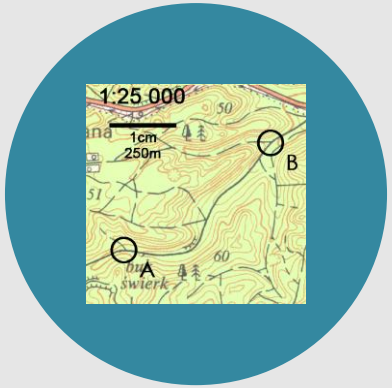
LEARNING MATHS AND SCIENCE

A Scientific Textbook with the collaboration of Poland, France, Macedonia, Ireland and Sweden

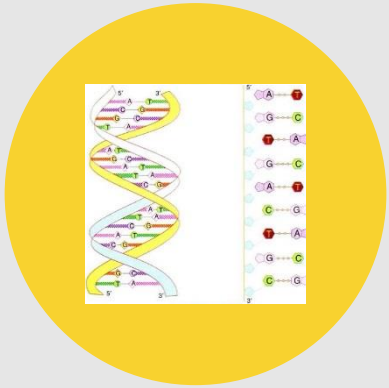
ERASMUS KA 2- Cooporation for innovation and the exchange of good practices, strategies good practice for European Schools

Subjects

1- MATHEMATICS AND MUSIC.



