UNDERSTANDING YOUR FOOD
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TEACHER NOTES

S5. Sweeter than sugar

Pupils do practical activities to compare the 'densities' of drinks containing artifical sweeteners and sugar.

Answers to questions on Pupil activity

Sheet S5. Task 1

The accurate measurement of volumes is very important.

1. aspartame, saccharin and acesulphame K are the most common
2. this will vary depending on the tablets
3. ~3.0 g
4. ~22.0 g
5. The artificial sweeteners weigh considerably less than equivalent *volumes* of sugar. These volumes have the *same* sweetness. The artificial sweeteners areconsiderably sweeter than sugar and are therefore present in relatively tiny amounts.
6. ~9.9 g
7. ~10.5 g
8. The sugar solution weighs more than an equal volume of sweetener solution. It has a greater *density*. The sweetener present has a much smaller mass than the sugar.

Task 2

1. Typical ingredients (e.g. Sainsbury's own brand lemonade):

'diet' lemonade	'ordinary' lemonade
carbonated water, citric acid, flavouring, acidity regulator: sodium citrate; artificial sweetener: aspartame; preservative: sodium benzoate; stabiliser: carboxymethyl cellulose	carbonated water, sugar, citric acid, flavouring, preservative: sodium benzoate; artificial sweetener: saccharin

2. Knowledge of food labelling will show that *sugar* appears before the artificial sweeteners and citric acid in the 'ordinary' lemonade. 'Ordinary' lemonade has a certain amount of dissolved sugar in it whereas 'diet' lemonade does not. Using the knowledge gained from Task 1, pupils need only to weigh equal volumes of the two samples to discover which is which. 10 cm^3 of 'ordinary' lemonade does indeed have a greater mass than 10 cm^3 of 'diet' lemonade ('ordinary' lemonade has a greater density than 'diet' lemonade).

Task 3

1. graph; make sure that a suitable scale is used for the vertical axis.
2. ~10.3 g
3. This will vary depending on which drinks you have chosen to test.

KS4
science and food technology

Timing - 40 - 60 minutes

Two pupil activity sheets S5 accompany this activity.

Requirements

- *artificial sweetener tablets*
- *granulated artificial sweetener*
- *ordinary table sugar (sucrose)*
- *balance, accurate to 0.1 g*
- *teaspoons*
- *distilled water*
- *10 cm^3 graduated pipettes*
- *teat pipettes*
- *small beakers or similar*
- *sample of 'ordinary' lemonade labelled A*
- *sample of 'diet' lemonade (be sure that it does not contain sugar) labelled B*
- *the empty bottles/containers from the lemonade or the labels from the containers or copies of these*
- *apparatus for testing for reducing sugar/glucose, i.e. heating equipment, water bath, Benedict's solution, test tubes or boiling tubes, test tube holder, test tube rack, safety goggles, Clinistix (if available), stop clock*
- *samples of any other drinks such as cola; these should be in labelled beakers but should not have their ingredients labels with them; the drinks will be used to find their sugar content*
- *graph paper*

SWEETER THAN SUGAR

There are a number of **artificial sweeteners** available to consumers. The most common examples are the very small 'tablets', each equivalent to a teaspoon of sugar which many people use to sweeten tea and coffee drinks. Sweeteners are also available in a granulated form (it looks like ordinary sugar) for use in cooking and for sprinkling over food. Again, one teaspoon of the granulated sweetener has the equivalent sweetness of one teaspoon of sugar.

SAFETY NOTE
YOU MUST NOT EAT OR DRINK ANY OF THE SUBSTANCES USED IN THIS INVESTIGATION

Task 1

You are given samples of sweetener tablets, a granulated sweetener and ordinary sugar (sucrose).

1. Find out, from the labels the chemical names of the artificial sweeteners .
2. Find the mass of four of the small tablets.
3. Find the mass of four teaspoons of the granulated sweetener.
4. Find the mass of four teaspoons of ordinary sugar.
5. What do you notice? How do you explain this?
6. Dissolve the four teaspoons of granulated sweetener in 100 cm^3 of water. Find the mass of 10 cm^3 of this solution as accurately as you can.
7. Dissolve the four teaspoons of sugar in 100 cm^3 of water. Find the mass of 10 cm^3 of this solution as accurately as you can.
8. What do you notice? How do you explain this?

Task 2

Artificial sweeteners can be used in the production of so-called 'diet' drinks, such as 'diet' lemonade and 'diet' cola.

You are given the empty bottles, or labels, from two bottles of lemonade. One of then is 'diet' lemonade and the other is 'ordinary' lemonade.

1. Copy, into a table, the ingredients in each lemonade, in the order they appear.
   Remember - the ingredients are shown in descending order of mass, i.e. the ingredient present in the largest amount is always first.
2. You are now given samples of the liquids from each bottle, but you do not know which is which! Using only the information you have learnt so far, devise a simple way of finding out which sample is 'ordinary' lemonade and which sample is 'diet' lemonade. Do not use up all of the lemonades.
   Explain your test and the results.
3. Carry out the Benedict's test (and/or the Clinistix test) on a small sample of each liquid to confirm your results.

Task 3

You are given information about the mass of different sugar solutions.

Amount of sugar (g) dissolved in 100 cm^3 of water	Mass (g) of 10 cm^3 of this solution
0	9.94
2	10.01
6	10.14
10	10.28
14	10.41
18	10.55
22	10.68

1. Plot a graph of this information. Put the amount of sugar dissolved (g) along the bottom (x axis). Put the mass of 10 cm^3 of solution up the side (y axis). Remember to give your graph a title. Label the axes.
2. Use your graph to predict the mass of a solution containing 10.5 g of sugar.

You are now given some samples of drinks.

3. Find the mass of 10 cm^3 of each of the samples. Use your graph to find out how much sugar is in each of the drinks. Record your results in a suitable table. Do all drinks contain the same amount of sugar?