THE SCIENCE
In this month’s column we are going to do two experiments which explore one of the properties of sodium bicarbonate, the ability to produce gaseous CO₂ when in the presence of an acid. In the first experiment you are going to make sherbet. Sherbet is found in children’s sweets – sherbet fountains, flying saucers, sherbet dabs and sherbet straws. It is a mixture of citric acid (3-hydroxy-pentanedioic acid-3-carboxylic acid [CH₂-COOH. COOH. COH.CH₂.COOH]), sugar and sodium bicarbonate.

Citric Acid
The appeal of sherbet as a children’s sweet is twofold, first the taste which is a mixture of sweet (from the sugar), tart (from the citric acid) and provides a satisfying fizz on the your tongue, which food scientists call ‘mouthfeel’ from the reaction of citric acid with sodium bicarbonate. The mouthfeel fizz comes from the evolution of CO₂ when the citric acid reacts with the sodium bicarbonate giving off CO₂ as foam:

In the second experiment you will see how the evolution of CO₂ can be used to cause pressure in a container and make a minor explosion.

EXPERIMENT 1: MAKING SHERBET

HEALTH & SAFETY
This is one of the very few chemistry experiments in which you are allowed to taste what you have made. Please regard it as a food science experiment rather than a chemistry experiment, and you must use food grade reagents. Do the experiment in the kitchen with food utensils. (Never taste anything in the chemistry lab.)

MATERIALS
You will need:
• icing sugar;
• bicarbonate of soda (food grade, available from supermarkets in the baking section);
• powdered citric acid (food grade, available from supermarkets in the baking section).

EXPERIMENT 2: POPPING SANDWICH BAGS AND FILM CANISTER MORTARS

HEALTH & SAFETY
This experiment causes a mild controlled detonation of a plastic bag with mildly caustic reagents so safety glasses must be worn and old clothes are recommended to be worn. This experiment is best done outside.

MATERIALS
You will need:
• 250 cm³ vinegar;
• sodium bicarbonate;
• two small ziplock (aka resealable) sandwich bags;
• kitchen paper roll

METHOD
Put one ziplock bag inside the other then set aside. Put a piece of kitchen paper flat onto a table and make a pile of five heaped teaspoons of sodium bicarbonate. Wrap the roll paper around the bicarbonate and twist the ends so you have a ‘wrap’ of bicarbonate. Pour 250 cm³ of vinegar into the inside bag. Take the wrap of bicarbonate and place in the inside bag but hold it at the top of the bag with your fingers – still outside the bag so it doesn’t fall into the vinegar (see picture). With your fingers still preventing the wrap from falling into the vinegar, zip up the inside bag then the outside bag. Then, placing the bag in the sink (if you are doing the experiment in the kitchen) or on a flat surface (if you are outside), allow the wrap to fall into the vinegar and gently shake so the kitchen paper unfurls and the bicarbonate can mix with the vinegar. There will be an immediate foaming action observed, and the bag will begin to swell, only stopping when it either pops or the zip fastener gives way. A version of this experiment can be done with 35 mm film canisters. Half fill with vinegar and add a wrap of about 1 teaspoon full of sodium bicarbonate and put the lid on. The lid will fly off with a satisfying pop after some seconds.