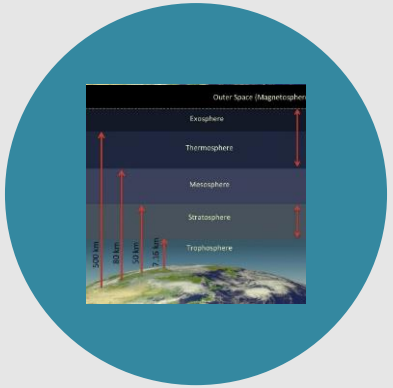
2- MATHEMATICS AND CARTOGRAPHY



3- SCIENCE AND BIOTECHNOLOGY

Subjects

4- SCIENCE AND FOOD IN THE SOCIETY



5- PHYSICS : GLOBAL CLIMATE CHANGE

6- CHEMISTRY : GLOBAL WARNING

Subjects

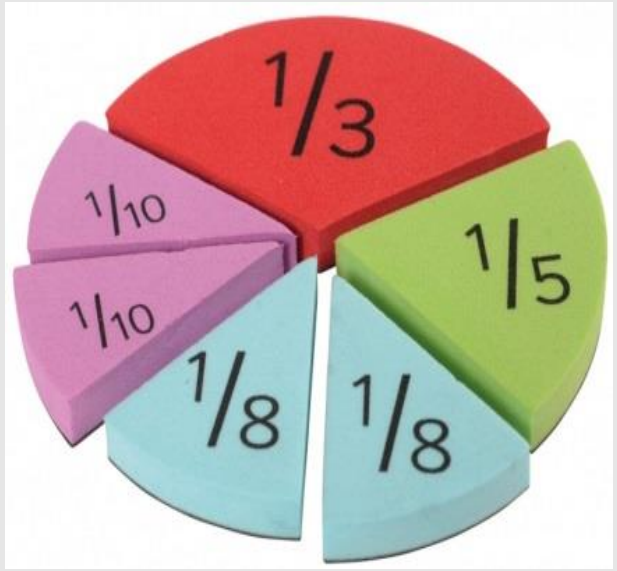
7- ENGLISH LESSON : SCIENTIFIC OR REALISTIC : THAT'S THE QUESTION

8- PE : ORIENTATION RACES AT SCHOOL

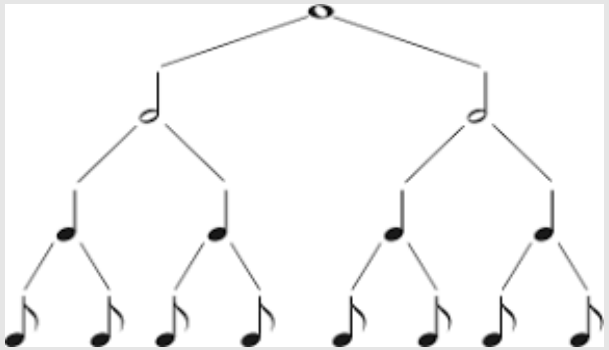
9- Ressources and weblinks for students

Subject 1 : Mathematics and Music

By: Bożena Szymańska-Pakos, Poland

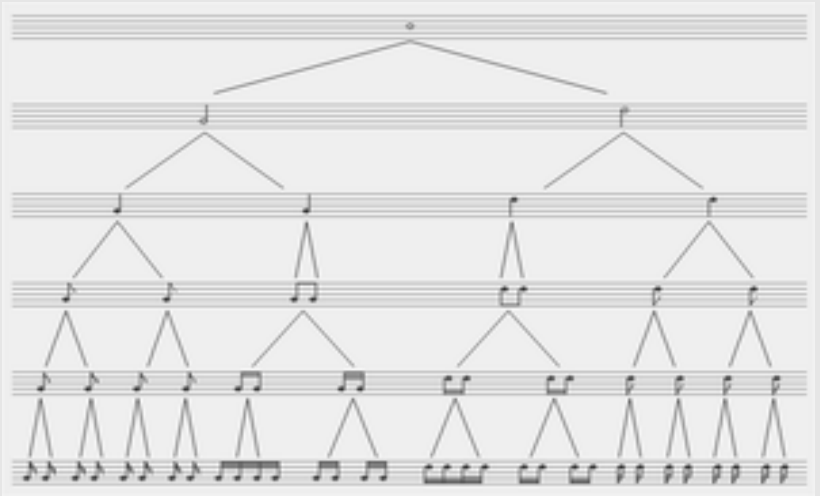


- That's the honest truth that music is full of mathematics.
- Searching for mathematics information in music, I found many interesting properties. Let's try to look at the rhythm in music. The rhythm determines the distribution of sounds over time. I will describe the notation based on fractions and general measure grouping . The note values are based on the note. Every note has got specific length. In fact, the length of the note is arbitrary, as the same melody can be played slowly or fast.
- That is why the length of the note is often given at the beginning of the song. In contrast to the sound itself, but we give it not as the number of vibrations per second, but as the number of notes (more often a quarter note or eighths) per minute.
- Further values are given as a fraction of the whole note:
- Divide the entire note (1) into two half notes (½) a half note (1/2) for two quarter notes (1/4), a quarter note (1/4) for two eights (1/8), etc.



Activity 1

- 1. What is the distribution of rhythmic values?
- 2. How much do we count the whole note?
- 3. What does the note eight look like?
- As you can see, we get each subsequent value by dividing the previous length values into 2. Such a regular division of rhythmic values is called division bipartite. The hierarchy in the picture below is clearly visible.



- As we can see, starting from the eight, the note performance has a "flag". Every next the finer value has one more flag than the previous one.
  The number of "flags" can also be calculated using the logarithm:
- $w = -(\log_2 s + 2)$. Where s is the value of the note as a fraction. For example, for 1/32 we get: $w = -(\log_2 \frac{1}{32} + 2)$ = - (-5 + 2) = 3. So we get that the thirty-two have three "flags". You also have to mention the dot that may appear next to the note. It means increase in value by half. Mathematically, this means multiplying the value by 3/2. This notation has been in force since the 7th century, although in the beginning additional characters often had a bit other meaning. This makes it difficult to play old songs .

Activity 2

- 1. How many „flags” have an eight? Calculate
- 2. How many flags has a half note? Calculate

