

# Chemistry in Your Shopping Basket



## background

This is a one hour activity session to demonstrate to pupils in Years 6-9 that chemistry is everywhere, including the items you may purchase in a supermarket. The event is based on five themes (Carbon dioxide, Nitrogen, Crude oil, Sodium Chloride and UV) and incorporates five small experiments that can easily be delivered in a classroom. A presentation is worked into the event and involves audience responses – this can either be delivered using a personal response system (PRS) or a show of hands.

## pre-planning required

### weeks before

- Recruit staff to run the workshops
- Borrow a Shopping Basket and buy non-perishable material for the basket (empty cases are best if you plan to deliver the event more than once)
- Order the chemicals and materials that you may require
- Familiarise yourself with the presentation found at [www.cfof.org/resources](http://www.cfof.org/resources) and adapt to suit your audience

### days before

- Organise the equipment and buy perishable material for the basket
- If using the PRS for the presentation, download the system onto your computer

## facilities required

- Presentation – AV equipment and if possible, PRS handsets for each students
- Experiments – Table that can easily be wiped down

## materials required

- safety glasses x2
- lab coats x2
- gloves x2

### Sodium Chloride Theme

- margarine
- toilet paper
- soap
- bleach
- table salt
- small clear plastic bag and twist-tie
- large clear plastic bag and twist-tie
- plastic washing up bowl
- bag of Ice x2
- cup of milk
- vanilla essence
- sugar – 1 tablespoon

### Carbon Dioxide Theme

- bread
- cake
- bottle of Fizzy Pop
- decaffeinated coffee
- balloons x3
- dry Ice
- powder funnel
- hot water
- 1L Flask
- universal indicator

\*10 MIN EITHER SIDE FOR SET UP

This activity is based on an event ran by Anne Willis and Dr Peter Hoare, Chemistry for our Future (CFOF) Teacher Fellows based at Northumbria University and Newcastle University, respectively.

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## SAFETY

A risk assessment must be done for this activity.

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### materials required

#### Crude Oil Theme

- candle
- fleece
- fairy liquid (at least 40ml)
- lipstick
- plastic washing up tub
- 250ml measuring cylinder
- 30ml 30% hydrogen peroxide
- manganese dioxide **powder** (NOT granules!)
- blue food colouring

#### Nitrogen Theme

- polystyrene cup
- frozen peas
- crisps
- light bulb
- liquid nitrogen
- banana
- piece of wood
- nail (large-headed – roof felt tacks work well)
- gloves
- piece of rubber tubing

#### UV Theme

- sunscreen
- £5 note/ credit card
- tin of white paint
- washing powder
- UV lamp
- bottle of tonic water

### The activity

#### Presentation

The presentation and notes can be downloaded at [www.cfof.org/resources](http://www.cfof.org/resources).

The presentation works through a number of multiple choice questions and students are asked to vote on the correct answer. If using a PRS the results of each question are displayed and discussed. However, a show of hands will work just as well.

The presentation runs through the whole session with intermediate breaks to discuss each of the five themes.



## Sodium Chloride

The shopping contents for this theme is soap, bleach, margarine and (toilet) paper and pupils are asked for the common chemical compound that links them. Discuss the use of sodium chloride (NaCl) as the raw material for making each of the items e.g. making paper and bleach involves chlorine; making margarine involves hydrogen and making soap involves sodium hydroxide, all obtained from the electrolysis of NaCl solution.

The students will now get the chance to make ice cream. This will take around 20 minutes so ask for a couple of volunteers to continue making the ice cream throughout the session.

- 1 Pour the milk into the medium sized clear plastic bag and add the sugar and a few drops of vanilla essence. Seal the bag.
- 2 Empty the ice into the large clear plastic bag and add two large tablespoons of salt.
- 3 Place the smaller bag containing the milk into the larger bag and shake the mixture. This is best done in the plastic washing tub to avoid spillage.
- 4 Ask the volunteers to continue shaking the mixture for 20 minutes.
- 5 Continue with the following activities and towards the end of the session invite pupils to try their homemade ice cream.



## Carbon Dioxide

The shopping contents are bread, cake, decaffeinated coffee and fizzy pop and again pupils are asked to identify the common theme which is carbon dioxide. Discussion can then lead into how bread is made through the respiration of yeast and why fizzy drinks turn flat if the lid is left off.

The workshop provider will then introduce dry ice as solid carbon dioxide and demonstrate its effects by adding the dry ice to boiling water to which a few drops of universal indicator have been added. This is best done in a flask. The acidity of carbon dioxide and the link to tooth decay with fizzy drinks can be raised.

Students then get the chance to inflate balloons without blowing.

- 1 Add several pellets of dry ice into a couple of non-inflated balloons (Tip: blow into the neck of the balloon to "free" it first and use a powder funnel placed in the neck of the balloon to aid getting the pellets in!). Tie knots to seal each balloon.
- 2 Pass the balloons round the room asking the pupils to pass them from hand to hand. The balloon will inflate as the dry ice sublimates.
- 3 Once the balloons have fully inflated with carbon dioxide, blow up a balloon with air and compare the rates at which the two fall to the floor. Explain how the balloon filled with carbon dioxide drops faster because it is more dense than air.



## Crude Oil

The shopping contents are a candle, a fleece, detergent and lipstick and the common theme pupils are asked to identify is that they are all products of crude oil.

The workshop provider will then use the fairy liquid to make elephant toothpaste.

- 1 Place the measuring cylinder in the middle of the plastic washing tub.
- 2 Add around 40ml of detergent to the cylinder. Add a few drops of blue food colouring to make the toothpaste colour.
- 3 Add a small amount (no more than half a level spatula) of manganese dioxide powder and mix well.
- 4 Measure approx. 30ml of 30% hydrogen peroxide into a plastic cup and then quickly pour into the cylinder - stand well back as the reaction will take place very quickly! Hot coloured foam will shoot out of the cylinder.
- 5 Once the foam has cooled, clean up with water.

An alternative but less dramatic version of the experiment can be performed using common household hydrogen peroxide, a packet of dried yeast stirred into some warm water and dish soap. The reaction will take place more slowly and doesn't produce as much heat.

## Nitrogen Theme

The shopping contents are a polystyrene cup, a packet of frozen peas, a light bulb and a packet of crisps and the common theme is nitrogen. Explain how nitrogen is an inert gas and is used as a replacement for air where oxidation is undesirable e.g. to preserve the freshness of packet food or to prevent the hot filament in a light bulb oxidising and burning out.

Discuss the properties of liquid nitrogen and how its very low temperature freezes items rapidly. At these extreme cold temperatures (-196°C) the properties of materials are significantly different. The workshop provider will then prove a banana can hammer a nail into a piece of wood using liquid nitrogen and/or that a piece of rubber tubing becomes hard and brittle.

## Ultra-violet Theme

The shopping contents are washing powder, white paint, sunscreen, £5 note and a credit card and the common theme is ultra-violet (UV). Give a brief introduction to the electromagnetic spectrum and explain where the visible and UV ranges sit. Pupils will be aware of the effects of UV through sunburn and understand that UV is found in sunlight. Use the lamp to demonstrate how white clothes phosphoresce under UV radiation and link this back to the washing powder. Then show the tonic water glowing blue under UV. Explain that green peas and beans glow red whilst ripe bananas glow blue. These properties are used by food processors when selecting produce.

The watermarks on the £5 note and the invisible MC marking on the credit card are used to demonstrate the effects of UV. Using a UV lamp, show the pupils the 'invisible' markings.

