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Learning Maths and Science

Textbook with dictionary

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Maths and Science Adventure

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2017.09.20.

Subject: Carbon and coal energy

Introduction

Information about carbon

Carbon is a chemical element with symbol **C** and atomic number 6. Carbon is one of the few elements known since antiquity. Carbon is one of the most abundant elements in the Earth's crust, and the fourth most abundant element in the universe by mass after hydrogen, helium, and oxygen. Carbon is the second most abundant element in the human body by mass (about 18.5%).

Information about carbon

Coal is made largely of carbon but also features other elements such as hydrogen, oxygen, sulfur and nitrogen. Coal starts off as plant matter at the bottom of water. It is eventually covered and deeply buried by sediments where over time metamorphosis (a change in form) takes place. Coal is a readily combustible rock formed from compaction and indurations of variously altered plant remains similar to those in peat. After a considerable amount of time, heat, and burial pressure, it is metamorphosed from peat to brown coal and then into hard coal.

Coal is classified into three main ranks:
a) Hard Coal: contains over 78% of carbon
b) Brown Coal (Lignite): contains 60 – 78% of carbon
c) Peat: contains ca. 30 % of carbon

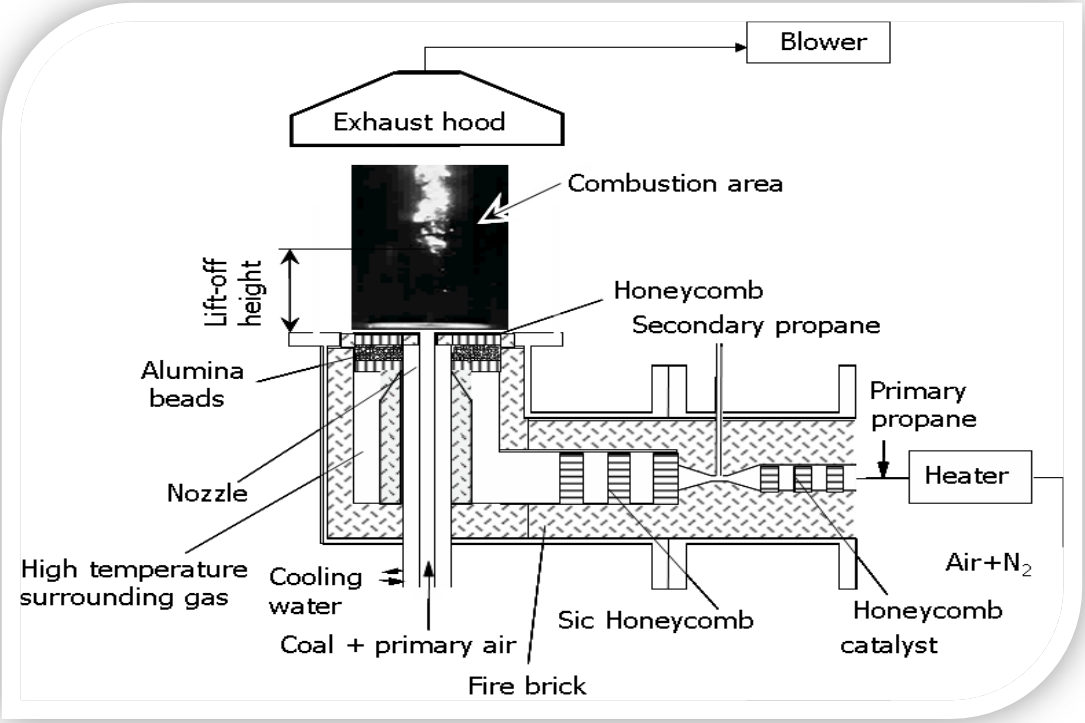
Coal has long been burned to create electricity and heat. The use of coal is increasing every year, in 2006 the world consumed over 6,000,000,000,000 kilograms of coal! Coal is the world's largest source of energy for the production of electricity. Coal is converted to electricity by being burned in a furnace with a boiler. The boiler water is heated until it becomes steam, with the steam then spinning turbines and generators to create the electricity. Nearly 70% of China's electricity comes from coal. In total, coal produces around 40% of the world's electricity.

Coal: A Fossil Fuel

Fossil fuels are derived from plant and animal matter. They formed naturally over millions of years. These energy-producing fuels are the remains of ancient life that have undergone changes due to heat and pressure. The primary fossil fuels are coal, petroleum and natural gas. Together they account for 85% of the world's energy consumption. Coal is a dark, combustible material formed, through a process known as coalification, from plants growing primarily in swamp regions. Layers of fallen plant material accumulated and partially decayed in these wet environments to form a spongy, coarse substance called peat. Over time, this material was compressed under sand and mud, and heated by the earth to be transformed into coal. Some scientists refer to coal as sedimentary rock. Coal is primarily composed of carbon, hydrogen, oxygen and nitrogen. There are several classifications of coal, which are rated according to their carbon content and heating value. per pound. A precursor to the formation of coal is peat.

Coal Uses

- Coal is used to generate heat, produce electricity, and make steel and industrial products. It is used worldwide as a fuel, second only to petroleum as the most consumed energy resource. Simple burning of coal produces heat for homes and industries.
- Coal is a major fuel for producing electricity. The coal is burned to turn water into steam. Thes team turns the blades of a turbine, which drives a generator to produce electricity. Coal is used for approximately 50% of the U.S. electricity production and 40% of the world's electricity. Coke is a hard material produced when coal is heated without air atapproximately 1000° C.
- Coke (which is almost pure carbon) is used to smelt iron ore for the production of steel. Coal tar, a sticky black liquid derived from coke, is used for paving roads and tarring roofs. The extraction and distillation of coal tar into separate compounds produces a variety of products for making drugs, plastics, paints and synthetic fibers.
- Coal gas, composed of methane and hydrogen, is a by-product of burning coal.
- Coal gas was used in the 1940s for residential lighting and cooking, but it was phased out because it was expensive. Today, coal gasification processes are being developed to be more cost effective. Methanol is now being developed and used as a fuel for engines.



Schematic combustion equipment

Activity 1

• Reviewing Coal as a Fossil Fuel

Objective

Students will review coal as fossil fuel.
Students will describe and illustrate how coal is formed.

Materials

Internet access, resource books, paper, construction paper, rolling pin, nonstick spray or oil,

Procedure

Determine students' knowledge of coal as a fossil fuel. Review concepts if needed:
- Coal is a major energy resource in the world. It is used for heating, producing electricity, and making various products.
- The formation of coal is due to the accumulation of plant matter, which has undergone changes due to pressure and heat.
- Coal is composed primarily of carbon, hydrogen, oxygen and nitrogen.
- There are different rankings of coal determined by their carbon content, hardness and heat content.
- Preview how coal is formed. Have student volunteer demonstrate and explain the process of coal formation.

Evaluation

Assign creative coal formation project. Students explain in writing and illustrate with models or diagrams, the process of coal formation.
Enrichment
Plan a field trip to collect fossils. Coal regions are common sites for fossil collecting, primarily fern fossils. (This also reinforces the fact that coal is formed from plant matter.) A rock and mineral club or geological agency may be of assistance.

Actvity 2

• Coal Combustion and Energy Use

Objective

Observe the combustibility of coal and recognize it as an energy fuel.

Materials

Small coal samples (1-3 cm. size), votive candles, votive candle holders, aluminum foil, matches, forceps or needle-nose pliers with insulated handles, goggles, thermometers, water, small beakers,

Procedure

Review that heat is a form of energy; and things that give off heat are an energy source. Introduce activity to recognize coal as an energy fuel. *This lesson can be structured as a teacher demonstration or as a student hands-on project. Teachers should use their discretion. Have students work with partners to share materials. Distribute materials, except for matches. Students put on goggles. They place candles on aluminum foil, place thermometers in bottom of beaker, and fill beaker with just enough water to cover base of thermometer (25-50 ml.). Students note temperature of water at room temperature. Teacher lights one candle for each group. Using forceps or pliers, students hold coal pieces in the flame for one minute. Students observe glowing coal, place coal in beaker and record water temperature immediately. (Coal samples are difficult to keep burning, but the absorbed heat is measurable.) Discuss observations. Facilitate class discussion on conclusions of experiment.

Evaluation

Students write procedure, data and conclusions of science lab, and diagram lab set-up.

Activity 3

• Coal Mining Investigation

Objective

Students will research and report on the different methods of coal mining.

Materials

Internet access, resource books, resource people.

Procedure

Introduce basic methods of coal mining: surface mining and underground mining.

Types of surface mining:
-Area or mountain top mining is done in relatively flat locations. Coal is removed in one location at a time with large machines such as draglines.
-Contour mining is done where coal is located in hills or mountains. Coal is excavated in circular tracks around the landscape.

Types of underground mining:
-Longwall mining is used to remove most of the coal in an area underground. A longwall mining machine cuts wide tunnels with rotating disks of steel teeth. Large steel jacks must be used to support the roof to prevent it from collapsing.
-Room and pillar mining involves removing part of the coal in an underground site. Much coal is left untouched to support the roof of the tunnels. This underground excavation looks like rectangular rooms, divided by coal pillars. Assign research to investigate mining practices, both past and present. Topics should include the basic process of excavating coal, efficiency of operations, health and safety of miners, economic ramifications and environmental impacts. Land reclamation issues should be included. (Specific dates indicating changes in the industry should be collected for next lesson.) Encourage students to use a variety of resources to gather information, which may include personal interviews of miners. Facilitate class discussion on research findings.

Evaluation

Students complete research on mining in written report with references cited.

Activity 4

• Writing chemical reactions appeared during combustion

Objective

Students will write combustion chemical reactions.

Materials

Notebook, books, periodicals, etc.

Procedure

Introduce and explain mechanism of chemical reactions appeared during combustion. The skeletal char, essentially FC, undergoes heterogeneous reactions with gaseous species. The heterogeneous combustion of carbon or char occurs primarily via one or more of the following reactions:

Reaction I. $C + \frac{1}{2}O_2 \rightarrow CO$

Reaction II. $C + O_2 \rightarrow CO_2$

Reaction III. $C + CO_2 \rightarrow 2\ CO$

Reaction IV. $C + H_2O \rightarrow CO + H_2$

Evaluation

Students know the mechanism of chemical reactions appeared during combustion.

Activity 5

• Comparing Energy Resources

Objective

Students will compare and contrast the use of coal energy to other energy resources in regard to safety, efficiency, environmental impact and cost.

Materials

Students' research, internet access, current resources: books, periodicals, etc.