Sources

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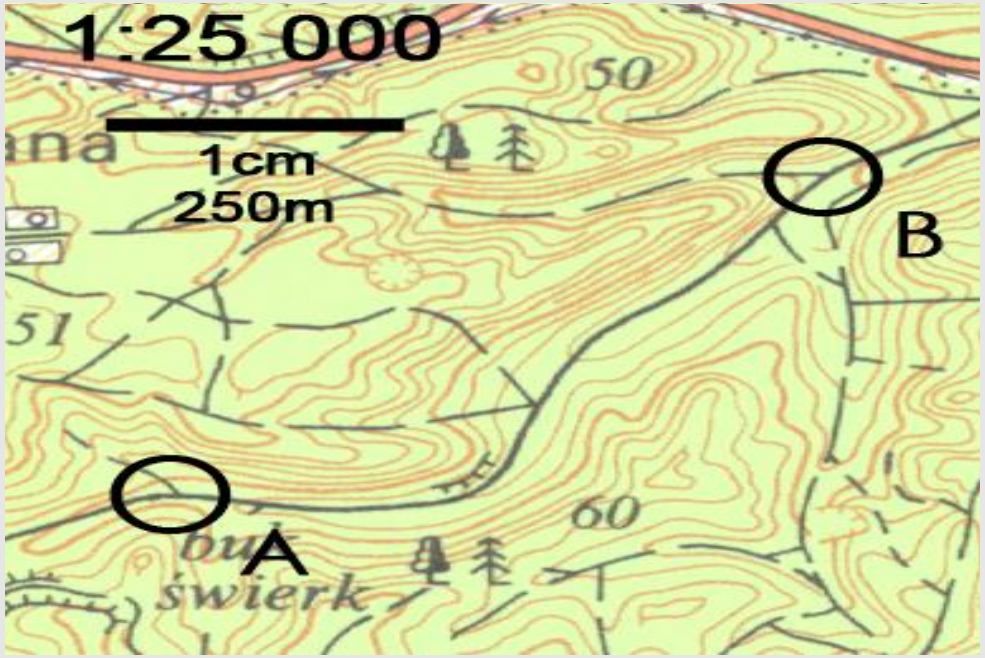
3. http://www.daktik.rubikon.net.pl/akustyka/spis_akustyka.htm
4. http://pl.wikipedia.org/wiki/Szereg_harmoniczny_(muzyka)
5. https://towarzystwo.edu.pl/assets/prace_matematyczne/zglinski2011.pdf
6. Sz. Jeleński, Śladami Pitagorasa, WSiP Warszawa 1988

Subject 2 : Mathematics and Cartography

By: Aneta Popiołek, Poland



- **"The uses of maps in human communication continually increase and diversify, reflecting the range of interests, knowledge, and aspirations."**

  - **John Noble Wilford from *The Mapmakers***

- Facts about Cartography and Maths

1. Cartography is an ancient discipline that dates from prehistoric times, often depicting hunting and fishing territories. Some of the earliest maps of the world were created by Babylonians in the 9th century BC. The first world map is credited to Martin Waldseemuller in 1507 which included a map of the U.S. before it was settled.
2. When is Maths used in nowadays Cartography? It helps cartographers with map scale, coordinate systems, and map projection.

Definition of map
A set of points, lines, and areas all defined both by position with reference to a coordinate system and by their non-spatial attributes.
Maps are the world representations reduced to points, lines, and areas, using a variety of visual resources: size, shape, value, texture or pattern, color, orientation, and shape. A thin line may mean something different from a thick one, and similarly, red lines differ from blue ones.

How are Maps used?
1.To locate places on the surface of the earth,
2.To show patterns of distribution,
3.To discover relationships between different phenomena by analyzing map information.
4.What are stages of creating map?
5.Geodetic measurements on the Earth's surface (lengths, angles, height differences).
6.Transfer measurements on a reference surface.
7.Reduction of the reference surface - the scale.
8.Projection of the surface on the sheet.

Definition of map scale
The relationship between distances on a map and the corresponding distances on the earth's surface expressed as a fraction or a ratio.
One unit of measurement on the map - 1 centimeter -- could represent 25 000 of the same units on the ground. This would be a 1 : 25 000 scaled map.

Large scale/Small scale
Cartographers talk about large and small scale maps. A large scale map shows a small area with a large amount of detail. A small scale map shows a large area with a small amount of detail. A good way to remember it: when you give a friend a map to your school or home, that's most likely a large scale map.

