Sugar containing nutrients (Item No.: P8012400)

Curricular Relevance

Area of Expertise: Biology
Education Level: Age 14-16
Topic: Nutrition and digestion
Subtopic: Nutrients
Experiment: Sugar containing nutrients

Difficulty	Preparation Time	Execution Time	Recommended Group Size
Intermediate	10 Minutes	10 Minutes	2 Students

Additional Requirements:

- Fruit juice
- Cake
- Fruit
- Honey
- Bread
- Jam
- Raisins

Experiment Variations:

Keywords:

Sugar detection, Fehling's test

Task and equipment

Information for teachers

Additional Information

Sugars are important nutrients in our foods. Like starch they belong to the carbohydrates. In contrast to starch, however, they can be directly absorbed into our bodies through the intestinal wall, without first having to be transformed through the digestive process. Hence they are very readily available as a source of energy, and it is for this reason that glucose has a refreshing and invigorating effect.


Hazards!

- Fehling's solution is harmful to health when swallowed and can cause burns when it contacts skin.
- Use protective glasses!

Disposal

Transfer the contents of the test tubes to the container for solutions of heavy metal salts.

Hint

Fehling’s solution I consists out of an aqueous solution of copper(II) sulfate, which forms together with Fehling’s solution II, which contains potassium sodium tartrate and sodium hydroxide, a deep blue tartrato-copper (II) complex. If monosaccharides like glucose are added, a redox reaction takes place in which copper(I) oxide (Cu_2O) is formed, which causes the orange brown precipitate.

Fehling's solutions I and II must be kept separate from each other, otherwise side reactions take place that affect the actual detection reaction.

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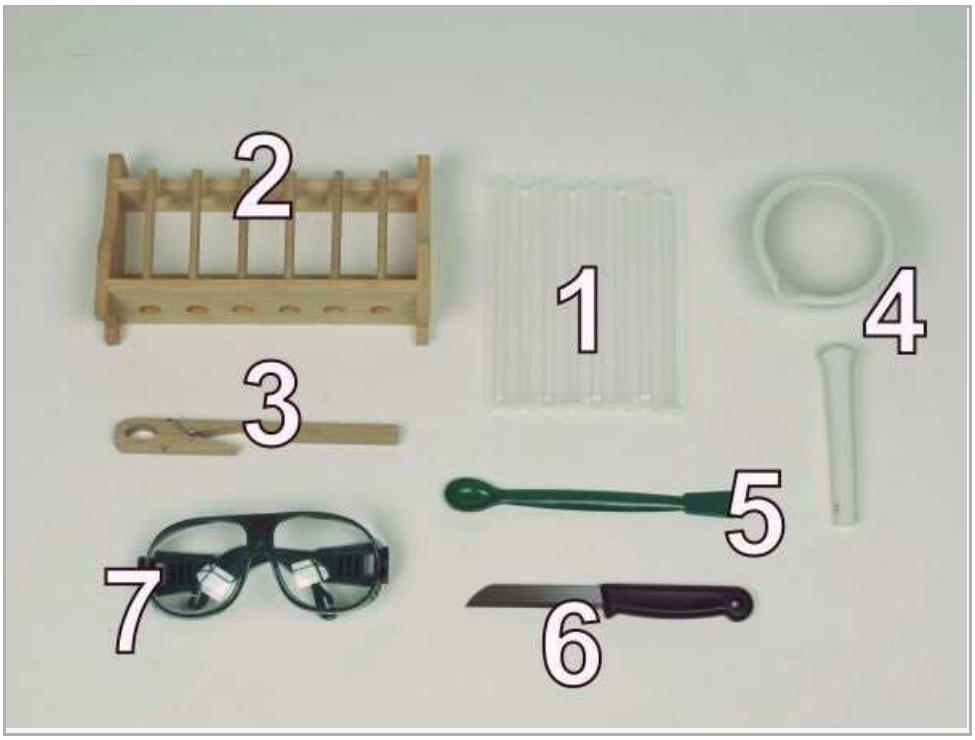
Task and equipment

Task

Which foods contain sugar?

Learn to recognize a possible test for sugar and examine foods for sugar content.

Equipment



Position No.	Material	Order No.	Quantity
1	Test tube 160x16 mm, 10 pcs	37656-03	(8)
2	Test tube rack f. 6 tubes, wood	37685-10	1
3	Test tube holder, up to d 22mm	38823-00	1
4	Mortar w. pestle, 70ml, porcelain	32603-00	1
5	Spoon,w.spatula end,18 cm,plastic	38833-00	1
6	Knife, stainless	33476-00	1
7	Protecting glasses, clear glass	39316-00	1
	Butane burner, Labogaz 206 type	32178-00	1
	Butane cartridge C206, without valve	47535-01	1
	Fehling's solution I 250 ml	30079-25	1
	Fehling's solution II 250 ml	30080-25	1
	D (+)-Sucrose 100 g	30210-10	1
	D(+)-glucose 1-hydr. 250 g	30237-25	1
	D-fructose -laevulose- 25 g	30128-04	1
	D(+)-Lactose, powder 100 g	31577-10	1
Additional material			
	Fruit juice		
	Cake		
	Various foodstuffs, e.g. fruit, honey, bread, jam, raisins		

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Set-up and procedure

Hazards!

- Fehling's solution is harmful to health when swallowed and can cause burns when it contacts skin.
- Use protective glasses!


Experiment 1

Attach the butane burner to the butane cartridge as shown in Figures 1 and 2. Using matches, light up the butane burner.