Procedure

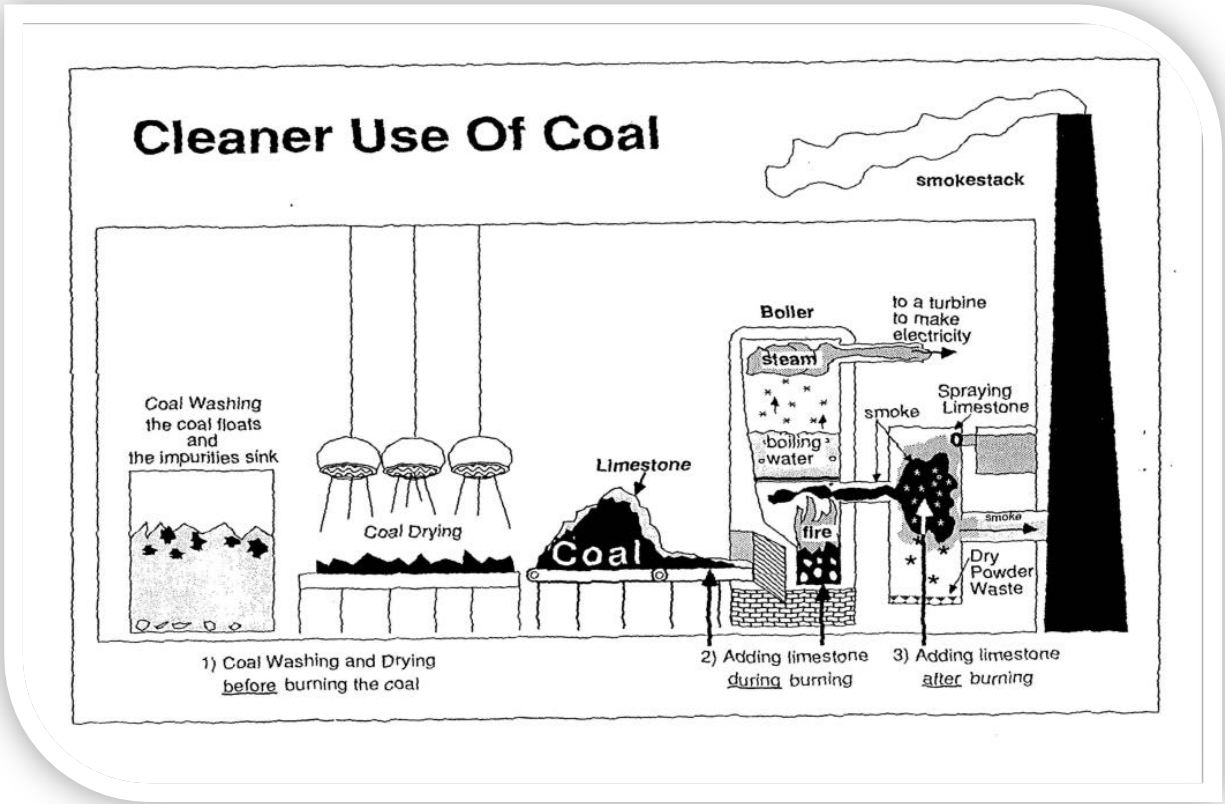
Discuss various renewable and nonrenewable energy resources: Renewable resources, of endless supply, include hydroelectric, solar, geothermal, biomass and wind power. Nonrenewable resources, which are limited in quantities, include petroleum, coal, natural gas, and uranium (used in nuclear power plants). Divide class into groups and assign different energy resources to be researched and compared to coal energy. Students should include topics of safety, efficiency, environmental impacts and cost.

Evaluation

Students compare and contrast coal energy to other sources of energy in a report, an oral presentation or a debate.

Bonus

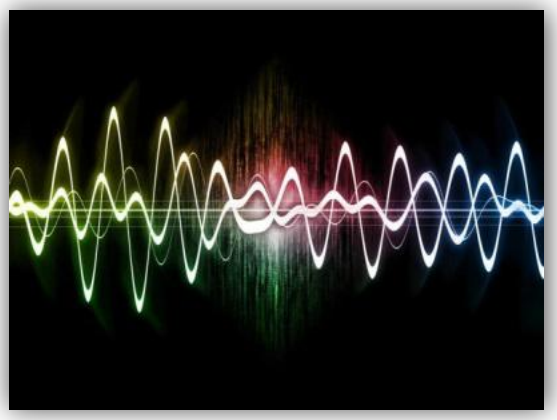
Plan a field trip to a coal power plant, which uses clean coal technology.



By: Danuta Kowalczyk, Poland

Subject: The Intensity of Sound

The human ear responds to sounds of an incredible range of intensity. The loudest sound that a healthy person can hear without causing damage to their ear has an intensity of 10^{12} times greater than the weakest sound they can hear. In order to avoid the use of numbers of a large range, we use the logarithmic function, which lowers the huge numbers of sound intensity to a scale ranging from 0 dB up to 140 dB.



- 0 dB sound intensity that is equivalent to the threshold of audibility.
- 140 dB, the sound intensity equivalent to the pain threshold of the human hear.

The intensity of sound is calculated by the function $\mathbf{D=10 \cdot \log\left(\frac{I}{I_0}\right)}$, where D is the intensity of sound in dB, **I** is the intensity of sound in Watt/m^2 and $\mathbf{I_0 = 10^{-12}}$ W/m^2 is the minimum sound intensity.

• Activity 1

a) Make **I** the subject of the above formula and sketch the graph.

b) What is the minimum value of **I**?

c) Describe the monotony of function **I**.

d) Deduce if it is possible to sketch a graph of the reverse of **I**, and if yes, sketch it.

• Activity 2

a) How many dB is the sound intensity of a whisper when **I = 5,2.10^{-12}** W/m^2 ?

b) Calculate **I**, if the intensity of the noise made by heavy traffic is 89,29 dB.

c) How many times greater than the intensity of a whisper is the intensity of heavy traffic?

• Activity 3

Match the characteristic sounds with their dB.

Characteristic sound	**dB**
The rustle of leaves	180
An aeroplane's take off from a distance of 60m	120
Industry with heavy machinery	20
Tearing of paper from a distance of 1m	95
A rock concert at distance of 1m from the loudspeakers	45
Take-off of a spacecraft	120

By: Neofyta Tsagaridou , Marinos Georgiou

(Math teachers)

Subject:The world of fats

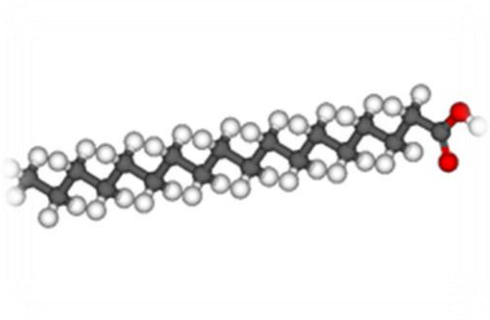
1. What are fats?

Fats are one of the three main macronutrients, others being **proteins** and **carbohydrates**.

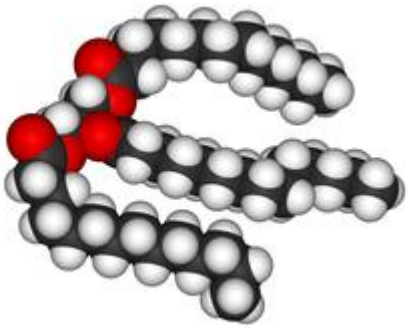
Fats and **cholesterol** are examples of **lipids** that we have in our bodies. Lipids are molecules that are not **soluble** in water, because of their **non-polar** structure. Water is a **polar** molecule so there is less attraction between water and non-polar molecules.

Fats are **esters** that are formed from glycerol and 1 to 3 fatty acids.

Fatty acids are long carbohydrate molecules, that have a **carboxyl group** at the end of the carbon chain. Even though the carboxyl group is a polar group, the long carbon chain of the fatty acid makes the molecule non-polar.



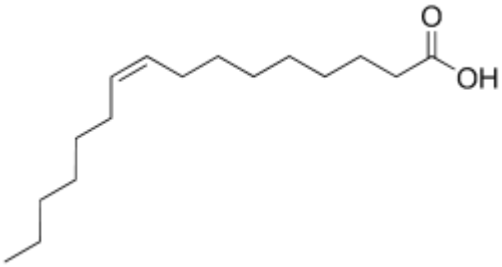
Steraic acid is a saturated fatty acid



Triglycerid has three fatty acids

Depending on the amount fatty acids attached to a fat, fats are listed into three categories: mono-, di-, and **triglycerides**. The fats in our body are most commonly triglycerides.

Fatty acids can be either **solid** or **liquid** at room temperature. The chemical reason for this is in the structure of their molecules. **Saturated** fatty acids, which are solid at room temperature, have only a straight carbon chain, with only single bonds between the carbon atoms. **Unsaturated** fatty acids have at least one double or triple bond located somewhere in the long carbon chain. This gives the molecule a bend in its chain. The **weak forces** between molecules are stronger on straight molecules than bended ones, and the stronger the force between the molecules, the lower the melting point of that substance is. This makes saturated fatty acids solid and unsaturated fatty acids liquid.



Palmitoleic acid is an unsaturated fat because of the double bond between 2 carbon atoms

2. Vegetable and animal fats

Depending on the **composition** of the substance, it can be solid or liquid at room temperature. For example butter consists of about 67% saturated fatty acids, and because of this it is solid at room temperature.

Different vegetable oils

Coconut oil (fat) in a solid form

Vegetable oils are fatty acids that have been extracted from plants. They are mostly **liquid** at room temperature, hence their name “oil”. Coconut oil is an exception to this, since it is **solid** at room temperature. Because of this the vegetable oils are sometimes referred to with the broader term “vegetable fat”.

Lard is an animal fat (from pig)

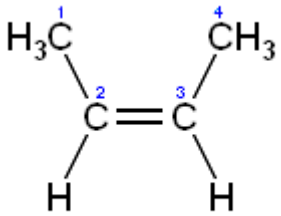
Butter is made from milk, which is an animal fat

Animal fats are fatty acids with some sort of animal source. This can be the fat from the animal's body or some sort of **dairy product**. Animal fats are solid at room temperature; their liquid counterparts are called animal oils.

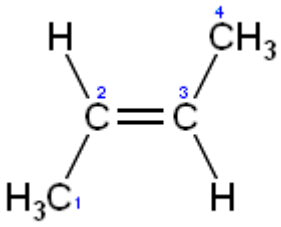
3. Cis- and trans-fats

Because of their chemical structure, unsaturated fatty acids can have ***cis-trans*-isometry**. This means that the double bond between two carbon atoms can make the carbon chain to be on the same side or the opposite sides of the double bond.

If the parts of the chain are on the same side of the double bond, they are called *cis*-fatty acids and they make a bend in the molecule structure. Most of the naturally occurring fatty acids are *cis*-fatty acids and they are liquid at room temperature.

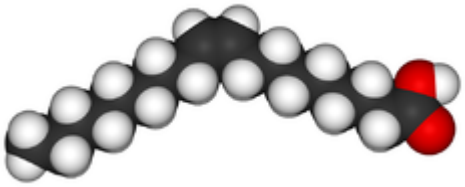


Cis-2-butene

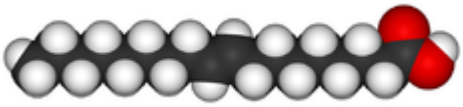


Trans-2-butene

If the carbon chain is on opposite sides of the double bond, then they are called trans-fatty acids. Because of this the structure of the fatty acid is straight with no bends in the chain, even though it is unsaturated. In the production of margarine the vegetable oils are **hardened**, so that the product is easier to spread. In some of these processes some of the unsaturated *cis*-fatty acids are transformed into *trans*-fatty acids. *Trans*-fatty acids are considered to be a health risk, increasing the chance for **cardiovascular** diseases.

