Air pollution

The pupils and students use two experiments to see how much particulate matter (petrol combustion) or acid (waste incineration) is released into the environment.

Biology | Ecology & environment | Air analysis & meteorology

Difficulty level	Group size	Preparation time	Execution time
easy	-	-	-

This content can also be found online at:

http://localhost:1337/c/61321458ba6f9b0003b8dda2

General information

Application

Experiment setup

Climate change and air pollution, especially from particulate matter, has become an integral part of our daily news picture.

This experiment is intended to show not only how much fine dust is released into the environment when petrol is burnt without the use of suitable filters, but also that pollutants such as acids are released unchecked into the environment during unofficial waste incineration.

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Application

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Other information (1/3)

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Prior knowledge

Pupils and students should already be aware of the environmental pollution caused by combustion. It is especially helpful if the topic of fine dust pollution has already been discussed.

Scientific Principle

The combustion of gasoline and garbage produces various waste products that are released into the air.

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Other information (2/3)

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Learning objective

The pupils and students use two experiments to see how much particulate matter (petrol combustion) or acid (waste incineration) is released into the environment.

Tasks

The students observe two experiments: one on air pollution caused by gas emissions from cars (gasoline combustion) and one on air pollution caused by illegal waste incineration.

Other information (3/3)

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Observations

In the experiment on the combustion of petrol, the inside of the Petri dish is covered with a layer of soot. In the experiment on illegal waste incineration, the litmus paper does not change colour in water, but turns red in lemon juice and also in the combustion gases.

Evaluation

The combustion of petrol releases not only carbon monoxide, carbon dioxide, nitrogen oxides and sulphur dioxide gases, but also particulate matter. These particles are harmful to the respiratory organs and carcinogenic. Catalytic converters and particulate filters can reduce the emission of this pollutant.

The second experiment has shown that acids are released when PVC is burned, as the litmus paper turns from blue to red when it comes into contact with acids. These acids can cause significant damage to the environment. Due to this release of pollutants, the incineration of waste is only allowed in purpose-built waste incinerators that prevent the transfer of pollutants into the environment.

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Safety instructions

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- Observe the hazard warnings of the chemicals used.
- The general instructions for safe experimentation in science lessons apply to this experiment.

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Equipment

Position	Material	Item No.	Quantity
1	Porcelain dish 140ml, d 100mm	32518-00	2
2	Pipette with rubber bulb, long	64821-00	1
3	Crucible tongs,w.bow,stainl.steel	46964-00	1
4	Scissors, straight,180 mm	64798-00	1
5	Security bolster, 26,5 cm x 36,5 cm, aluminium	39180-01	1
6	Protecting glasses, clear glass	39316-00	1
7	Litmus paper, blue, 1 box	30678-01	1
8	PVC-plates,pack.5 pcs.	31751-02	1
9	Petroleum ether, 100-140 C,500 ml	30037-50	1

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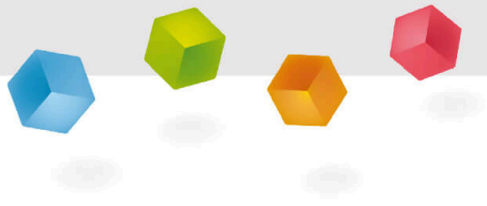

Set-up and procedure

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Set-up and procedure (1/2)

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air pollution from car exhaust gases

- Place an evaporating dish on the protected table top and drop a few drops of petroleum ether into it with the pipette.
- Once the drops have been added, the petroleum ether must be ignited. If you wait too long to ignite, an explosive gas mixture can form.
- When the petroleum ether burns in the porcelain bowl, the vapour produced is collected with the evaporation bowl. This is held upside down over the flame with the help of the crucible tongs.

Required utensils

Set-up and procedure (2/2)

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Air pollution due to illegal waste incineration

- In a preliminary experiment, litmus paper is dipped in water and lemon juice.
- Cut a strip about 5 cm long and 1 cm wide from a PVC sheet (PVC = polyvinyl chloride). PVC is a plastic material that is found in many everyday objects. As an alternative, therefore, other such items can be used, such as a piece of floorboard or cable insulation.
- Break a piece of ESBIT in half and place the two halves in an evaporating dish so that one half is tilted over the other. Place the tray on the protected tabletop and light the dry fuel. Then place the PVC piece in the flame.
- Moisten a strip of blue litmus paper and hold it with the crucible tongs in the combustion gases from the PVC.

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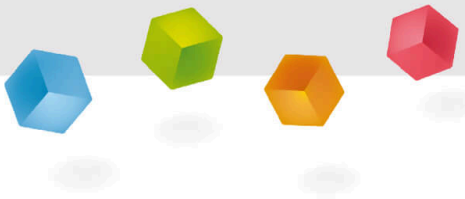

Report

Task 1

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What observations could you make in experiment 1?

- ○ None of the answers are correct.
- ○ The petri dish, which was held over the flame, has turned black. This black color consists of combustion particles that were released during the gasoline combustion.
- ○ The petri dish, which was held over the flame, remained white, because gasoline burns very clean. This proves that cars are less harmful to the environment than assumed.

Check

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Task 2

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Besides the soot layer, what else is released when gasoline is burned?

- ○ Apart from the soot layer, which consists of fine substances that are harmful to health, only water vapour is released. Cars therefore have no influence on the greenhouse effect.
- ○ None of the answers are correct.
- ○ In addition to the soot layer, which consists of fine substances that are harmful to health, carbon monoxide, carbon dioxide, nitrous oxides and sulphur dioxide gases are also released.

Check

Task 3

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What does it mean that litmus paper turns from blue to red when held in PVC smoke?

- ○ It means that the combustion of PVC is completely safe. Only if the paper remains blue, there is a danger to the environment.
- ○ It means that when PVC is incinerated, among other things, lye is released. In the case of illegal waste incineration, this is released unfiltered into the environment.
- ○ It means that acid, among other things, is released when PVC is incinerated. During illegal waste incineration, this acid is released unfiltered into the environment.

Check

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