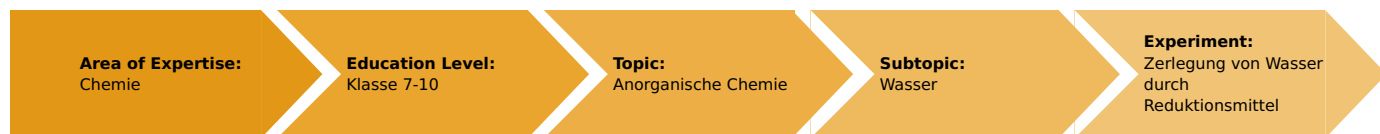


# Degradation of water by reducing agents (Item No.: P7155500)

## Curricular Relevance



### Difficulty



Easy

### Preparation Time



10 Minutes

### Execution Time



10 Minutes

### Recommended Group Size



2 Students

### Additional Requirements:

### Experiment Variations:

### Keywords:

reduction, reducing agent, water

## Task and equipment

## Information for teachers

## Learning objectives

- Water can be decomposed by reducing agents.
- In the process, hydrogen is produced.

## Notes on set-up and preparation

### Preparation

The zinc powder should be dry, but not oxidised. If necessary, dry it overnight at a moderate temperature (approximately 50 °C) before performing the experiment.

### Remarks on the students' experiments

The reaction of calcium with water occurs violently even with the slow addition of the water through the sand. In any case, extremely refractory test tubes should be used. Definitely inform the students of the necessity for the hydrogen-oxygen test.



## Hazard and Precautionary statements

Zinc powder:

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

P273: Avoid release to the environment.

Calcium, granular:

H261: In contact with water releases flammable gases.

P402 + P404: Store in a dry place. Store in a closed container.

## Hazards

- Lubricate rubber-glass connections with glycerol. Do not use force!
- During the experiment explosive mixtures are formed. Wear protective glasses!

## Remarks on the method

In this experiment, the already elaborated terms reducing agent, etc. are repeated and consolidated using new examples. Water has already been identified as hydrogen oxide here. A verification of this fact, which is also appropriate for the introduction of the analysis/synthesis term, is performed in a separate experiment.

## Waste disposal

- Dispose of zinc oxide as a heavy metal waste.
- Allow the calcium to react completely and put it into the collection container for acids and alkalis.

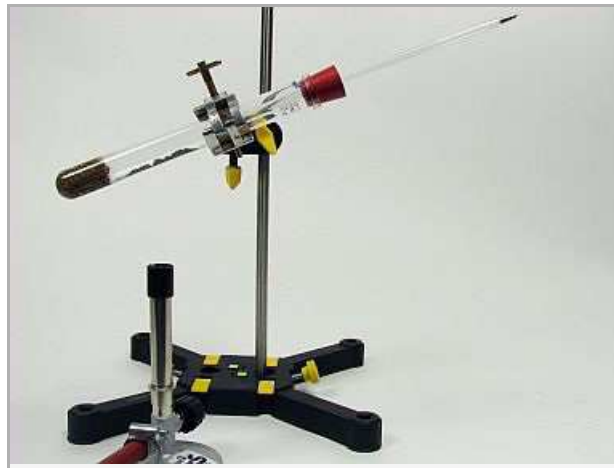
# Degradation of water by reducing agents (Item No.: P7155500)

## Task and equipment

### Task

#### Which elements does water consist of?

Decompose water using a reducing agent.



Equipment



Position No.	Material	Order No.	Quantity
1	Boss head	02043-00	1
2	Universal clamp	37715-00	1
3	Protecting glasses, clear glass	39316-00	1
4	Support base, variable	02001-00	1
5	Test tube brush w. wool tip,d25mm	38762-00	1
6	Support rod, stainless steel, l=370 mm, d=10 mm	02059-00	1
7	Wash bottle, 250 ml, plastic	33930-00	1
7	Spatula, powder, steel, l=150mm	47560-00	1
8	Test tube rack f. 6 tubes, wood	37685-10	1
8	Test tube, 18x188 mm, 10 pcs	37658-03	(3)
8	Test tube holder, up to d 22mm	38823-00	1
9	Rubber stopper, d = 22/17 mm, 1 hole	39255-01	2
10	Pipette with rubber bulb	64701-00	1
10	Glass tubes, straight with tip, 10	36701-62	(1)
11	Test tube,180x20 mm,DURAN, PN19	36293-00	2
	Butane burner f.cartridge 270+470	47536-00	1
	Butane cartridge CV 300 Plus, 240 g	47538-01	1
	Wood splints, package of 100	39126-10	(1)
	Calcium, granular 50 g	30049-05	1
	Glycerol, 250 ml	30084-25	1
	Standard sand, fine 2500 g	31825-79	1
	Iron wool 200 g	31999-20	1
	Zinc, powder 100 g	31978-10	1
Additional material			
	Distilled water		