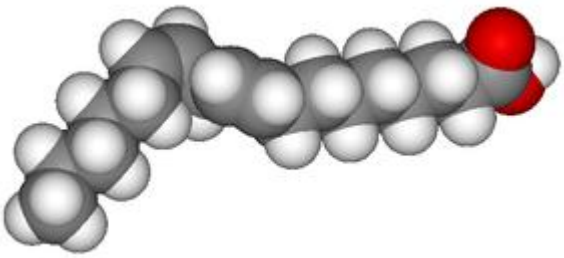


Cis-fatty acids have bends in their structure



Trans-fatty acids have a straight structure

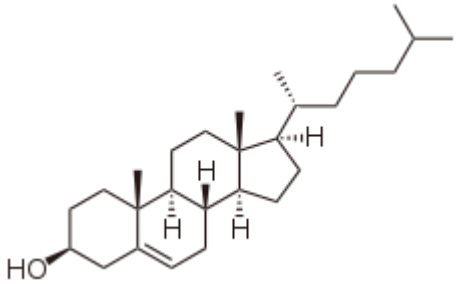
Fatty acids that have multiple *cis*-bonds are called polyunsaturated fats. Many of these fatty acids can't be produced in our bodies and we must get them through our diet. **Essential** fatty acids (EFA),also called omega-fatty acids and previously called vitamin F, are fatty acids that our body absolutely needs to function properly.



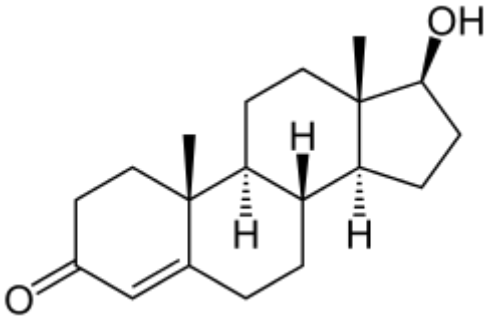
Linoleic acid is an essential polyunsaturated fatty acid, that our body doesn't produce itself.
It has been found to protect our brain, heart and **nerve** systems.

4. Cholesterol

Cholesterol is a lipid, just like fats, so they are not soluble in water. It's structure **resembles** that of steroids, like testosterone. Cholesterol is a vital aspect in a lot of our body functions, such as producing vitamin D and hormones.

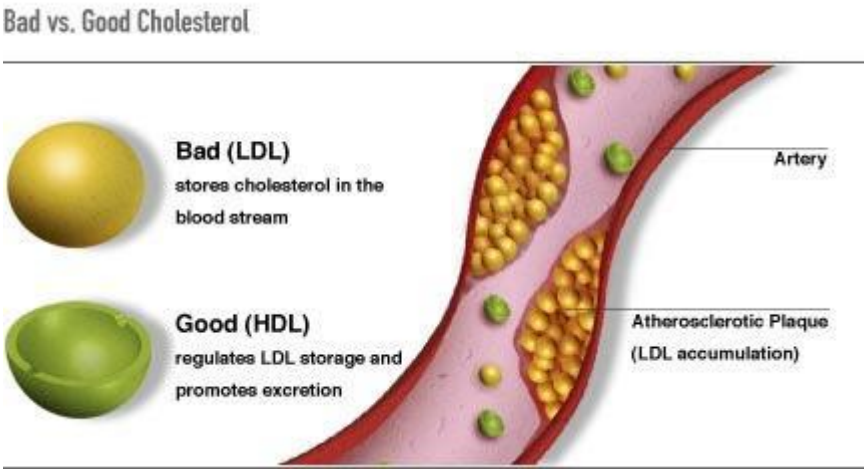


Cholesterol-molecule



Testosterone-molecule

Cholesterols are transferred in our **blood circulation** with the help of certain lipoproteins. There are 2 types of lipoproteins HDL (high **density** lipoprotein) and LDL (low density lipoprotein), often referred as “good cholesterol” and “bad cholesterol”. This is because the LDL has a lower density of protein, making it less soluble in water and blood. This makes it easier for the LDL to get stuck in blood vessels, increasing the chance for cardiovascular diseases.



• Activities

1. Explain in your own words, why fats are not soluble in water.
   Explain the chemical reasons why some fatty acids have lower and some higher melting points. Find (on the internet) 2 examples of fatty acids and their melting points that work like you've explained.

2. Research information about the composition of the butter/oil that you use daily. Explain the properties of your butter/oil based on its composition.

3. Find information (on the internet) about trans fats and how they are formed in the production of margarine. What can be done to decrease the amount of trans-fats in both margarine production and our diets?
   In which products are there the most trans fats?

4. Compare the cholesterol and testosterone molecules and explain the similarities and differences in them.
   Explain why LDL and HDL have different effects in our blood vessels..

• Extra activity

Write a short essay on how fats affect our health from the viewpoint of chemistry.

Use this text and your own research done on activities 1-4.

Cover at least the following topics:

- Vegetable oils compared to animal fats
- Trans fats
- Essential fatty acids
- Cholesterol

• Procedure

The optimal way of working on this is to divide students into groups of 4 (or 4 pairs) and every group covers activities 1-4, one activity per student (or pair). After everyone has done their activity, the group of 4 (or 4 pairs) teaches their activity to the rest of the group.

This can be expanded to cover their topic as well, since activities and topics are related.

Note that a lot of the information on activities require additional research and cannot be done with this document alone. Critical analysis of the internet sources should be emphasised!

The extra activity can be used as a homework, because it covers most of the topics, but still requires independent work.

By: Antti Pekkala, Finland

• Sources

Leena Turpeenoja & Kalle Lehtiniemi: *Mooli 2 KE2 Ihmisen ja elinympäristön kemiaa*, Otavan Kirjapaino Oy, Keuruu 2016

Pictures:
https://en.wikipedia.org/wiki/Fat

https://fi.wikipedia.org/wiki/Tyydyttym%C3%A4t%C3%B6n_rasvahappo

https://fi.wikipedia.org/wiki/Kasvirasva

https://en.wikipedia.org/wiki/Animal_fat

https://en.wikipedia.org/wiki/Butter

https://fi.wikipedia.org/wiki/Cis-trans-isomeria

https://fi.wikipedia.org/wiki/Transrasva

https://fi.wikipedia.org/wiki/Monityydyttym%C3%A4t%C3%B6n_rasvahappo
https://en.wikipedia.org/wiki/Cholesterol

https://en.wikipedia.org/wiki/Testosterone

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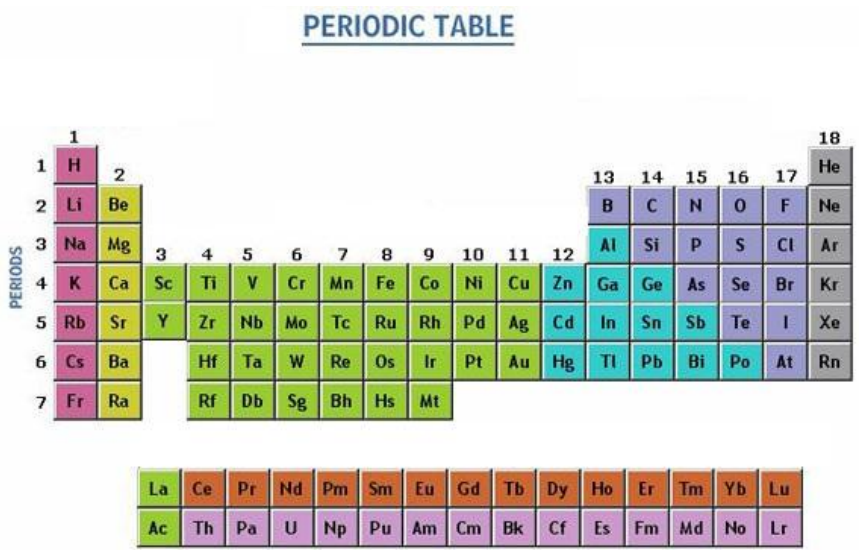
Subject: Metals and non methals

Alcaline Earth metals and halogens

Introduction

Earliest classification of elements was on the basis of their appearance and physical or chemical properties. That time few elements were known therefore it was quite easy to classify those elements on the basis of their properties. According to that concept, elements can be classified as metals and non-metals. Both of these types of elements are differed in their appearance, reactivity, conductivity and chemical properties. For example, metals have a lustre surface with electropositive nature. They have 1, 2, or 3 electrons in their valence therefore metals tend to lose electrons to form cations. That is the reason; they are a good conductor of heat and electricity.



Metals are hard, malleable and ductile in nature. Because of the formation of cation, they form ionic compounds with non-metals. On the contrary, non-metals are brittle solids or liquids and gases. They are electronegative in nature as they tend to accept electrons and form anions. These anions can form ionic compounds with metals such as sodium chloride. Today in the long form of the periodic table, non-metals are placed at the right side of the table from 13th to 18th group. Let's discuss the position of different non-metals in the periodic table with their characteristics Metals are very reactive. They tend to loose electrons easily and form positively charged ions; therefore metals are called electropositive elements. Sodium metal forms sodium ions Na^{+}, Mg forms positively charged Magnesium ions $Mg^{2+}$and aluminium forms aluminium ions Al^{3+}. The electropositive nature allows metals to form compounds with other elements easily.

Metals	**Non-metals**
Shiny surface, has characteristic luster.	Not lustrous at all. Most of them are dull elements.
Good conductor of electricity.	Poor conductor of electricity, due to the lack of metallic bond.
Metals are solids, except mercury, the only liquid metal.	Non-metals are solids, liquids and gases.
Metals on reaction with non-metals, lose electron(s) to form a positive ion or cation.	Non-metals gain electron(s) from the metals, to form negative ion or anion.
Metals only form ionic compounds.	Non-metals form ionic, covalent and coordinate bonds too.

Alkaline earth metals can be defined as the metals which are present in the group 2 of the periodic table. They share same chemical properties and there is a gradation in their physical properties.
The group II elements are better known as alkaline Earth metals. These elements have two electrons in their valence shell and while writing the configuration these notations are preceded by the respective noble gas configurations.

Their general configuration is written as [Noble gas] ns^2 wherein **'n'** represents the valence shell.

The **electronic configuration** of the alkaline earth metals are as follows

Element	**Symbol**	**Atomic number**	**Electronic Configuration**
Beryllium	Be	4	$[He]2s^2$
Magnesium	Mg	12	$[Ne]3s^2$
Calcium	Ca	20	$[Ar]4s^2$
Strontium	Sr	38	$[Kr]5s^2$
Barium	Ba	56	$[Xe]6s^2$
Radium	Ra	88	$[Rn]7s^2$

Given below are some of the alkaline earth metals characteristics :

Atomic and ionic radii

The alkaline Earth metals atomic and ionic radii are smaller compared to members of the alkali metals. As Group II elements have higher nuclear charge, these allows electrons to be more attracted towards the nucleus resulting in the reduced size of atomic and ionic radii.

