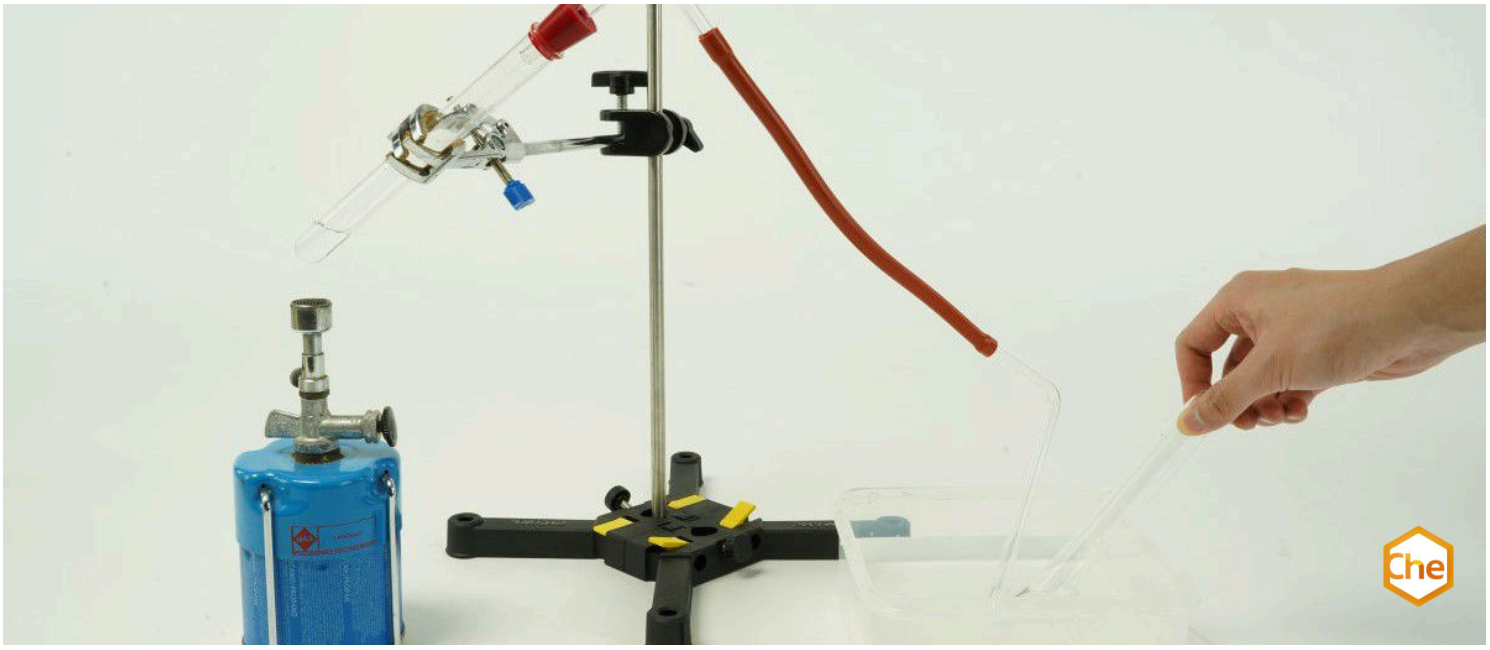
The characterisation of methane



Chemistry | Industrial Chemistry | Petrochemistry

Difficulty level	Group size	Preparation time	Execution time
easy	2	10 minutes	10 minutes

This content can also be found online at:

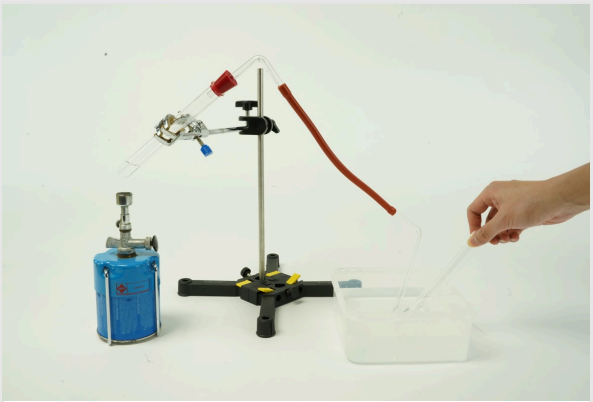
http://localhost:1337/c/6343064e580cc10003957fc9

PHYWE

Teacher information

Application

PHYWE



The experimental setup

Methane is an organic compound with the molecular formula CH_4 and at the same time the simplest alkane.