Example 1

The longest river in Suwalszczyzna region is Czarna Hańcza. In Poland the length of this river is 108 km. Let's calculate the length of that part of the river Czarna Hańcza on the map, if scale of the map is 1:500 000.
Because 1 cm on the map corresponds to 5 km in real life, so
108:5=21,6
On the map that part of Czarna Hańcza has 21,6 cm

Example 2

- The deepest lake in Poland is Hańcza Lake (the maximum depth is 108,5m), which is located in Suwałki Landscape Park. The area of this lake is 304,4 hectares. What is the area of the lake on the map above. The result we are going to give in square milimetres. The area of the lake in reality and the shape of the lake on the map are both 'similar figures'. So the ratio of the areas of these figures equals the square scale of similarity.
- Let's create the following signifiers:
- Ar – the area of Hańcza Lake in reality Ar=304,4 hectares
- Am - the area of Hańcza Lake on the map in scale s = 1:500 000
- Then

$$\frac{Am}{Ar} = k^2$$

We will write Ar in square milimetres (then we will get Am also in square milimetres)
Let's recollect:
1 hectare = 10 000m2 = 108 cm2 =1010 mm2 so Ar = 304,4 * 1010 mm2

We are using properties of operations on powers and we receive

$$\frac{Am}{304{,}4 \cdot 10^{10}} = \left(\frac{1}{5 \cdot 10^5}\right)^2$$

$$Am = 304{,}4 \cdot 10^{10} \cdot \frac{1}{25 \cdot 10^{10}} = 12{,}176\ (mm^2)$$

The area of Hańcza Lake on the map equals about 12,2 milimetres 2

Exercises

1.Wisła – the longest river in Poland - is 1047 km long. Calculate the length of Wisła on the map, in the scale 1 : 300 000. Give the answer in centimeters.

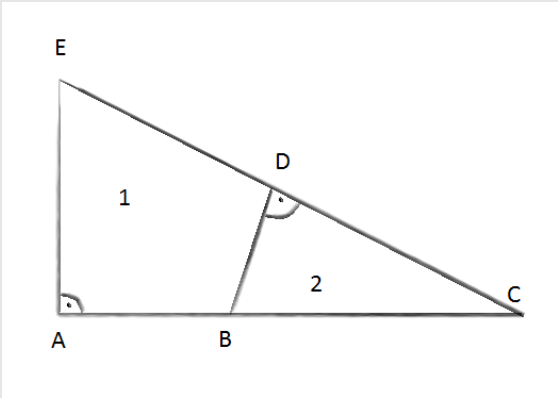
2- The distance from Rzeszów to Radom (two polish cities) on the map in the scale 1:250000 is 80 cm. Calculate, how is its real length.

3- Calculate the scale of the map if:
a) 1 cm on the map is 4m in reality
b) 1 cm2 on the map is 4 m2 in reality.

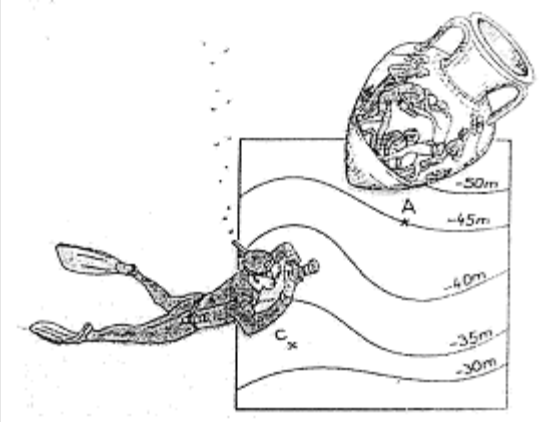
4- A building of the area 150m2 has been marked on the map as rectangle 20 cm x 30 cm.
a) calculate the scale of this map,
b) determine the dimensions of this building in the scale 1:500

5- A plot has the form of rectangle 50 m x 40 m. How many cm2 has it on the map in the scale 1:2 000?

6- Mr. and Mrs. Nowak allocated 26 000 PLN on purchase of land. One of the offers included drawing of two neighboring plots in 1 : 1 000 scale. One square meter costs 35 pln. What is the cost of the plot 2? Can Mr and Mrs Nowak buy it? The distances between points A, C, B, E are IAEI = 5cm, IECI = 13cm, IBCI = 6,5cm.