The radii increases while moving down the group due to the gradual increase in the number of the shells and the overall screening effect.

Physical Property	Be	Mg	Ca	Sr	Ba	Ra
Atomic Radius (pm)	112	160	197	215	222	--
Ionic Radius (pm)	27	72	100	118	135	148

Melting and Boiling Points

The alkaline Earth metals M.P and B.P (melting point and boiling point) are typically low and they do not display the regular trends down the group. However, melting and boiling points are higher than the corresponding alkali metals of the same period and this is because alkaline Earth metals have smaller atomic size in comparison. This results in more closely packed crystal lattices. As they have two electrons in their valence shell resulting in the formation of strong metallic bonds for atom binding in the metal crystal lattice resulting in higher melting and boiling points.

Physical property	Be	Mg	Ca	Sr	Ba	Ra
Melting point (k)	560	920	1112	1041	1000	973
Boiling point (k)	2770	1378	1767	1654	2123	1800

• Activity for the students

Experience

- The reaction between Magnesium and Hydrochloric Acid
- **Aim:** To investigate the reaction between magnesium and hydrochloric acid. The more concentrated the acid is, the faster the magnesium ribbon will dissolve. This is because the rate of reaction depends on how frequently the molecules of the reacting substances collide. A more concentrated substance has more molecules for a given volume than a more dilute substance. Because there are more molecules about, the frequency of successful collisions is greater, and the reactions happen faster.

Discussion

This demonstration can be used to illustrate the characteristic reaction of metals with acid, a single replacement reaction, or to demonstrate the generation of hydrogen gas. The flammability of hydrogen gas can be demonstrated by carefully holding a match or fireplace lighter up to the popping hydrogen bubbles. An audible crackling sound is heard as the hydrogen burns.

Materials

- Petri dish
- 1cm strip of magnesium ribbon
- wash bottle containing 1M HCl
- forceps
- overhead projector

Procedure

Place the Petri dish on the overhead projector. Pour hydrochloric acid into the Petri dish to a depth of about 5mm. Turn on the projector and focus it. Using forceps, place the magnesium ribbon into the Petri dish. The magnesium reacts with the acid, producing visible bubbles of hydrogen gas.

Safety Precautions

Magnesium ribbon is a flammable solid. Hydrochloric acid is a corrosive liquid. Hydrogen gas is explosive. However, the very small quantities and low dilutions used in or produced by this demo present little hazard. Wear safety goggles. Keep flammables and open flame away from the vicinity.

• Questions for the students

1. Write the equations of the chemical reaction between magnesium and hydrochloric acid
2. Represent the electronic distribution of the following atoms and ions (they do not represent symbols)

   $_{11}A$ $_{12}B^{2+}$ $_{17}D^{-}$
3. What kind of ion will form the atom A when participate in chemical reaction?

• Answer

1.

Net Ionic Equations

$Mg(s) + 2\ HCl(aq) \rightarrow H_2(g) + MgCl_2(aq)$

$Mg(s) + 2\ H^+(aq) + 2\ Cl^-(aq) \rightarrow H_2(g) + Mg^{2+}(aq) + 2\ Cl^-(aq)$

We leave the spectator ions out —
$Mg(s) + 2\ H^+(aq) \rightarrow H_2(g) + Mg^{2+}(aq)$

to give the NET IONIC EQUATION

2.

$_{11}A$ 2-8-1

$_{12}B^{2+}$ 2-8

$_{17}D^{-}$ **2-8-8**

3. $_{11}A^{+}$

By: Portuguese team

Subject: Tobacco

1. Introduction

Information about tobacco and nicotine

Tobacco is a green, leafy plant that is grown in warm climates. After it is picked, it is dried, ground up, and used in different ways. It can be smoked in a cigarette, pipe, or cigar. It can be chewed (called smokeless tobacco or chewing tobacco) or sniffed through the nose (called snuff).

Nicotine is one of the more than 4,000 chemicals in cigarettes and its smoke. It is the chemical that makes tobacco addictive or habit forming. Once we smoke, chew, or sniff tobacco, nicotine goes into our bloodstream, and our body wants more. The nicotine in tobacco makes it a drug. This means that when we use tobacco, it changes our body in some way. Because nicotine is a stimulant, it speeds up the nervous system, so we feel like we have more energy. It also makes the heart beat faster and raises blood pressure.

HEALTH RISKS

Smoking is one of the largest factors contributing to the poor health. It is estimated that 24% of all deaths are due to smoking. 13% of 15 year olds smoke (2010). Each year, smoking is responsible for 1 in 5 deaths. Smoking contributes to 90% of the cases of lung cancer but can also contribute to many other forms of cancer and other diseases, such as heart attack, stroke, damaged blood vessels and arteries.

HEALTH RISKS MALAWI

The health risks to workers growing tobacco are very high. The workers, rarely have access to protective clothing and absorb nicotine through their skin - equal to smoking 50 cigarettes a day. As a result of this, many suffer from Green Tobacco Sickness (GTS), which is also called nicotine poisoning. Symptoms include abdominal pains, headaches, muscle weakness, breathlessness and coughing fits. It is common to find children working on the tobacco plantations as their families are poor and they need the money. The health effects can be worse for children as they are small.

Information sheet: Tobacco and child labour in Malawi

Malawi began exporting tobacco in 1893, 2 years after Britain set up a colonial government in what was known as Nyasaland. During the 1970's, tobacco production globally shifted from developed countries to developing countries, and intensification of tobacco production in Malawi followed.

Today, tobacco is grown primarily in family-owned smallholder farms and in tobacco estates. Tenant farmers, contracted by the landowner to cultivate the crop for one year at a time, are supplied with agricultural inputs, food and other basic materials in return for labour and a final payment. The cost of the inputs and other materials are deducted from the final payment. Usually, all members of tenant farmer families, including children, work in tobacco-growing.

The tenancy system may create the impression that children do not work. However, in reality, fathers, or the contract holders, have to rely on the work of their wives and children in order to provide an income which can sustain the most minimum of living conditions.

The involvement of children in tobacco production is extensive. While not technically or formally employed, children work alongside their parents in all activities of tobacco farming including in the use of pesticides and other hazardous tasks. While some of these are viewed as training, a large proportion of the children miss out on schooling. Children above nine years of age are heavily involved in tasks like clearing fields, making nursery beds and watering nurseries, and picking and transporting tobacco.

• Activity 1

Chain talking

In this activity your students will get to know new things about each other by discussing different topics, including smoking.

Objectives
Students will talk about tobacco in our lives.
To explore some links between tobacco and everyday life.
To start thinking about smoking and tobacco.

Materials
Activity Sheet 1 – Tobacco Topics

Internet access

Procedure
Arrange the class into groups of four. Explain that this activity will let them find out more about each other and some of the global issues connected to smoking.

Give the groups the first topic from the list and ask them to discuss it. After 2 minutes ask one person from each group to join another group. Ask the groups to continue their discussion.

Give the groups the next topic on the list and ask them to discuss it for 2 minutes. Then every 2 minutes ask the groups to either swap 1 person from their group or give them a new topic from the list to discuss. The activity is finished when all the topics have been discussed.

At the end ask the class the questions below to find out what they thought about the activity and what they found out about each other and about the topic of tobacco and smoking.

For some topics they can use the Internet to find more information.

Class discussion questions

Did you like the activity?
Did you find out anything interesting about other people in your class?
What was the most interesting story/idea/fact that was shared?
Did you find any connection between the questions? What?
All the questions can be connected to tobacco and smoking. Can you find out how?
You can use the activity sheet to help make the connections.

Evaluation
Students create posters, comics or ppt presentations to introduce their ideas.

Activity sheet 1

Tobacco Topics

Topic	Possible references to tobacco
Your childhood, place of birth and family.	Child labour in production of tobacco; Tobacco companies working on specific strategies for attracting clients based on social status, family status, race, education, etc.
What is your favourite movie and why?	Movies are a tool for promoting smoking, used intensively in the past but still used nowadays.
Do you take care of the environment in your everyday life?	Deforestation for tobacco production. Pesticides used for tobacco production; Pollution from processing, transporting and using tobacco; non-degradable filters.
Do you have any "bad habits" and how did they start?	
Do you, a relative or a friend who is a smoker? Why do they smoke?	
What you would grow if you had a garden? What do you grow in your garden if you have one? Why?	Tobacco is one of the most cultivated plants, which is not used for food. Globally, we grow more tobacco than mushrooms, cherries, and apricots.
Who was your role model when you were younger? Why?	Many "celebrities" participate in the direct or indirect advertisement of smoking.
What is your dream job? Why?	Rights of the tobacco workers around the world.

• Activity 2

Moving Debate

This activity explores our opinions around smoking and tobacco farming

Objectives
To explore the groups views on smoking and tobacco farming.

To introduce some of the issues related to tobacco and its production

Materials
'I agree' and 'I disagree' signs printed

List of statements (see below)

Enough space for people to comfortably stand in a line

Procedure

Place the 'I agree' and 'I disagree' signs on opposite walls in the room. There should be enough space in between for people to stand and move around freely. Explain that you are going to read out a statement (see below) and each person must decide if they agree or disagree with it. If they strongly agree with what was read out, they should stand close to the 'I agree' sign. If they strongly disagree, they should stand close to the 'I disagree' sign. Depending on how strongly they feel they should find a space on the imaginary line that connects the 'agree' and 'disagree' statements. If they cannot decide or simply do not know, then they should stand in the middle.

To start give them a simple statement like 'summer is more fun than winter'.

Once everyone is standing on the imaginary line , ask for a volunteer to share with the rest of the group why they chose to stand where they did. What is their opinion? Next ask a volunteer from the other side of the imaginary line. Ask the people to respond to their classmates. Can they convince someone to change their position?

Go through each of the statements following the same procedure.

When you have finished ask the class what they thought of the activity? What did they like? Dislike? Is it good to hear different points of view? Why? Why not? Does it matter if we have different points of view? Did anyone change their mind during the discussion?

Statements

Smoking is an activity people do with their friends.

It is up to me if I smoke, it doesn't affect anyone else.

I have never thought about who makes the cigarettes that are sold in Scotland.

Working on a tobacco farm can be bad for your health.

It is more dangerous to smoke a cigarette than to work on a tobacco farm.

Tobacco farmers are lucky as it is a good way of making money and lots of people buy cigarettes all over the world.

It is okay for children to work on tobacco farms for free to help their parents.

Evaluation

Students create posters, comics, ppt presentations, to introduce their ideas. They use the internet to find more information.

• Activity 3

Tobacco and Health

This activity looks at how smoking and growing tobacco can be bad for your health

Objectives

To find out about the health risks linked to growing and harvesting tobacco

To think about the health risks linked to smoking cigarettes

To reflect on the health and wellbeing of both tobacco growers and smokers

Materials

- Several prints of the two photos (one for each small group)
- Coloured cards
- Copies of Health Information Cards
- Internet access

Procedure

- Split the class into small groups. Each group will have two photos to look at – one showing a young person in Malawi, working on a tobacco farm, the other one showing a young person, smoking. Ask the groups to discuss and write down on coloured cards the health risks for the two young people in the photo. Ask them to select one colour for each photo.
- You could give them a copy of the Health Risks Info Card to help or/and they can use the Internet
- Now ask the groups to discuss and write down the reasons why the person in the photo might smoke or have to work growing tobacco.
- Finally ask them to discuss how smoking or growing tobacco might affect the lives of the people in the photo in any other ways and to write them down.
- Now ask the groups to look at their ideas and see if there are any similar ideas written on both coloured cards. These will be things which could affect both young people.