As the main component of natural gas, methane plays an essential role in usable energy production. Methane is also one of the main components of biogas, which is produced from the fermentation of energy crops, liquid manure and organic raw materials.

In this experiment, methane is produced from aluminium carbide and water and its properties are investigated.

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Other teacher information (1/3)

PHYWE

Prior knowledge

Students should have knowledge of the periodic table and basic knowledge of organic compounds. Students should know that methane is CH_4 .

Students should know the basics of working with chemicals and be able to work with a butane gas or Bunsen burner.

Principle

In this experiment, the students synthesise methane and make statements about the properties of methane based on their observations.

Other teacher information (2/3)

PHYWE

Learning objective

The students learn that methane can be produced from aluminium carbide and water. In addition, methane is a colourless, flammable gas that is explosive in certain mixing ratios with air.

Tasks

Make methane and investigate some of its properties.

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Other teacher information (3/3)

PHYWE

Notes on set-up and procedure

Preparations

It is recommended to check the aluminium carbide used beforehand. If this reacts only sluggishly after a longer storage time, 10 % hydrochloric acid can be used instead of water.

Regular Bunsen burners can still be used instead of the butane burner.

Notes on the student experiments

Take care not to overheat and not to bring the burner flame too close to the opening of the test tube. The experimental apparatus should be disassembled in the fume cupboard after extinguishing all open flames.

Safety instructions

PHYWE

The general instructions for safe experimentation in science lessons apply to this experiment.

Explosive gases are produced during the experiment.

Put on protective goggles!

Ventilate the room well after the test!

Make rubber-glass compounds slippery with glycerine!

For H and P phrases, please refer to the safety data sheet of the respective chemical.

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

PHYWE

Student information

Motivation

PHYWE

A gas cooker

Fossil fuels such as crude oil and natural gas consist of organic compounds and currently still cover almost all of modern society's energy needs. Among the carbon compounds is also methane, the main component of natural gas and biogas.

Methane can therefore be found in large quantities in nature, but can also be synthesised from carbon-containing compounds and water.

One method will be explored in more detail in this experiment.

PHYWE

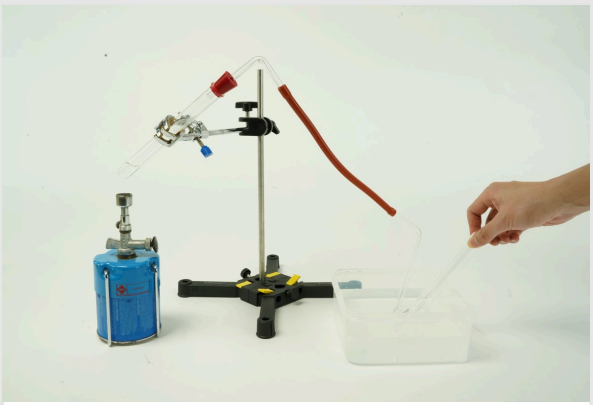
Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Tasks

PHYWE



The experimental setup

How can methane be produced?

Make methane and investigate some of its properties.

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Equipment

Position	Material	Item No.	Quantity
1	Support base, variable	02001-00	1
2	Support rod, stainless steel, l=370 mm, d=10 mm	02059-00	1
3	Boss head	02043-00	1
4	Spoon, special steel	33398-00	1
5	Dish, plastic, 150x150x65 mm	33928-00	1
6	Wash bottle, 250 ml, plastic	33930-00	1
7	Test tube,180x20 mm, PN19	MAU-17080101	1
8	Glass tube,right-angled,.	MAU-10030703	1
9	Glass tubes,r.angled,hook/tip, 10	36701-56	1
10	Test tube, 180x18 mm,100pcs	37658-10	1
11	Test tube brush w. wool tip,d20mm	38762-00	1
12	Test tube rack for 12 tubes, holes d= 22 mm, wood	37686-10	1
13	Universal clamp	37715-01	1
14	Rubber stopper, d=22/17 mm, without hole	39255-00	1
15	Rubber stopper, d = 22/17 mm, 1 hole	39255-01	1
16	Rubber tubing, i.d. 6 mm	39282-00	1
17	Protecting glasses, clear glass	39316-00	1
18	Glycerol, 250 ml	30084-25	1
19	Calcium carbide,granul. 250 g	48018-25	1
20	Butane burner with cartridge, 220 g	32180-00	1
21	Water, distilled 5 l	31246-81	1