7- The following picture shows a map of the seabed on a scale 1:500



The shape of the seabed is shown with contour lines with markings concerning the depth .The amphora (point A) is lying on the seabed. The diver Colin is moving at a depth of 25 meters. His location is marked as a point C. With the help of the map, work out the distance between the diver from the amphora!

Subject 3 : Science and Biotechnology- DNA sequencing

by Rabeya Begum Klara Teoretiska Gymnasium Sollentuna, Sweden

Comparative molecular cytogenetic analyses of a major tandemly repeated DNA family and retrotransposon sequences in cultivated jute Corchorus species (Malvaceae).

Rabeya et al., 2013, Annals of Botany

Theory in class room

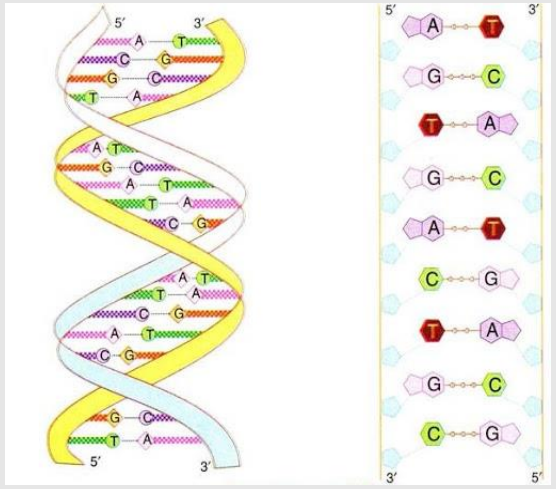
What is DNA

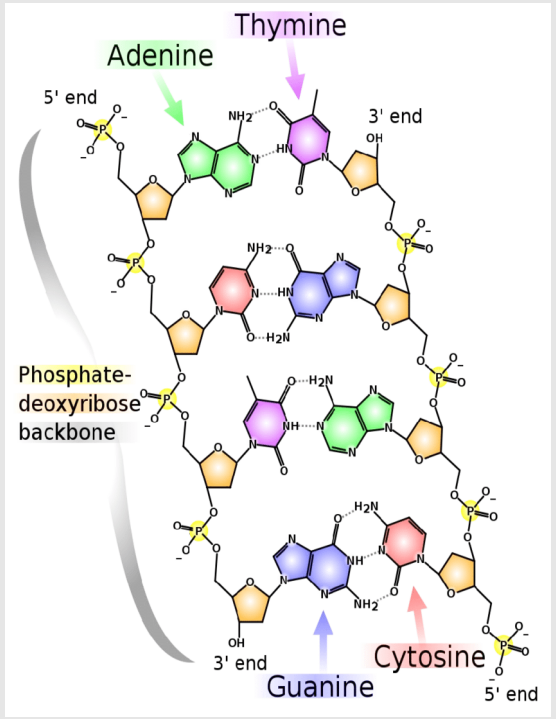
DNA is the genetic code that gives all the characteristics of living things. It stands for DeoxyRiboNucleicAcid (DNA).

Structure and function of DNA

DNA molecule has two parallal spiral strands

Each strand contains a chain of nucleotides and each nucleotide consists of a sugar molecule, a phosphate molecule which is the backbone of DNA and one of four nitrogen base pairs, namely, adenine (A), guanine (G), cytosine (C) and thymine (T). Two strands of the DNA molecule are connected by the hydrogen bonds. Adenine pairs with the thymine and guanin pairs with the cytosine





DNA carries the genetic information for organisms which decide the traits depending on their arrangement.

What is DNA sequencing? And why does it important?

DNA sequencing is the process that determines the order of the nitrogen bases (nucleotides) adenine, guanine, cytosine and thymine in DNA. The sequence of DNA is the inherited genetic information in every cells and therefore the determination is important both in basic and developed research on organisms in the field of biology and medicine. The DNA sequencing is also very important for identifying diseases and also how to cure them.

Laboratory work

DNA isolation

Jute (Chorchorus species) seedlings were grown under greenhouse conditions. Genomic DNA was isolated from young leaves using the CTAB (cetyltrimethylammonium bromide) standard protocol.

