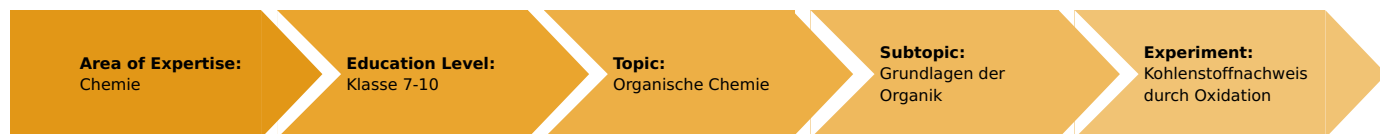


The detection of carbon by oxidation (Item No.: P7170200)

Curricular Relevance



Difficulty



Easy

Preparation Time



10 Minutes

Execution Time



10 Minutes

Recommended Group Size



2 Students

Additional Requirements:

Experiment Variations:

Keywords:

organic compounds, tests for carbon dioxide, oxidation

Task and equipment

Information for teachers

Learning objectives

- Carbon cannot always be detected directly in organic substances.
- In such cases, it can be oxidized to carbon dioxide with copper(II) oxide, carbon dioxide can then be detected with limewater.

Notes on setup and procedure

Preparation:

Provide fresh limewater if possible.

Notes on the student experiments:

Ammonia is generated when urea is heated (formation of biuret), so that only a small amount should be heated in the combustion spoon and the experiment should be stopped as soon as the urea starts to melt. Carry out the experiment in a fume hood if possible.



Hazard and precautionary statements

Calcium hydroxide:

- H315: Causes skin irritation.
 H318: Causes serious eye damage.
 H335: May cause respiratory irritation.
 P261: Avoid breathing dust/fume/gas/mist/vapours/spray.
 P280: Wear protective gloves/protective clothing/eye protection/face protection.
 P305 + P351 + P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do - continue rinsing.

Copper(II) oxide:

H302: Harmful if swallowed.

H410: Very toxic to aquatic life with long lasting effects.

P260: Do not breathe dust.

P273: Avoid release to the environment.

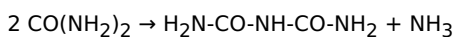
P501: Dispose of contents/ containers to be collected by a licensed contractor in accordance with national and local regulations.

Hazards

- To make glass/rubber connections, wet the glass with glycerol so that it can be easily inserted!
- Calcium hydroxide solution is caustic. Wear protective glasses!
- Gases with an unpleasant smell are evolved when urea is heated. If possible perform the experiment in a fume hood otherwise air the room well!

Notes

The oxidation of non-decomposable organic substances and the detection of the carbon as carbon dioxide was carried out long ago by Justus von Liebig. When urea is heated above its melting point, biuret is formed:



Remarks on the method

The previous experiments should arouse the realization that not all detection methods are suitable in all cases, but that they must be expanded or specialized according to the requirements. The detection of hydrogen can be carried out quantitatively when dry glassware is used. The detection of nitrogen as ammonia will be discussed in more detail in a separate experiment (P7170400).

Waste disposal

- Pour limewater into the container for acid and alkali wastes.
- Put urea and decomposition products in the biodegradable waste (compost) or dispose of as solid organic material.

The detection of carbon by oxidation (Item No.: P7170200)

Task and equipment

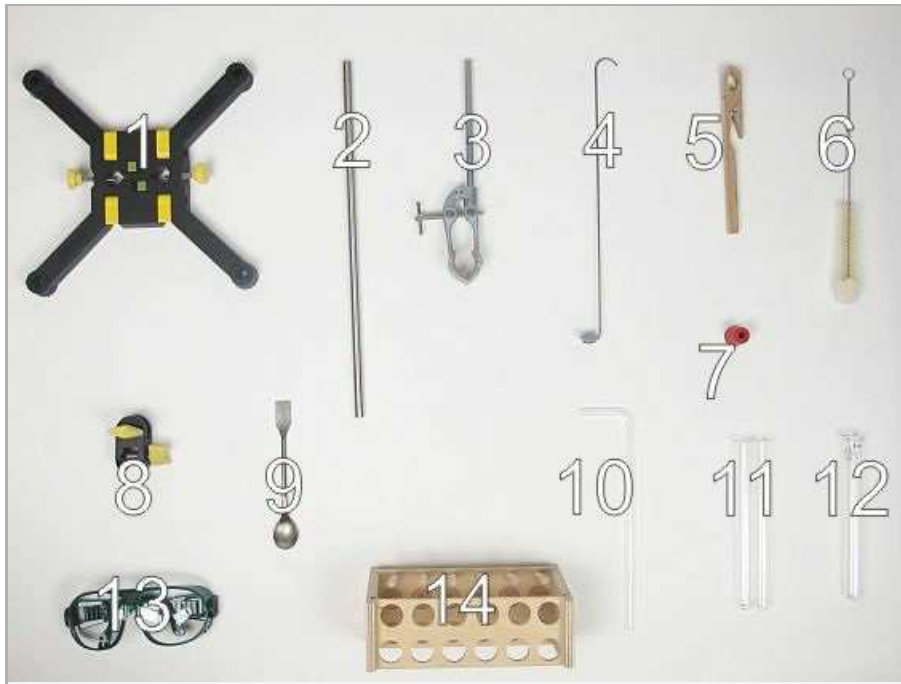
Task

How can carbon be detected in substances which are not combustible and do not decompose to carbon?