## Set-up and procedure

### Set-up

### Hazards

- Lubricate rubber-glass connections with glycerol. Do not use force!
- During the experiment explosive mixtures are formed. Wear protective glasses!



### Set-up

Set up the support stand according to Fig. 1 - Fig. 4. Clamp the Duran test tube perpendicularly in the clamp (Fig. 5).

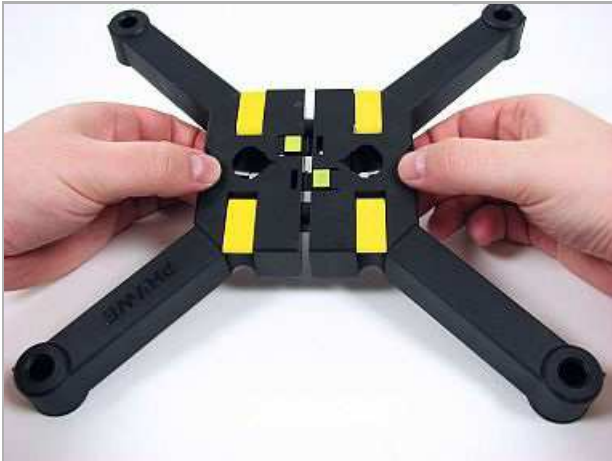


Fig. 1



Fig. 2

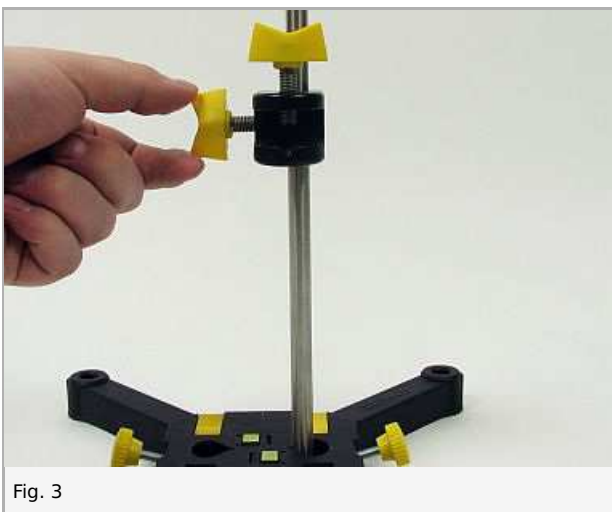


Fig. 3

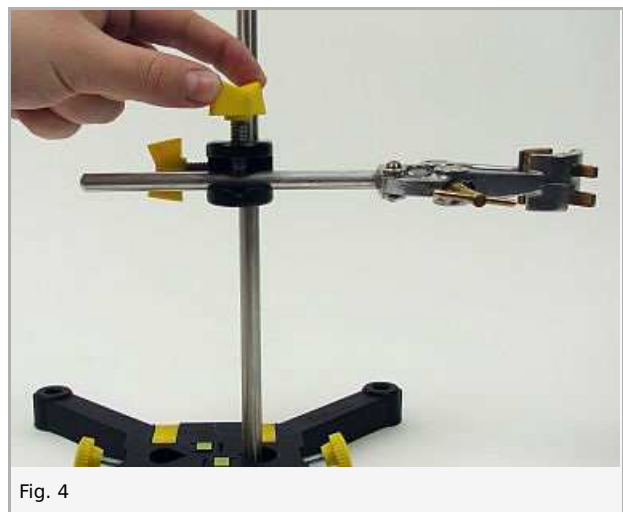


Fig. 4

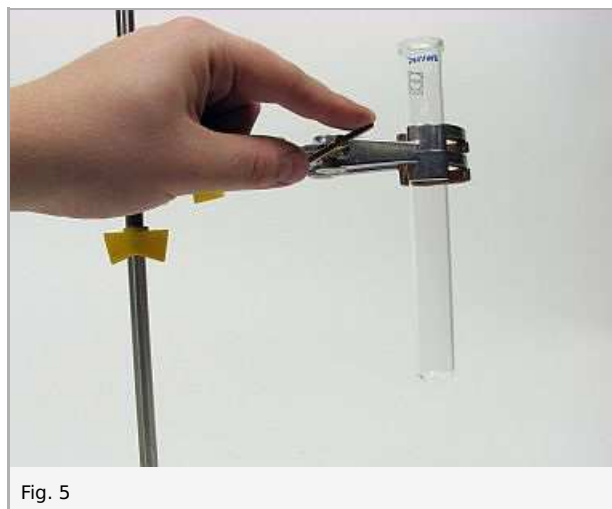


Fig. 5

Pour sand into the test tube to a height of approximately 3 cm (Fig. 6). Fill the pipette with water and use it