing liquid nitrogen can cause moisture in the air to freeze around the openings of the covers or caps on a liquid nitrogen container and can result in a pressure explosion.

Do not allow containers of liquid nitrogen to remain open to the air for long periods of time. There is a danger of condensed liquid oxygen that can form in the liquid nitrogen. This can create a fire hazard.

Do not place liquid nitrogen in any container other than a Dewar flask. This includes foam coffee cups.

Wear heavy insulated or cryogenic gloves when working with liquid nitrogen. (Any helpers should also wear gloves.) Keep all spectators at a safe distance.

Wear goggles while performing this experiment.

Do not allow any student or individual to make small batches of liquid nitrogen ice cream unless they have been properly trained to handle a cryogenic fluid and they have all the proper safety equipment and apparatus to do this procedure.

All materials used in this experiment must be reserved for food use only. The materials must be stored in an area where there is no possibility of contamination from laboratory chemicals.

## Disposal

Excess liquid nitrogen should be properly disposed by an individual trained in the use of a cryogenic fluid.

There are no disposal problems with food-related materials in this experiment.

## Procedure

Combine all ice cream materials in a large stainless steel bowl. Stir to dissolve all the sugar.

Slowly add some liquid nitrogen to the ice cream mixture while stirring. CAUTION: A fog will be formed.

Continue to stir while adding additional liquid nitrogen in small quantities. It will take approximately 2 liters of liquid nitrogen to freeze the mixture.

## References

Kurti, Nicholas, and This-Benckhard, Hervé, *Chemistry and Physics in the Kitchen*, **Scientific American**, **270**, No. 4, 66, (April 1994)