Examine urea for carbon content.



Equipment



Position No.	Material	Order No.	Quantity
1	Support base, variable	02001-00	1
2	Support rod, stainless steel, l=370 mm, d=10 mm	02059-00	1
3	Universal clamp	37715-00	1
4	Combustion spoon, l=300 mm	33346-00	1
5	Test tube holder, up to d 22mm	38823-00	1
6	Test tube brush w. wool tip,d25mm	38762-00	1
7	Rubber stopper, d = 22/17 mm, 1 hole	39255-01	1
8	Boss head	02043-00	1
9	Spoon, special steel	33398-00	1
10	Glass tubes,right-angled, 10	36701-59	1
11	Test tube, 180x18 mm,100pcs	37658-10	(2)
12	Test tube,180x20 mm,DURAN, PN19	36293-00	1
13	Protecting glasses, clear glass	39316-00	1
14	Test tube rack for 12 tubes, holes d= 22 mm, wood	37686-10	1
	Butane burner f.cartridge 270+470	47536-00	1
	Butane cartridge CV 300 Plus, 240 g	47538-01	1
	Glycerol, 250 ml	30084-25	1
	Urea, 250 g	30086-25	1
	Copper-II oxide,powder 100 g	30125-10	1
	Calcium hydroxide solution 1000ml	31458-70	1

Set-up and procedure

Set-up

Hazards

- To make glass/rubber connections, wet the glass with glycerol so that it can be easily inserted!
- Calcium hydroxide solution (limewater) is caustic. Wear protective glasses!
- Gases with an unpleasant smell are evolved when urea is heated. If possible perform the experiment in a fume hood otherwise air the room well!



Setup

Set up the stand as shown, with the universal clamp about halfway up the support rod (Fig. 1 to 4).



Fig. 1



Fig. 2



Fig. 3



Fig. 4

Wet the end of the short arm of the right-angled glass tube with glycerol and slide it carefully through the rubber stopper (Fig. 5).



Fig. 5

Procedure

Transfer a small spatula tip of urea to the combustion spoon and try to ignite it (Fig. 6). Fill urea into a test tube up to a height of about 0.5 cm and heat it for about 2 minutes (Fig. 7).



Fig. 6



Fig. 7

Put a spoonful of urea into the Duran test tube, pound it to compact it as much as possible and then put in two spoonfuls of copper oxide on top of it (Fig. 8). Fit the rubber stopper with the right-angled tube onto the Duran test tube. Clamp the test tube horizontally on the stand and turn the right-angled tube so that the long arm points downwards (Fig. 9).



Fig. 8



Fig. 9

Fill limewater into a test tube until it is about one third full. Position the test tube so that the long arm of the right-angled tube fits into it. Adjust the height of the Duran test tube so that the end of the long arm is immersed in the limewater (Fig. 10).



Fig. 10

First heat the copper oxide, then the urea (Fig. 11+12). Stop heating after about 3 minutes, take the long arm of the right-angled tube out of the limewater before turning off the burner.

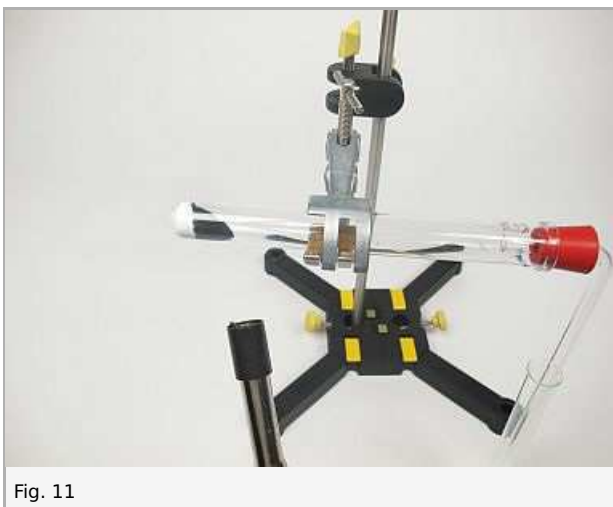


Fig. 11



Fig. 12

Waste disposal

- Pour limewater into the container for acid and alkali wastes.
- Put urea and decomposition products in the biodegradable waste (compost) or dispose of as solid organic material.

Report: The detection of carbon by oxidation

Result - Observations

Note your observations.

- a) Combustion spoon.
- b) Test tube.
- c) Duran test tube.

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Evaluation - Question 1

Draw conclusions from your observations and name some properties of urea which you derive from your observations.

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Evaluation - Question 2

Which process took place in the Duran test tube as the black copper-(II) oxide was heated on top of the urea?

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Evaluation - Question 3

Which other components of urea (and other organic substances) were also detected?

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