to thoroughly moisten the sand without getting water on the test tube's walls (Fig. 7). Use only enough water to wet the sand with no excess liquid above the sand's surface.

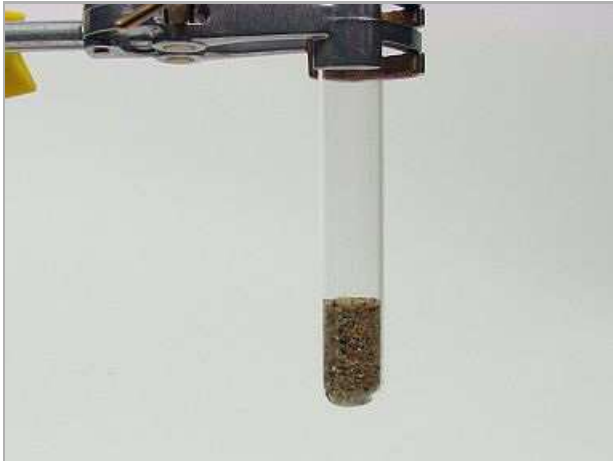


Fig. 6

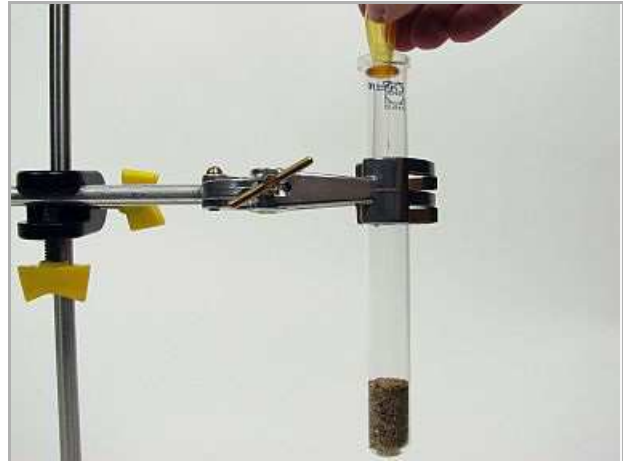


Fig. 7

Turn the universal clamp until the test tube is clamped at an angle (Fig. 8). Place an approximately 5 cm long strip of dry zinc powder above the moistened sand (Fig. 9 + Fig. 10). Insert a bit of iron wool into the end of the glass tube (Fig. 11). Then twist the latter into the rubber stopper (lubricate with glycerol) (Fig. 12), and seal the test tube with the stopper (Fig. 13).