Genomic DNA digestion

Genomic DNA of jute plants was digested with the restriction enzymes and separated by agarose gel electrophoresis. DNA fragments were purified from the gel and then analysed in the DNA sequencing machine in the laboratory of Vetenskapshus (Science house) in Stockholm.

Fig. DNA sequencing equipments

Analysis of the DNA sequencing

Students got the whole genomic sequence on their hand and they were asked to compare the DNA sequencing between the whole genome and the DNA fragment sequencing what they have prepared. They also needed to investigate the different repetitive DNA sequences from their lab sequencing data.

Students used the method ”Whole-genomic alignment (WGA)” which helps to predict the evolutionary relaionship at the DNA level between two or more genomes. It showed the sequence alignment among genomes. With the help of this program students learned to create or design the phylogenetic tree.

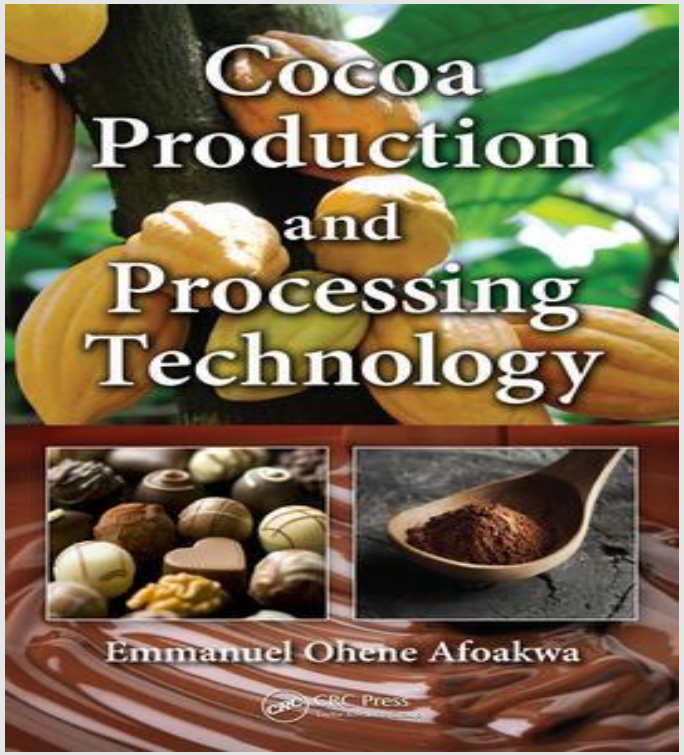
Students those were even more interested to know which protein are going to be made from the different repetitive sequences, they were most welcome to use the software ”The Human Protein Atlas” and have fun through learning DNA and protein.

Sources

- Rabeya et al. 2013. Comparative molecular cytogenetic analyses of a major tandemly repeated DNA family and retrotransposon sequences in cultivated jute Corchorus species (Malvaceae). Annals of Botany (112): 123–134.
- CN Dewey, 2012. Whole genome alignment. Evolutionary Genomics, Springer.
- Pictures are collected from google website
- http://www.biologydiscussion.com/dna/dna-structure-function-packaging-and-properties-with-diagram/16966
- http://www.sun.ac.za/english/faculty/science/CAF/units/dna-equipment