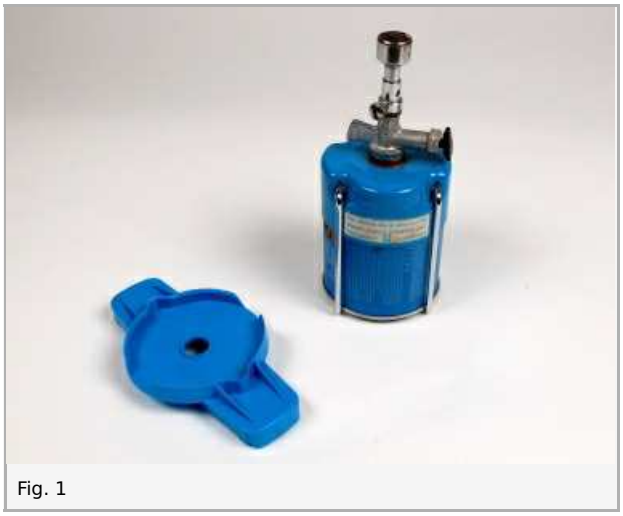
Fig. 1

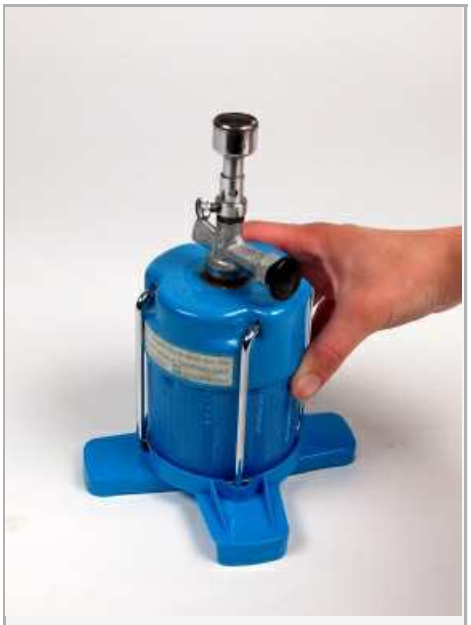
Fig. 2

Quarter fill a test tube with water and drop in a spatula tip of glucose. Close the test tube with your thumb and shake until the glucose has dissolved (Fig. 3).

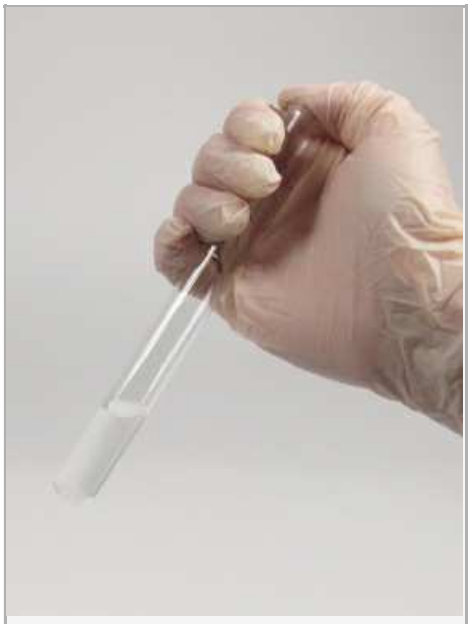

Fig. 3

Pour into a second test tube the same quantity of mixture of Fehling’s solutions I and II and heat the contents of both test tubes to boiling.

Be careful to ensure that no delay in boiling occurs, as the mixture of Fehling’s solution has a very strong caustic soda content and is accordingly very corrosive. On no account should it be allowed to spurt out of the test tube. Therefore don’t heat the test tube at the bottom, but a little below the surface of the liquid (Fig. 4). Move it gently to and fro while heating and hold it so that its mouth is away from people.

Fig. 4

Pour both liquids together as soon as they boil.

What happens as soon as you have poured the solutions together? Note your observationsin in the report.

Experiment 2

Repeat the experiment without adding sugar. Note your observations in the report.

Experiment 3

Repeat the experiment, but using fructose instead of the glucose. Note your observations in the report.

Experiment 4

Repeat the experiment one more, but using saccharose or milk sugar (lactose). Note your observations in the report.

Experiment 5

Fill a test tube about a quarter full with fruit juice, add in a second test tube the same quantity of mixture of Fehling’s solution I and II and proceed as desribed above. Note your observations in the report.

Experiment 6

Crumble some cake with a few millilitres of water in a mortar, pour the liquid into a test tube, ass the same quantity of mixture of Fehling’s solution I and II and heat to boiling. Note your observations in the report.

Fig. 5

Fig. 6

Disposal

Transfer the contents of the test tubes to the container for solutions of heavy metal salts.

Report: Sugar containing nutrients

Result – Observations 1

Write down your observations on Experiment 1.

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Result – Observations 2

Write down your observations on Experiment 2.

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Result – Observations 3

Write down your observations on Experiment 3.

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Result – Observations 4

Write down your observations on Experiment 4.

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Result – Observations 5

Write down your observations on Experiment 5.

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Result – Observations 6

Write down your observations on Experiment 6.

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Evaluation – Question 1

What reactions occurred? What conclusions do you draw? How can sugar be detected?

Evaluation – Question 2

What happens during experiments 3 and 4? Can all the sugars be detected in accordance with the successful method used in the first two experiments?

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Evaluation – Question 3

Does the fruit juice contain sugar which can be detected with Fehling’s solution?

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Evaluation – Question 4

Does the cake contain sugar which can be detected with Fehling’s solution?

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Evaluation – Additional Task

Using the methods described above examine other foodstuffs for fat. Liquids can be studied directly, not liquid foods have to be crumbled with some water in a mortar. Tabulate all your results.

Foodstuff	Taste	Fehling's test positive?
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0

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