Fig. 8

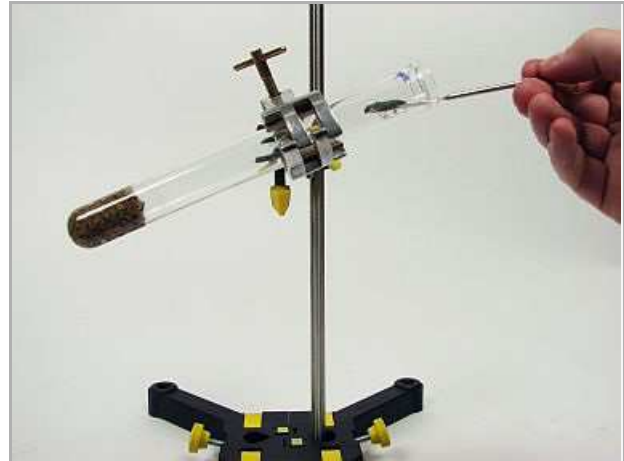


Fig. 9



Fig. 10

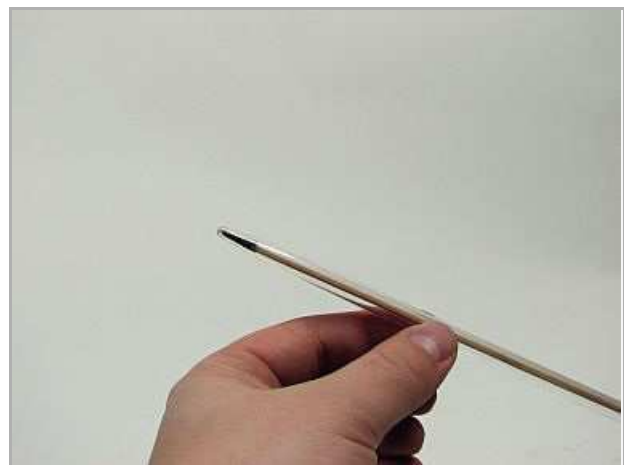


Fig. 11

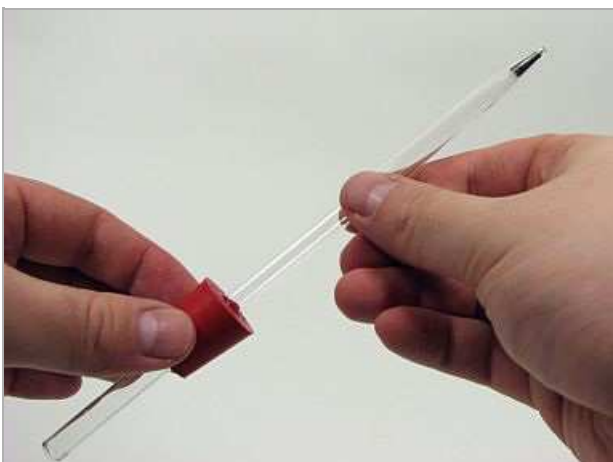


Fig. 12



Fig. 13

## Procedure

## Procedure

Heat the zinc powder with a small burner flame; then heat it strongly for approximately 1 minute (Fig. 14). Place an upside-down test tube over the nozzle of the glass tube with tip (Fig. 15), and then heat the moist sand (Fig. 16). Regulate the burner's flame so that a flow of water vapour which is uniform and not too strong is produced.





Fig. 14

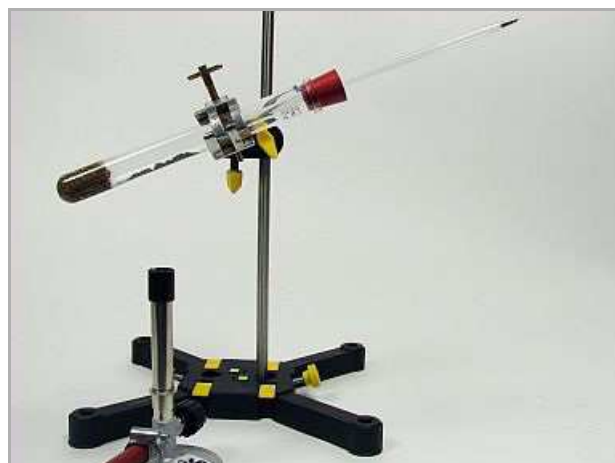


Fig. 15

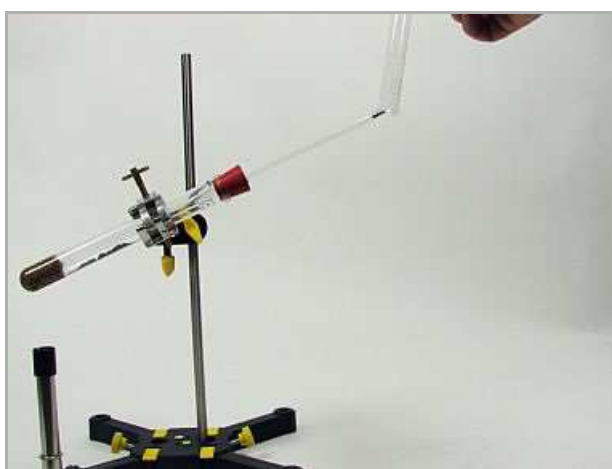


Fig. 16

After approximately half a minute perform the hydrogen-oxygen test in the upside down test tube. Ignite the gas escaping from the glass tube's nozzle with a burning wooden splint (Fig. 17).

