



Make a Comet Model and Eat it!



Created for Deep Impact, A NASA Discovery Mission
Student – Inquiry

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Comets have sometimes been described as dirty snowballs, snowy dirtballs or something in between. But what does that really mean? It means that these they are believed to be a cold mixture of frozen water, dry ice (frozen carbon dioxide), and other sandy/rocky materials left over from the early formation of our solar system. In this activity, we are going to develop a comet model that you can eat. Once your team has made your comet, you'll trade a sample of it with another team. Once traded, you will use your different senses to demonstrate the filters on an instrument called a spectrometer that will collect data on the Deep Impact spacecraft. A spectrometer analyzes the structure and composition of comets by using nine different filters. You will use four of your senses individually to decide what is in the ice cream. Most of the ingredients can be found in your home.

Comet connection: Discuss the following ingredients to be added to the ice cream to represent dust (Black/brown cookies in fine and large chunks), rocks (peanuts), carbon dioxide (coconut flakes). Then have the students begin to add ingredients. Make sure they are also adding some ingredients to represent what we might find in a comet. Possibilities are: peppermint, toffee or other ingredients to represent new discoveries. Remember to choose food that will not dissolve while the ice cream is setting. Each team should make their own choice of ingredients. Now close the bags carefully.

Form small research groups of 2 - 4 students. Make sure no one has any allergies (milk, peanuts, etc) that are used for this activity. You'll need to gather the following materials for each group:

- One sandwich size re-closable plastic bag per team of 2 - 4
- One Gallon size re-closable plastic bag per team of 2 - 4
- Small cups for eating ice cream - one for each person on the team. Two additional cups are needed to trade with another team - one to "feel only" and one to "taste, smell and look at".
- Plastic spoons for everyone
- Pairs of rubber kitchen gloves, oven mitts or have them use cloths or sweaters (The comet bags get cold!!)
- Ice (enough to fill a gallon size bag 1/2 full per team) - or bring in fresh snow from outside.

- Chunky cookies in black or brown, crushed candies (like toffee or peppermint), gummy bears, coconut flakes and peanuts
 - Whole milk (2% won't work)
 - Sugar
 - Vanilla extract
 - Evaporated milk
 - Salt
 - Can opener
 - Something to use to crush cookies and other additives
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To begin: Wash hands! You may choose to use food gloves.

HINT: One person should hold the bag while another pours ingredients into the bag. To cut the activity time, you can pre-mix the milk, evaporated milk, sugar and vanilla in the small bags and pre-measure the salt into the large bags. Make enough sandwich bags of ice cream mix for each team to have one. Squeeze the air out as much as possible and seal the sandwich bags carefully each time they are opened to add ingredients.

STEP #1:

Mix into the sandwich size bag
 One-third cup evaporated milk (or cream)
 Two-thirds cup whole milk
 5 level spoonfuls of sugar
 Less than ¼ tsp of vanilla

Each team adds the ingredients they feel should be in their "comet" and records those ingredients for confirmation later.

HINT: Squeeze any extra air out of the sandwich bag and close it. Be sure it cannot leak. [Turn it upside down to check.]

SUGGESTIONS FOR LARGER GROUPS: For a class of 20 (10 groups of 2)

- 3 - 4 cans - 12 fl oz each
- 1 gallon of milk (you'll have some left over)
- 20 cookies
- 1/4 lb of sugar
- 1 bag of peanuts and 1 bag of coconut flakes
- 1/4 bottle of vanilla or leave this ingredient out
- 10 sandwich size re-closable bags (but best to make a couple extra)

- 10-gallon size re-closable bags
- 2 - 3 containers of table salt (you'll have some left over)

STEP #2

Place the sandwich bag into the bottom of the gallon bag. Put in approximately 10 heaping spoonfuls of salt if you did not pre-load the salt earlier. You can pre-load salt into the bags at home.

STEP #3

Fill the gallon bag (containing sandwich bag) at least 1/3 full of ice.

STEP #4

1. Close the larger bag tightly to remove as much air as possible. Check for leaks.
2. Gently shake and roll the bag while keeping it in constant motion for approximately 6 - 10 minutes or until half the bag has turned to water.
[SUGGESTION: Rubber gloves, mitts, cloth towels or other thick fabric may be needed to hold the bag because it will get extremely cold. Start with bare hands so students can feel the temperature change].
3. Gently feel the sandwich bag through the icy mixture. When the milk/sugar mixture in the sandwich bag has hardened into soft ice cream, open the gallon bag and remove the sandwich bag containing the ice cream. Carefully and briefly rinse the outside of the sandwich bag to get the salt/ice mixture off or the ice cream will carry the taste. Scoop the ice cream into one cup for each member of the team. Fill two cups to trade with another team - one they will only feel and one from which they will all get one bite. Put your own ice cream cup aside for the moment.

STEP #5

Once each team has received a cup to "feel" and a cup to "taste" everyone is ready to research a sample "comet."

A spectrometer takes different kinds of data through different filters. Pretend that your eyes, hands and taste buds are filters on a spectrometer taking data from your "comet". Record the following on a data sheet:

- Look at the "comet" and see what you can observe **visually**. Record it on a data page.
- Take the "feel only" cup and have each team member **feel** the contents with their fingers. Record any new data discovered.
- **Smell** the ice cream and record any additional data.
- Each team member can **taste** one bite of ice cream and record any final information about its contents.

STEP #6

Compare your results with the team who made the ice cream you tasted and see how close you came to being correct. Now teams can eat the ice cream that they made themselves.

- Share your conclusions about your comet with your class.
- Optional extension for older students: Learn more about [spectrometers](#).

SOME TIPS FOR THE TEACHER:

- If the students toss the bags back and forth or bang them against a surface while freezing the ice cream, they may break.
- Bring dishtowels, cloths or other insulator for hands to guard against discomfort while they are turning their bags over and over.
- Have a mop available for dripping water or do the activity outside.
- Limit the amount of any material students put into their ice cream to one plastic spoonful so supplies last.
- Mark one of your serving cups to the amount of sugar and salt measurements to pre-load bags faster. Mix all ingredients in class if you want your students to work on measurements, percentages and fractions.
- Older students can use [The Chemistry and Thermodynamics of Ice Cream](#) after this activity.