PHYWE
Robert-Bosch-Breite 10
37079 Göttingen
Tel.: 0551 604 - 0
Fax: 0551 604 - 107
info@phywe.de
www.phywe.de

Set-up (1/2)

PHYWE

1. Set up the support according to Fig. 1 - Fig. 3 with the socket and tripod clamp.

2. Clamp the Duran test tube at an angle in the clamp (Fig. 4).

Figure 1

Figure 2

Figure 3

Figure 4

Set-up (2/2)

PHYWE

Figure 5

Figure 6

3. Fill the pneumatic tub two-thirds full with tap water. Fill the test tube with tap water, close it with your thumb and place it in the pneumatic tub with the opening facing downwards (Fig. 5 and 6).

4. Connect the angled tube to the glass tube with tip (gas introduction tube) using a piece of tubing. Carefully screw the free leg of the angled tube (make it slippery with glycerine!) into the rubber stopper (Fig. 7).

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Procedure (1/3)

PHYWE

1. Put a spatula tip of aluminium carbide on the bottom of the Duran test tube (Fig. 7). Pour about 2 cm of distilled water on top (Fig. 8) and close the Duran test tube with the stopper on which the angled tube and the gas introduction tube are located (Fig. 9). Immerse the gas introduction tube in the pneumatic tub and direct the tip under the test tube filled with water.

Figure 7

Figure 8

Figure 9

Procedure (2/3)

PHYWE

Figure 10

Figure 11

2. Carefully heat the Duran glass until a gas can be observed. Then set the burner flame as small as possible.

3. Wait for about 30 seconds, then pour the gas into the inverted test tube filled with water (Fig. 10). Once filled, close it with the rubber stopper and place it in the test tube rack (Fig. 11).

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Procedure (3/3)

PHYWE

Figure 12

4. Take the gas inlet tube out of the pneumatic tray and extinguish the burner flame immediately. Remove the experimental apparatus from the workplace.

5. Then light the burner flame again. Hold the test tube with the opening pointing downwards, remove the stopper and hold the mouth of the test tube, which is still pointing downwards, to the burner flame (Fig. 12).

Disposal

Allow the aluminium carbide to react completely with more water. Then put the contents of the test tube into the collection container for acids and alkalis.

PHYWE

Report

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Task 1

PHYWE

Which of these properties is true of methane under normal conditions?

- [ ] insoluble in water
- [ ] odourless
- [ ] flammable
- [ ] gaseous
- [ ] colourless

Check

Task 2

PHYWE

To which group of substances does methane belong?

- Sulphides
- Ester
- Alcohols
- Alkanes

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Task 3

PHYWE

Methane is the main component of natural gas. Ethane, propane and butane is the rest. Therefore, natural gas is also categorised by its methane content, which is on average between 75% and 99%.

○ True ○ False

Check

Task 4

PHYWE

Drag the words into the correct boxes!

This experiment is about the _____ of methane.
For this, _____ was made to react with water.
The _____ for the synthesis is:

$Al_4C_3 + 12\ H_2O \rightarrow 4\ Al(OH)_3 + 3\ CH_4$

aluminium carbide
reaction equation
synthesis

Check

PHYWE
Robert-Bosch-Breite 10
37079 Göttingen
Tel.: 0551 604 - 0
Fax: 0551 604 - 107
info@phywe.de
www.phywe.de

Task 5

PHYWE

Enter the observed properties of methane in the general substance profile. Complete it by finding the relevant information in the textbook.

Substance name		Boiling point	
Chemical symbol		Other properties	
Colour		Occurrence	
Aggregate state		Use	
Melting point			

Slide	Score / Total
Slide 17: Methane	0/5
Slide 18: Fabric	0/1
Slide 19: Natural gas	0/1
Slide 20: Synthesis	0/3

Total 0 / 10

Solutions Repeat Export text

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de