Discussion Points

- What are the health risks for the Malawi young person?
- What are the health risks for young people smoking?
- Why might young people start smoking?
- Why might young people have to work on tobacco farms in Malawi?

Debrief and reflection

Ask the class if they knew about the risks of working on tobacco farms? How do they feel now about smoking? Do they think this information will influence their choice to start or quit smoking?

Evaluation

Students create posters, comics, ppt presentations to introduce their ideas. They can create flyers and hand them out at school, local cafes, youth centres etc.

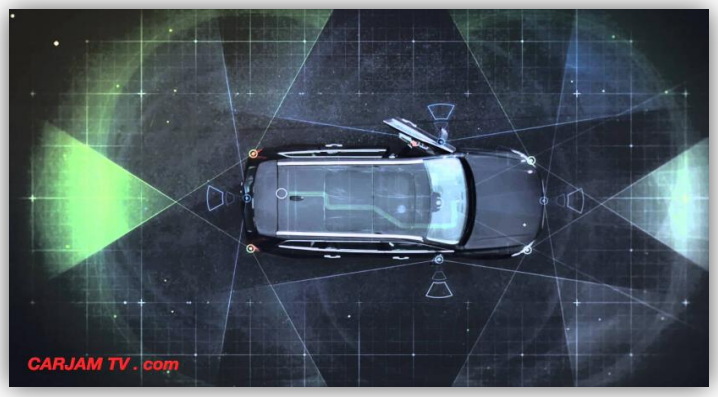
By: Bulgarian team

Subject:Autonomous cars

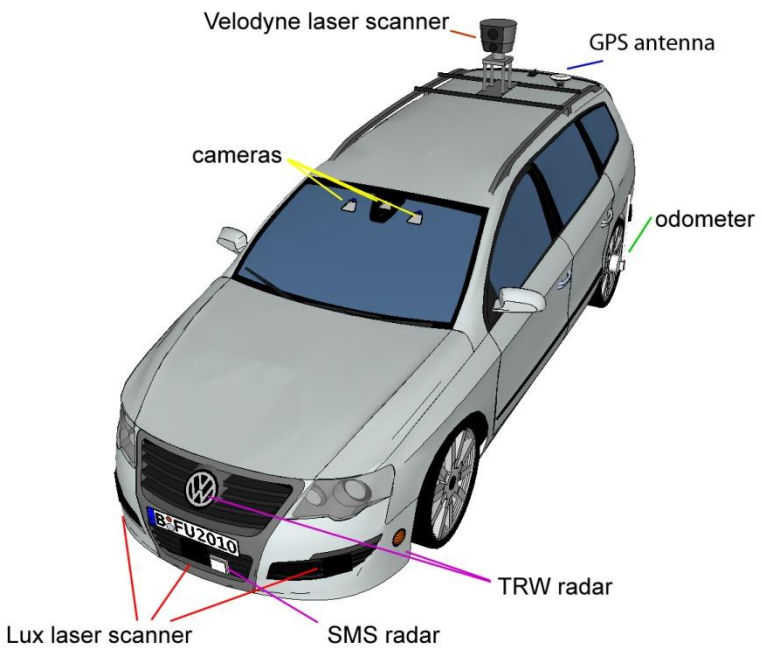
About autonomous cars in nutshell

An autonomous car (also known as a driverless car, self-driving car) is a vehicle that is capable of sensing its environment and navigating without human input. Many such vehicles are being developed, but as of July 2017 automated cars permitted on public roads are not yet fully autonomous. They all require a human driver at the wheel who is ready at a moment's notice to take control of the vehicle. But in one or two years fully-autonomous cars will appear on the roads.

Operating principle



The car has many sensors built in to detect the object around it, such as cameras, lasers, gps, and odometry. To process the data which comes from these sensors an avarage self-driving car has more than 50 ECU (Electronic Control Unit) built in. The car is able to identify road signs, traffic lights, and obstacles like a pedestrian or a cyclist. It can also make the best route to your destination using the traffic information and the information from other cars.



Advantages

Autonomous cars have many advantages. It's very comfortable to read the news while your car is driving to your destination instead of you, especially on long journeys. The car also can save time for us by planning the shortest way to the destination. These cars are even safer and more enviromental-friendly, the sensors and the communications between cars could prevent more than 90% of the accidents according to the analysts. Almost every self driving car are eletric so they don't produce any carbon dioxid.

Disadvantages

On the other hand these cars are more expensive than the ordinary ones. Their price start at 25.000 € and the sky is the only limit. The driving experience also not the same as in a normal car, it can be very strange to sit in a car which you don't control.

Automated urban metro systems - Grade of Automation 4 (GoA4)

The first line to be operated with Automatic Train Operation (ATO) was London Underground's Victoria line, which opened in 1967. Since then, ATO technology has been developed to enable trains to operate even without a driver in a cab. Underground trains, which use now the most developed system (Grade of Automation 4 as known as GoA4), are capable of operating automatically at all times (unattended train operation - UTO), including door closing, obstacle detection and emergency situations. On-board staff may be provided for other purposes, e.g. customer service, but are not required for safe operation. These kind of trains can be found in Barcelona, Paris, London, Rome and in Budapest.

• Activity 1

Internal combustion engines

Objective:

Students get acquainted with the principles and harmful effects of internal combustion engines.

Materials and devices needed:

A model of the engines, computer, internet connection

Procedure/Task:

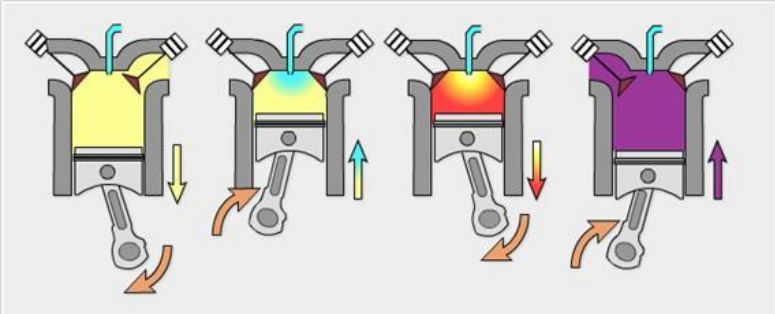
The driving force when driving a car is usually provided by internal combustion engines. Their common feature is that combustion of fuel and work is carried out in the same space in the engine cylinder.

They can be divided according to their functional principles into:

- Otto-engines (petrol)
- Diesel-engines

The Otto-engine combines fuel-air mixture into the cylinder and compresses it.
The gas mixture is switched on by an electric spark at an appropriate time.

The diesel engine puts clean air into the cylinder and compresses it. The injector sprays the fuel at high pressure into the combustion chamber
where it ignites itself.



1. Intake 2. Compression 3. Ignition 4. Exhaust

Evaluation:

The teacher explains the working principles of internal combustion engines and demonstrates them with the help of the models. Teacher emphasizes the basic differences between otto-engines and diesel engines.

Using the Internet students find information about exhaustion of harmful gases, prepare notes and demonstrate their findings using tables/graphs.

At the end of the lesson proper understanding is checked through quiz questions.

• Activity 2

Electric motor operating principle

Objective:

Students experience the existance of Lorentz force and get acquainted with the principle of operation of the electromotor.

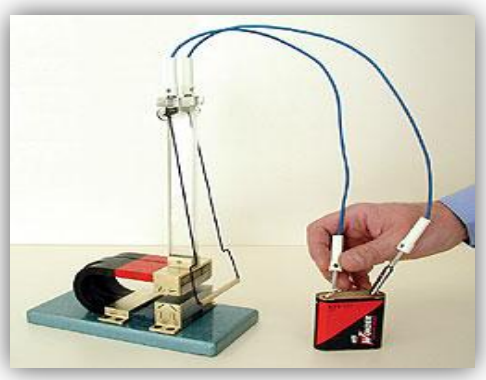
Materials/Devices:

Horseshoe magnet, straight conductor, stand, electricity source, computer, internet

Procedure:

Teacher explanation about the force acting on moving charges in magnetic fields ($F=B \cdot l \cdot I$)

Students working in groups of 5 do the experiment (Demonstartion of Lorentz force)

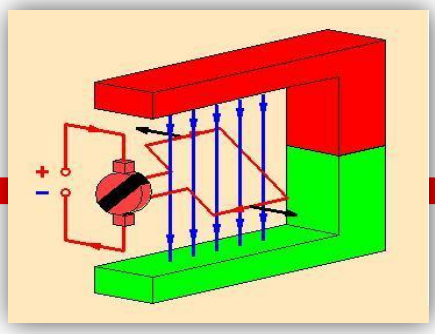


Students explore the information on the Internet and get acquainted with the principle of operation of the electromotor, then prepare a short presentation about it.

Method:

Following the teacher's explanation students demonstrate the Lorentz force with the help of the materials/devices for the experiment. Teacher helps where needed. During the experiment students cooperate, discuss and interpret the procedure.

It is essential that students understand the information they find on the Internet during exploration and share it with the groups. TH planning and execution of the presentation helps in the process.



• Activity 3

Reflection of light and waves

Objective:

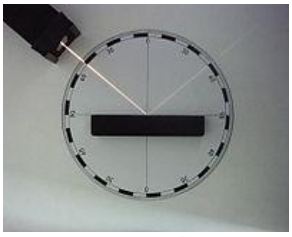
Students get acquainted with the phenomenon of reflection of electromagnetic waves, and the way this phenomenon is used in the control of self-driving cars.
To get acquainted with the natural law of reflection of light.

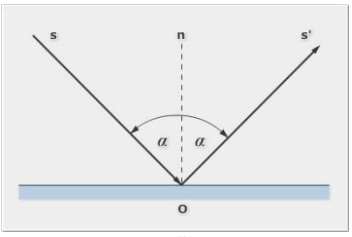
Materials/Devices:

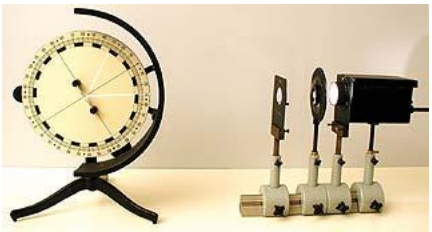
Optical set, source of light, reflective surfaces

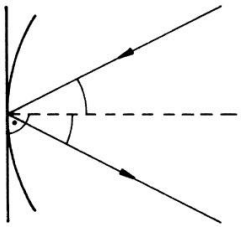
Procedure:

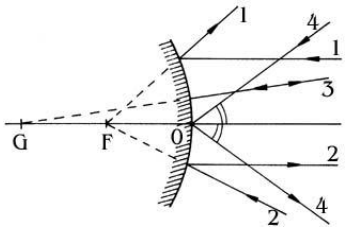
In small groups students perform the experiments, observe the reflection of light on flat, concave and convex surfaces. Students observe the way of light in plane-parallel plate and formulate regularities.