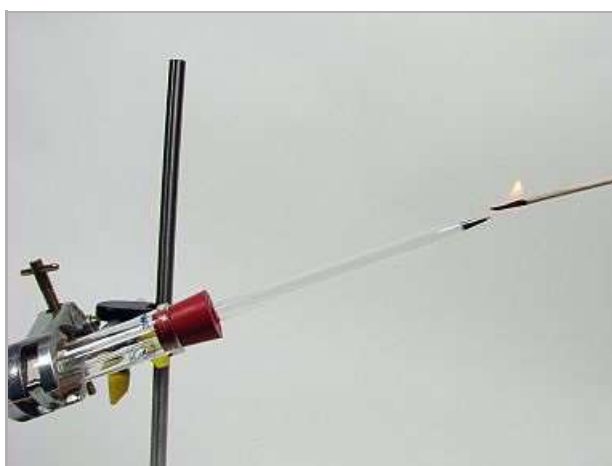


Fig. 17

Extinguish the burner flame, let the apparatus cool, and disassemble it. Clamp the second Duran test tube perpendicularly onto the support stand (Fig. 18).

Put a spatulaful of calcium grains into this tube (Fig. 19); pour approximately 3 cm of sand onto it (Fig. 20).



Fig. 18

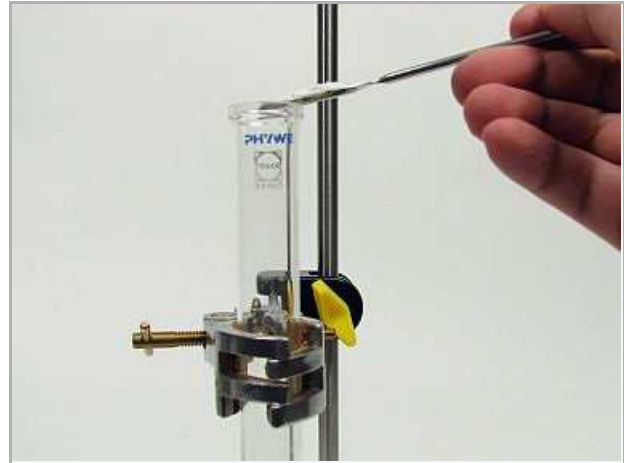


Fig. 19



Fig. 20

Moisten the sand from the top with the pipette (Fig. 21). Close the test tube with the stopper rapidly (Fig. 22).

Place an upside down test tube over the nozzle (Fig. 23), and perform the hydrogen-oxygen test approximately half a minute after the reaction has begun.



Fig. 21



Fig. 22

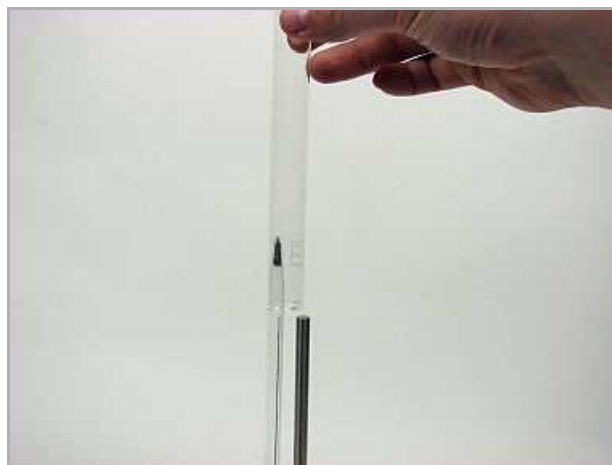


Fig. 23

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Ignite the gas with a wooden splint at the nozzle. Pick up a dry test tube with the test tube holder and hold it with its opening downwards over the flame.

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## Waste disposal

Allow the contents of the test tubes to react completely (if necessary, add some more water) and after completion of the reaction pour the contents into the collection container for acids and alkalis.

# Report: Degradation of water by reducing agents

## Result - Observations

Note your observations.

Experiment 1:  
Experiment 2:

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## Evaluation - Question 1

Draw conclusions from the two experiments. State the processes occurring in a word equation.

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### Evaluation - Question 2

Name the properties of the substances resulting from this experiment.

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### Evaluation - Question 3

Comment on the terms reducing agent and oxidising agent with the aid of this experiment. Name the reduced and the oxidised substances.

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### Evaluation - Question 4

Which other substances could also be used here as reducing agents (reasons)?

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