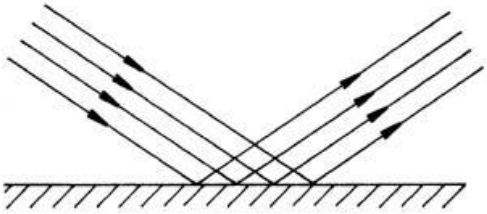












Method:

Students prepare notes on the experiments, where they illustrate their measurements, observations with figures and drawings. On the basis of what they have learnt students interpret the navigation of the self-driven car.

After completing the experiments and preparing their notes, students discuss where in nature can reflection of light be observed. They collect photographs from the Internet, which are shared at the end of the lesson.

• Activity 4

Logic circuits

The understanding of sign conversion is essential for the understanding of our information-technology world.

Computers digitally store signs which are used to complete various logical operations with the help of the so called logic gates. The function of processors is also based on logic gates.

Devices/means:

Accessories for the simple circuit: conductor, power source, switch, bulb, computer, internet

Description of the task:

Teacher describes the logical operation, then the students individually complete some more comlicated tasks involving logical operations for example (A or B) and (C or A). Individual solutions are checked, errors are discussed and corrected. Having dealt with the theory students in groups complete the **and, or**, and **no**t logic gates regarding simple circuit.

- Operations are fulfilled by the logical gates
- Operations are defined with the help of their truth tables
- The truth table contains all the combinations of the input values as well as the output values based on the input

The lamp only lights up when both switches are on

The lamp lights up if any one of the switches is on

Figure 1. Logical multiplication and summation with switches

Negation is implemented when the switch connection to the consumer is parallel. The lamp lights up (Y true) if the K switch is off and does not light up if the switch is on.

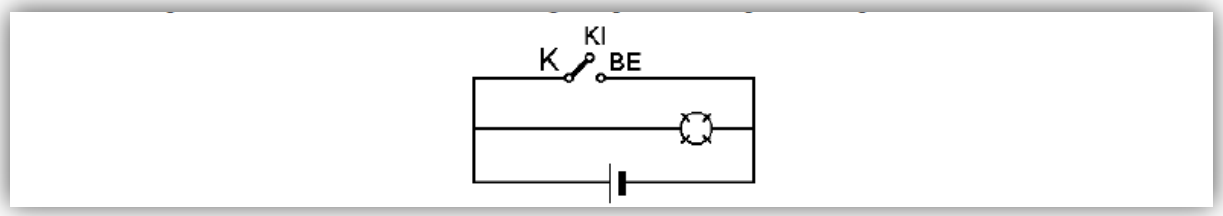
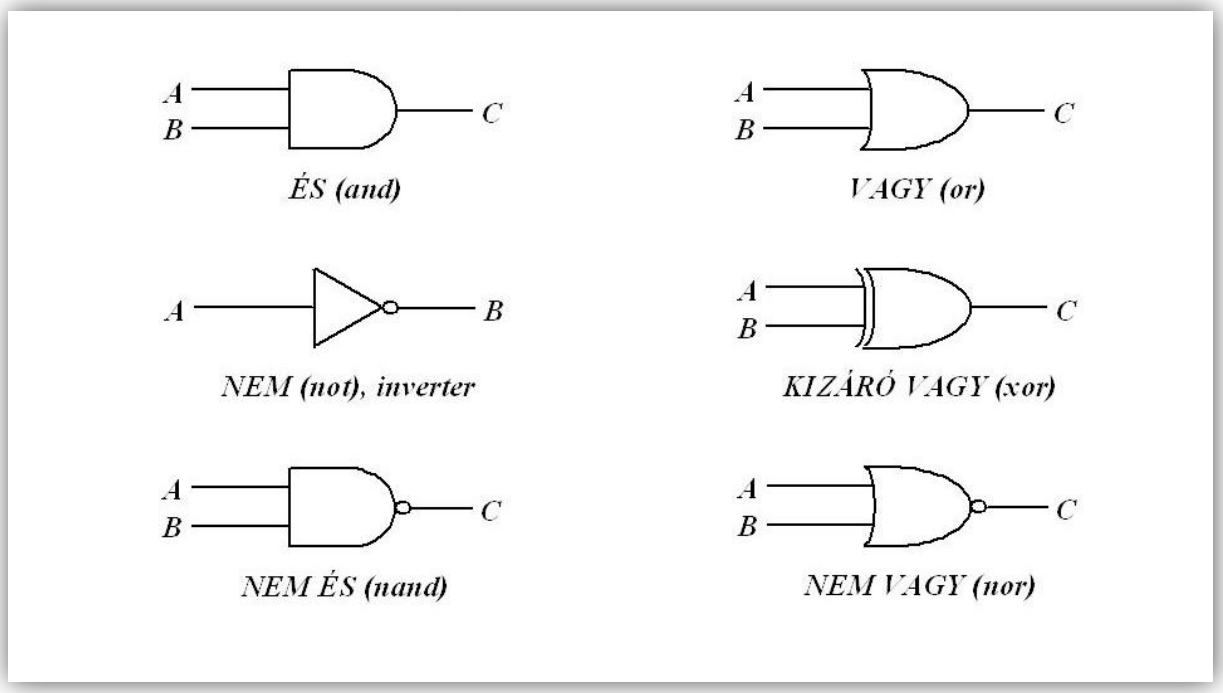


Figure 2. Implementation of negation with the help of a switch.

Students get acquainted with the signs of the logic circuits:

Logic circuits



Method:

The teacher explain the importance of signal conversion and the logical operations. Students individually solve a complex task, which is afterwards discussed by the whole group. Afterwards students work in groups and prepare the simple circuits. At the end of the lesson students individually look for the schematic drawing of the logic circuits on the Inernet and draw them in their notebooks**.**

• Activity 5

Students will get acquainted with the cutting edge means of transport, the history of self – driving (autonomous) automobile, the road that led to its creation and the possibilities for further development. Students have to get information about the companies, which experiment with such automobiles. Students have to evaluate and analyse the type from their own perspective as common everyday users.

Equipment needed:

Computer, Internet, projector

Description of task:

Students work in pairs and prepare presentations with one of the following titles:

1. The history of creation of self-driving automobile, what kind of demand initiated the development of the self-driving car (trucks, drones?)
2. Have you seen a self-driving car on the road? Which companies, and with what aim are developing self-driving cars? For example Google, Tesla… What kind of technological innovations do they implement?
3. Would you, or would you not buy a self-driving car? Explain your reasons.

By : Hungarian team

Sources:

https://en.wikipedia.org/wiki/List_of_automated_urban_metro_subway_systems

https://en.wikipedia.org/wiki/Autonomous_car

https://www.theverge.com/2017/7/7/15934756/tesla-model-3-production-electric-car-musk

Carbon and coal energy

English	Polish	Finnish	Greek	Bulgarian	Portuguese	Hungarian
Ancient	starożytny	ikivanha	αρχαίο	древен	antigo	antik
Boiler	kocioł	kattila	λέβητας	котел	caldeira	vízmelegítő
Carbon	węgiel (pierwiastek)	Hiili (alkuaine)	άνθρακας	въглерод	carbono	szén
Coal	węgiel (minerał)	kivihiili	κάρβουνο	Въглища	carvão	kőszén
Coalification	uwęglenie	turvettuminen	ανθρακοποίηση	Овъгляване	coalificação	kőszén kifejtés
Honeycomb	plaster miodu	(hunaja)kennorakenne	κηρήθρα	Медна пита	Favo de mel	méhsejt
Combustion	spalanie	poltto	καύση	взрив	combustão	gyulladás
Crust	osad	kuori	κρούστα	кора	crosta	kéreg
Effective	skuteczny	tehokas	αποτελεσματικό	ефективен	efetivo	hatékony
Exhaust	spaliny	pakokaasu	εξαντλώ	отделя	escape	kimerült
Fibre	Włókno, światłowód	kuitu	ίνα	тъкан	fibra	rost
Forceps	szczypce	ottimet	τσιμπίδα	пинцет	forceps	csipesz
Fossil	skamieniałość	fossiilinen	απολίθωμα	изкопаемо	fóssil	őskori lelet
Fuel	paliwo	polttoaine	καύσιμα	гориво	combustível	üzemanyag
Furnace	piec	polttouuni	φούρνος	пещ	forno	kazán
Handle	uchwyt	kahva	Λαβή	дръжка	alça	fogantyú
Hood	dygestorium	kansi	κουκούλα	качулка	capuz	motorháztető
Insulate	izolować	eriste	μονώνω	изолиран	isolar	elszigetel
Lignite	wegiel brunatny	ruskohiili	φαιάνθρακας	Лигнитни въглища	Carvão de lignite	barnaszén
Matter	materia	materia	ύλη	Вещество	matéria	anyag
Nitrogen	azot	typpi	άζωτο	Азот	nitrogénio	nitrogen
Nozzle	dysza	suutin	στόμιο	Дюза	bocal	szórófej
Oxygen	tlen	happi	οξυγόνο	Кислород	oxigénio	oxigén
Paving	utwardzać	päällyste	λιθόστρωση	Паваж	pavimentação	útburkolat
Petrol	benzyna	bensiini	βενζίνη	Бензин	petróleo	benzin
Petroleum	ropa naftowa	raakaöljy	πετρέλαιο	Нафта	nafta	petroleum
Pliers	obcęgi	pihdit	πένσα	Клещи	alicates	harapófogó

Pressure	ciśnienie	paine	πίεση	напрежение	pressão	nyomás
Roof	komin	katto	στέγη	покрив	cobertura	tető
Sample	próbka	näyte	δείγμα	Проба	amostra	minta
Sediment	osad	sedimentti	ίζημα	утайка	sedimento	üledék
Source	źródło	lähde	πηγή	източник	fonte	forrás
Steam	para	höyry	ατμός	пара	vapor	gőz
Sulfur	siarka	rikki	θείο	сяра	enxofre	kén
Tar	smoła	piki/terva	πίσσα	катран	resina	kátrány

The Intensity of Sound

English	Polish	Finnish	Greek	Bulgarian	Portuguese	Hungarian
sound	Dźwięk	ääni	ήχος	звук	Som	hang
intensity	Natężenie	intensiteetti	Ένταση	интензивност	intensidade	erősség
range of intensity	Zakres natężenia	intensiteetin vaihteluväli	Εύρος Έντασης	Диапазон на интензивност	Faixa de intensidade	Intenzitás tartománya
loudest sound	Najgłośniejszy dżwięk	kovin ääni	Ελάχιστος ήχος	Най-силния звук	Som mais alto	leghangosabb
Range	Zasięg	vaihteluväli	Εύρος	диапазон	alcance	tartomány
large range	Daleki zasięg	suuri vaihteluväli	Ευρύ Εύρος	Широк диапазонпраг на чуваемост	Grande alcance	széles tartomány
the threshold of audibility	Próg słyszalności	kuulokynnys	κατώτατο όριο ακουστικής	Праг на чуваемост	Limiar da audição	hallásküszöb
the pain threshold	Próg bólu	kipukynnys	όριο πόνου	Праг на болка човешки слух	Limiar da dor	fájdalomküszöb
the pain threshold the human hear	Próg bólu ludzkiego słuchu	Ihmiskorvan kipukynnys	όριο πόνου του ανθρώπινου αυτιού	Праг на болка човешки слух	Limiar da dor para o ser humano	emberihallás fájdalomküszöb
Logarithmic function	Funkcja logarytmiczna	logaritminen funktio	Λογαριθμική συνάρτηση	Логаритмична функция	Função logarítmica	Logaritmus függvény
Scale	Skala	asteikko	Κλίμακα	скала	escala	skála
Formula	Wzór	kaava	Τύπος	формула	fórmula	képlet
Graph	Wykres	kuvaaja	Γραφική παράσταση	Разстояние 1 м.	gráfico	grafikon
function	Funkcja	funktio	Συνάρτηση	функция	função	függvény
Monotony function	Funkcja monotoniczna	monotoninen funktio	Μονοτονία συνάρτησης	Монотонна функция	Função monótona	monoton függvény
Reverse function	Funkcja przeciwna	käänteisfunktio	Αντίστροφη συνάρτηση	Обратна функция	Função inversa	inverz függvény

minimum	Minimum	minimi	ελάχιστο	минимум	mínimo	minimum
sound intensity	Intensywność dźwięku	äänen intensiteetti	ένταση ήχου	Интензитет на звука	Intensidade do som	témahangerősség
the subject	Temat	aihe	Το θέμα	тема	sujeito	téma
the above formula	Powyższy wzór	yllä oleva kaava	Ο πιο πάνω τύπος	Долната формула	A formula acima	a fenti képlet
sketch the graph	Naszkicować wzór	luonnostele graafi	Κατασκεύασε τη γραφική παράσταση	Скициране на графиката	Esboce o gráfico	rajzolj diagramot
Deduce if it is possible	Dedukować możliwość	Päättele, onko mahdollista	Συμπέραινε αν είναι δυνατό	Извод дали е възможно	Deduzir se for possível	döntsd el, hogy lehetséges-e
the reverse of I	Drugie ja	I:n käänteisfunktio	Το αντίστροφο της ένταση	Обратното на	O inverso de	a függvény inverze
a whisper	szept	kuiskaus	Ο ψίθυρος	шепот	sussuro	suttogás
the intensity of heavy traffic	Natężenie ruchu drogowego	raskaan liikenteen intensiteetti	Η ένταση πυκνής τροχαίας κίνησης	Интензивността на тежкия трафик	Intensisdade do tráfego pesado	a forgalom mértéke
rustle of leaves	Szelest liści	lehtien rapina	Θρόισμα των φύλλων	Шумоленето на листата	O sussuro das folhas	a levelek zörgése
distance of 1m	Odległość 1m	1 metrin etäisyys	Απόσταση ενός μέτρου	Разстояние 1 м.	Distância de 1 m	1 méter távolság
Take-off of a spacecraft	Start statku kosmicznego	avaruusaluksen lähtölaukaus	Απογείωση διαστημικού οχήματος	Излитане от пространството	Descolagem	az űrhajó landolása
Describe the monotony	Opis jednostajny	Kuvaile monotonisuutta	Περιγράψτε τη μονοτονία	Описание на монотонност	Descrição de monotonia	jellemezd monotonitás szerint
How many times greater	Ile razy większy	Kuinka monta kertaa suurempi	Πόσες φορές μεγαλύτερη	Колко пъти по-голяма	Quantas vezes maior	hányszor nagyobb
the intensity of the noise	Natężenie dźwięku	melun intensiteetti	Η ένταση της φωνής	Интензитет на шума	Intensidade do som	zajszint
Deduce if it is	Dedukować	Päättele, onko	Συμπέραινε αν	Извод дали е	Deduzir se for	döntsd el, hogy

possible	możliwość	mahdollista	είναι δυνατό	възможно	possível	lehetséges-e
sketch a graph of the reverse	Szkicować wykres odwrotny	Luonnostele käänteisfunktion kuvaaja	Κατασκευάστε τη γραφική παράσταση της αντίστροφης	Скициране графиката на обратната страна	Esboce o gráfico do lado oposto	rajzold le a függvény inverzét
sound intensity of a whisper	Natężenie gośności szeptu	Kuiskauksen ääni-intensiteetti	Ένταση θορύβου ενός ψιθύρου	Звуков интензитет на шептене	Intensidade do som do suspiro	a suttogás hangossága

The world of fats

English	Polish	Finnish	Greek	Bulgarian	Portuguese	Hungarian
Fat	Tłuszcz	Rasva	Λίπος	Мазнина	gordura	Zsír
Protein	Proteiny (Białka)	Proteiini	Πρωτεΐνη	Белтък/протеин	proteina	Fehérje
Carbohydrate	Węglowodory	Hiilihydraati	Υδατάνθρακες	въглехидрат	Hidrato de carboni	Szénhidrát
Cholesterol	Cholesterol	Kolesteroli	Χοληστερίνη	холестерол	colesterol	Koleszterin
Lipid	Lipidy (Tłuszcze)	Lipidi	Λιπίδια	липид	lipidos	Lipid
Soluble	Rozpuszczalny	Liukeneva	Διαλυτός	разтворим	solúvel	Oldódó
Non-polar	Niepolarny	Pooliton	Μη πολικός	неполярен	apolar	Apoláris
Polar	Polarny	Poolinen	Πολικός	полярен	polar	Poláris
Esters	Estry	Esterit	Εστέρες	естери	esteres	Észter
Fatty acid	Kwas tłuszczowy	Rasvahappo	Λιπαρό Οξύ	Мастна киселина	Ácidos gordos	Zsírsav
Carboxyl group	Grupa karboksylowa	Karboksyyli-ryhmä	Καρβοξυλική ομάδα	Карбоксилна група	Grupo carboxilo	Karboxil csoport
Triglycerid	Trigliceryd	Triglyseridi	Τριγλυκερίδια	триглицериди	triglicerídeos	Triglicerid
Solid	Ciało stałe	Kiinteä	Στερεό	твърд	sólido	Szilárd
Liquid	Ciecz	Neste	Υγρό	течност	líquido	Folyékony
Saturated	Nasycony	Tyydyttynyt	Κεκορεσμένο	наситени	saturado	Telített
Unsaturated	Nienasycony	Tyydyttymätön	Ακόρεστα	ненаситени	insaturado	Telítetlen
Weak forces	Słabe oddziaływanie	Heikot voimat	Ασθενείς δυνάμεις	Слабо взаимодействие	Forças fracas	Gyenge kölcsönhatás
Composition	Skład	Koostumus	Σύνθεση	сплав	composição	Összetétel
Vegetable oils	Oleje roślinne	Kasvirasva	Φυτικά έλαια	Растително олио	Óleos vegetais	Növényi olaj
Animal fats	Oleje zwierzęce	Eläinrasva	Ζωϊκό Λίπος	Животинска мазнина	Gordura animal	Állati zsír
Dairy product	Nabiał	Maitotuote	Γαλακτοκομικό προϊόν	Течни продукти	Produto lácteo	Tejtermék
Cis/trans-isometry	Izomeria cis/trans	Cis/tran-isomeria	Γεωμετρική	Цис/Транс	Isómeros cis e	Cisz/transz-

			Ισομέρεια	изометрия	trans	izoméria
Hardening	Hartowanie	Kovetus	Σκλήρυνση	втвърдяване	solidificar	Keményedés
Cardiovascular	Sercowo-naczyniowy	Sydän- ja verisuoni-	Καρδιαγγειακές	Сърдечно-съдова	cardiovascular	Szív- és érrendszeri
Essential	Podstawowy	Välttämätön	Ουσιώδες	съществен	essencial	Alapvető
Nerve	Nerw	Hermo	Νεύρο	нерв	nervo	Ideg
Resemble	Przypominający	Muistuttaa	Μοιάζω	Прилича на	Assemelha-se	Hasonlít
Blood circulation	Przepływ krwi	Verenkierto	Κυκλοφορία του αίματος	оросяване	Circulação sanguinea	Véráramlás
Density	Gęstość	Tiheys	Πυκνότητα	плътност	densidade	Sűrűség

Metals and non methals

English	Polish	Finnish	Greek	Bulgarian	Portuguese	Hungarian
Elements	Pierwiastki chemiczne	Alkuaineet	Στοιχεία	елементи	Elementos	Elemek
Periodic table	Układ okresowy pierwiastków	Jaksollinen järjestelmä	Περιοδικός Πίνακας	Периодична таблица	Tabela Periódica	Periódusos táblázat
Chemical properties	Właściwości chemiczne	Kemialliset ominaisuudet	Χημικές ιδιότητες	Химични свойства	Propriedades químicas	Kémiai tulajdonságok
Reactivity	Reaktywność	Reaktiivisuus	Δραστικότητα	реактивност	Reatividade	Reakcióképesség
Conductivity	Przewodnictwo	Johtavuus	Αγωγιμότητα	проводимост	Condutividade	Vezetőképesség
Electropositive elements	Pierwiastek elektrododatni	Elektropositiiviset alkuaineet	Ηλεκτροθετικά Στοιχεία	Електропозитивни елементи	Elementos electropositivos	Elekropozitív elemek
Electronegative	Pierwiastek elektroujemny	Elektronegatiivinen	Ηλεκτροαρνητικός	електронегативни	Electronegativo	Elektronegatív
Conductors	Przewodnik	Johdin	Αγωγοί	проводници	Condutores	Vezetékek
Electronic configuration	Konfiguracja elektronowa	Elektronikonfiguraatio	Ηλεκτρονική διαμόρφωση	Електронна конфигурация	Configuração electrónica	Elektronikus konfiguráció
Metals	Metale	Metallit	Μέταλλα	метали	Metais	Fémek
Non-metals	Niemetale	Epämetallit	Αμέταλλα	неметали	Não metais	Nemfémek
Lustre	Połysk	Kiilto	Λάμψη	блясък	Brilho	Ragyogás
Valence	Wartościowość	Valenssi	Σθένος	валентност	Valência	Vegyérték
Electrons	Elektrony	Elektronit	Ηλεκτρόνια	електрони	Electrões	Elektronok
Cations	Kationy	Kationit	Κατιόντα	катиони	Catiões	Kationok
Appearance	Zjawisko	Ulkonäkö	Εμφάνιση	вление	Aparência	Megjelenés
Anions	Aniony	Anionit	Ανιόντα	аниони	Aniões	Anionok
Reactive	Reaktywny	Reaktiivinen	Αντιδραστικός	реактивен	Reativo	Reaktív
Metallic bonds	Wiązania metaliczne	Metallisidos	Μεταλλικοί δεσμοί	Метални връзки	Ligações metálicas	Fémes kötések

Covalente bonds	Wiązania kowalencyjne	Kovalenttinen sidos	Ομοιοπολικοί δεσμοί	Ковалентни връзки	Ligações covalentes	Kovalens kötések
Good conductor of electricity	Dobry przewodnik elektryczny	Hyvä sähköjohdin	Καλός αγωγός του ηλεκτρισμού	Добър проводник на електричество	Bom condutor de eletricidade	Jó elektromos vezető
Gradation in their physical properties	Wzrost właściwości fizycznych	Fysikaalisten ominaisuuksien jaksottaisuus	Διαβάθμιση στις φυσικές τους ιδιότητες	Увеличаване на физичните свойства	Gradação das suas propriedades físicas	A fizikai tulajdonságok osztályozása
Alkaline earth metals	Metale zasadowe	Maa-alkalimetallit	Αλκαλικές γαιές	Алкални метали	Metais alcalinoterrosos	Alkáliföldfémek
Noble gas configuration	Konfiguracja gazów szlachetnych	Jalokaasurakenne	Διαμόρφωση ευγενών αερίων	Конфигурация на благородни газове	Configuração de gás nobre	Alkáliföldfémek
Atomic Radius	Promień atomowy	Atomisäde	Ατομική ακτίνα	Радиус на атома	Raio atómico	Atom sugár
Ionic radii	Promień jonowy	Ionisäde	Ιωνικές ακτίνες	Йонни радиуси	Raio iônico	Ionos sugarak
Melting points	Punkt topnienia	Sulamispiste	Σημεία τήξης	Точка на топене	Pontos de fusão	Olvadáspontok
Boiling points	Punkt wrzenia	Kiehumispiste	Σημεία βρασμού	Точка на кипене	Pontos de ebulição	Forráspontok
Crystal lattice	Siatka krystaliczna	Kiderakenne	Κρύσταλλο πλέγμα	Кристална решетка	Estrutura cristalina	Kristályrács
Molecules	Cząsteczki	Molekyylit	Μόρια	молекули	Moléculas	Molekulák
Electronic distribution	Rozmieszczenie elektronowe	Elektronien jakauma	Ηλεκτρονική διανομή	Електронно разпространение	Distribuição eletronica	Elektronikus elosztás
Ionic equations	Równanie jonowe	Reaktioyhtälö (ionin vaihto)	Ιωνικές εξισώσεις	Йонни уравнения	Equações iônicas	Ionos egyenletek
Sodium	Sód	Natrium	Νάτριο	натрий	Sódio	Nátrium
Magnesium	Magnes	Magnesium	Μαγνήσιο	магнезий	Magnésio	Magnézium
Beryllium	Beryl	Beryllium	Βηρύλλιο	берилий	Berílio	Berillium

Tobacco

English	Polish	Finnish	Greek	Bulgarian	Portuguese	Hungarian
tobacco	Tabaka	tupakka	Καπνός	тютюн	tabaco	Dohány
nicotine	Nikotyna	nikotiini	Νικοτίνη	никотин	nicotina	Nikotin
drug	Narkotyk	huume	Φάρμακο/Ναρκωτικό	наркотик	droga	Drog
cigarette	Papierosy	savuke	Τσιγάρο	цигара	cigaro	Cigaretta
pipe	Fajka	piippu	Πίπα	лула	cachimbo	Pipa
cigar	Cygaro	sikari	Πούρο	пура	charuto	Szivar
chemicals	Chemikalia	kemikaalit	Χημικές ουσίες	химикали	Produtos químicos	Vegyszerek
bloodstream	Krwiobieg	verenkierto	Κυκλοφορικό σύστημα αίματος	кръвообръщение	Circulação sanguínea	Véráram
Blood pressure	Cisnienie krwi	verenpaine	Πίεση αίματος	Кръвно налягане	Pressão arterial	Vérnyomás
stimulant	Stymulator	piriste/stimulantti	Τονωτικό	стимулант	estimulante	Élénkítőszer
Nervous system	System nerwowy	keskushermosto	Νευρικό σύστημα	Нервна система	Sistema nervoso	Idegrendszer
Lung cancer	Nowotów płuc	keuhkosyöpä	Καρκίνος του πνεύματος	Рак на белите дробове	Cancro do pulmão	Tüdőrák
Heart attack	Atak serca	sydänkohtaus	Έμφραγμα	инфаркт	Ataque cardíaco	Szívroham
stroke	Udar	infarkti	Αποπληξία	удар	infarte	Infarktus
Blood vessels	Naczynie krwionośne	verisuonet	Αιμοφόρα αγγεία	Кръвоносни съдове	Vasos sanguineos	Véredény
arteries	Tętnice	valtimot	Αρτηρίες	артерии	arterias	Artériák
Protective clothing	Ubranie ochronne	suojavaatetus	Προστατευτικά ρούχα	Защитно облекло	Roupa de protecção	Védőruházat
Green tobacco sickness	Choroba plantatorow tytoniu	nikotiinimyrkytys	Πράσινη ασθένεια καπνού	Зелена тютюнева болест	Doença verde do tabaco	Nikotin mérgezés
symptoms	Symptomy	oireet	Συμπτώματα	симптоми	sintomas	Tünetek

Abdominal pains	Bóle brzuszne	vatsakivut	Κοιλόπονοι	Коремни болки	Dores abdominais	Hasi fájdalmak
Muscle weakness	Osłabienie mięśniowe	lihasheikkous	Μυϊκή αδυναμία	Мускулна слабост	Fraqueza muscular	Izomgyengeség
breathlessness	Zadyszka	hengenahdistus	Δύσπνοια	задух	Falta de ar	Légszomj
Coughing fits	Napad kaszlu	yskimiskohtaus	Κρίση βήχα	Пристъпи на кашлица	Ataques de tosse	Köhögőroham
Developed countries	Kraje rozwnięte	länsimaat	Αναπτυγμένες χώρες	Развити страни	Paises desenvolvidos	Fejlett országok
Developing countries	Kraje rozwijające się	kehitysmaat	Αναπτυσσόμενες χωρες	Развиващи се страни	Paises em desenvolvimento	Felődő országok
Tenant farmers	Rolnik najemny	torppari/vuokraviljelijä	Ενοικιαστές αγρότες	наемателви	Fazendeiro inquilino	Földbérlő gazdák
Tenancy system	System dzierżawy	torpparijärjestelmä	Σύστημα Μίσθωσης	Арендаторска система	Sistema de arrendamento	Bérleti rendszer
income	Dochód	tulot	Εισόδημα	доход	renda	Jövedelem
pesticides	Pestycydy	tuholaismyrkyt	Φυτοφάρμακα	пестициди	pesticides	Rovarirtók
nurseries	Żłobek	taimitarhat	Φυτώρια	разсадници	viveiros	Óvodák
deforestation	Wylesienie	Metsän hakkuu	Αποψίλωση των δασών	обезлесяване	desflorestamento	Erdőirtás
pollution	Skażenie	saasteet	Ρύπανση	замърсяване	poluição	Szennyezés
Nondegradable filters	Filtry niedegradowalne	Hajoamattomat suodattimet	Μη διασπώμενα φίλτρα	Неразграждащи се филтри	Filtros não degradáveis	Nem lebontható szűrők
addictive	Uzależniajacy	koukuttava	Εθιστική	пристрастяващ	viciante	Függőséget okozó
blood	Krew	veri	Αίμα	кръв	sangue	Vér

Autonomous cars

English	Polish	Finnish	Greek	Bulgarian	Portuguese	Hungarian
Cylinder	Cylinder	Sylinteri	κύλινδρος	Цилиндър	cilindro	Henger
Fuel	Paliwo	Polttoaine	καύσιμα	гориво	combustível	Tüzelőanyag
force	Siła	Voima	δύναμη	сила	força	Erő
Pump	Pompować	Pumppu	αντλία	помпа	bomba	Szivattyú
Air	Powietrze	Ilma	αέρας	въздух	ar	Levegő
Pollutant	Substancja znieczyszczająca środowisko	Saaste, epäpuhtaus	Ρύπος	замърсител	poluente	Káros anyag
Object	Przedmiot	Kohde	Αντικείμενο	предмет	objeto	Tárgy
Power source	Źródło mocy	voimanlähde	Πηγή ενέργειας	захранване	Fonte de energia	Áramforrás
Horseshoe magnet	Podkowa	Hevosenkenkämagneetti	Πεταλοειδής μαγνήτης	подкова	Imã em ferradura	Patkómágnes
Wave	Fala	Aalto	Κύμα	вълна	onda	Hullám
Reflection	Odbicie	Heijastus	Αντανάκλαση	размисъл	reflexão	Visszaverődés
Light source	Źródło światła	Valonlähde	Πηγή φωτός	Източник на светлина	Fonte de luz	Fényforrás
Observation	Obserwacja	Havainto	Παρατήρηση	наблюдение	observação	Megfigyelés
Experiment	Eksperyment	Koe, kokeilu	Πείραμα	експеримент	experiência	Kísérlet
Nature	Natura	Luonto	Φύση	природа	natureza	Természet
Computer	Komputer	Tietokone	Ηλεκτρονικός υπολογιστής	компютър	computador	Számítógép
Operation	Operacja	Operaatio	λειτουργία	операция	operação	Művelet
Switch	Łącznik	Kytkin	Διακόπτης	ключ	interruptor	Kapcsoló
Bulb	Żarówka	Polttimo	λάμπα	крушка	bulbo	Izzó
Concave mirror	Zwierciadło wklęsłw	Kovera peili	Κοίλος καθρέφτης	Вдлъбнато огледало	Espelho côncavo	Homorú tükör

Convex mirror	Ziwerciadło wypukłe	Kupera peili	Κυρτός καθρέφτης	Изпъкнало огледало	Espelho convexo	Domború tükör
plane mirror	Zwierciadło płaskie	Tasainen peil	Επίπεδο κάτοπτρο	Проско огледало	Espelho plano	Sík tükör
Angle of incidence	Kąt padania	Tulokulma	Γωνία πρόσπτωσης	Ъгъл на разпространение	Ângulo de incidência	Beesési szög
Incidence perpendicular	Prostopadły kąt padania	Kohtisuora tulo	Κάθετη Πρόσπτωση	Перпендикулярно падане	Incidência perpendicular	Beesési merőleges
Principle of operation	Zasada działania	Toimintaperiaate	Αρχή της Λειτουργίας	Принцип на действие	Princípio da operação	Működési elv
Work	Praca	Työ	Δουλειά	работа	trabalho	Munka
Control	Konrola	Hallita, hallinta	Έλεγχος	контрол	controlo	Ellenőrzés
Compression	Kompresja	Kompressio	Συμπίεση	Компресия	compressão	Sűrítés
Combustion chamber	Komora spalania	Polttokammio	Θάλαμος καύσης	Горивна камера	Câmara de combustão	Égéstér
Clear	Czysty	Puhdas	Καθαρό	чисто	claro	Tiszta
Pressure	Ciśnienie	paine	Πίεση	налягане	pressão	Nyomás
Ignite	Zapalać	Sytyttää	Ανάβω	възпламени	incendeia	Meggyullad
Spark	Iskra	Kipinä	Σπίθα	искра	faísca	Szikra
Law	Prawo	Laki	Νόμος	закон	lei	Törvény
Light	Światło	Valo	Φως	светлина	luz	Fény

Contens

Subject

Dictionary