Subject 4 : Science and Food in Society

by Rabeya Begum Klara Teoretiska Gymnasium Sollentuna



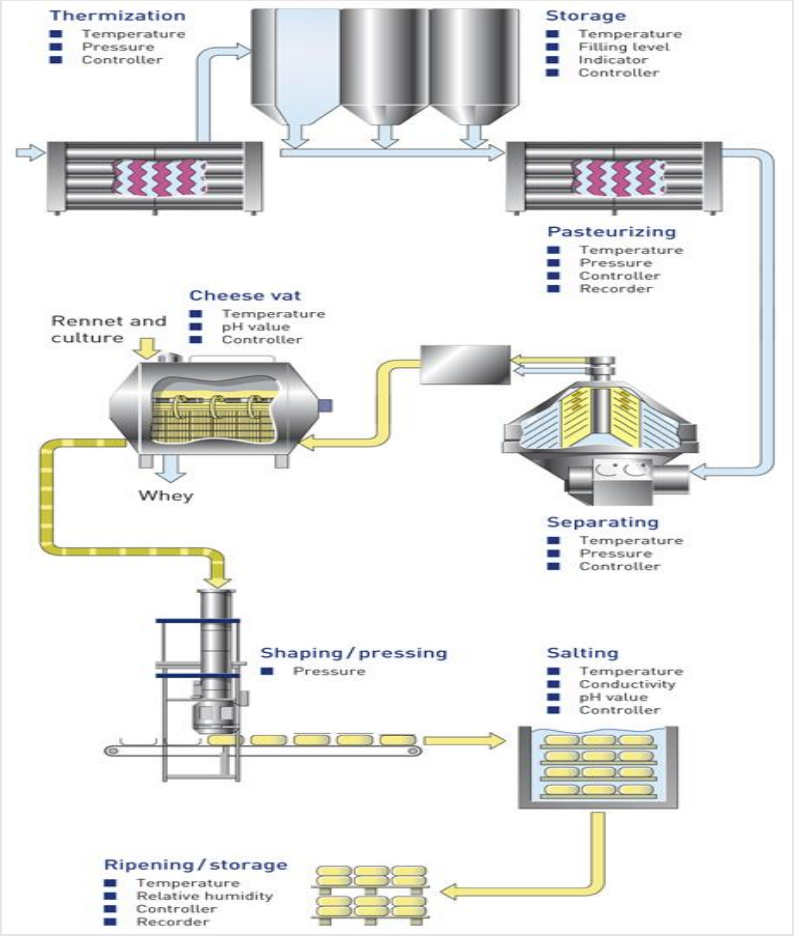
Food is one of the basic need in our society. When science was not that much advanced people used very few techniques to produce different kinds of foods. Nowadays scientists use different technology and microborganisms to produce multiple varieties of food with different qualities. For example, people get yogurt, different kinds of cheese, lactose-free milk with the help of biotechnologies only from milk. Some examples were taken below :

Example 1: Cheese production from milk

It was discovered that liquid from the calves` stomach`s contained some juice that allowed the milk to coagulate and therefore they started using it for cheese making. The calves` stomach´s juice consists of a mixture of various enzymes that are useful for breaking down the milk. One of the enzymes called chymosin precipitates the milk protein casein. Casein is a phosphorous protein found in milk and has a hydrophilic tail. It is a major constituent of the milk protein can bind to calcium.

Fig 1. Cheese production

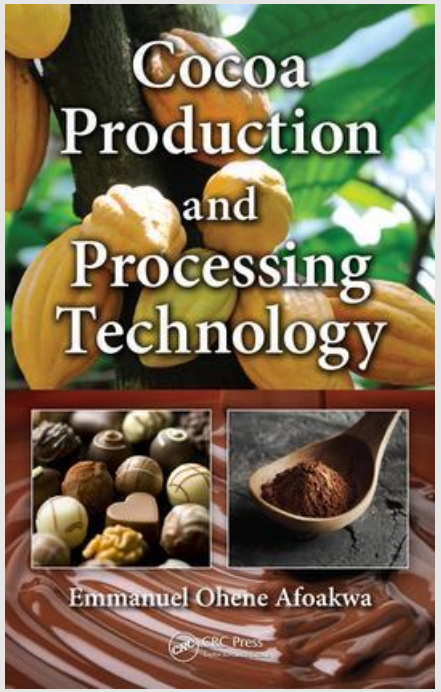
The hydrophilic tail allows the protein to form small lumps with tails outward. The chymosin, however, cuts off these tails and the remaining hydrophobic parts of the casein bind to each other so that the molecules join together in a network of curds forming threads.



Example 2: Cocoa bean production for chocolate by using genetic engineering methods

- A large boxes of cocoa seeds are collected and then it is covered by banana leaves. The seeds are allowed to ferment for about a week with yeast fungi as bacteria. During the fermentation process, certain microbes work simultaneously, others replacing one another.
- The fermentation process starts with different species of yeast cells, breaks down (hydrolyzing) the pectin that surrounds the seeds and then ferments sugar to ethyl alcohol and carbon dioxide.

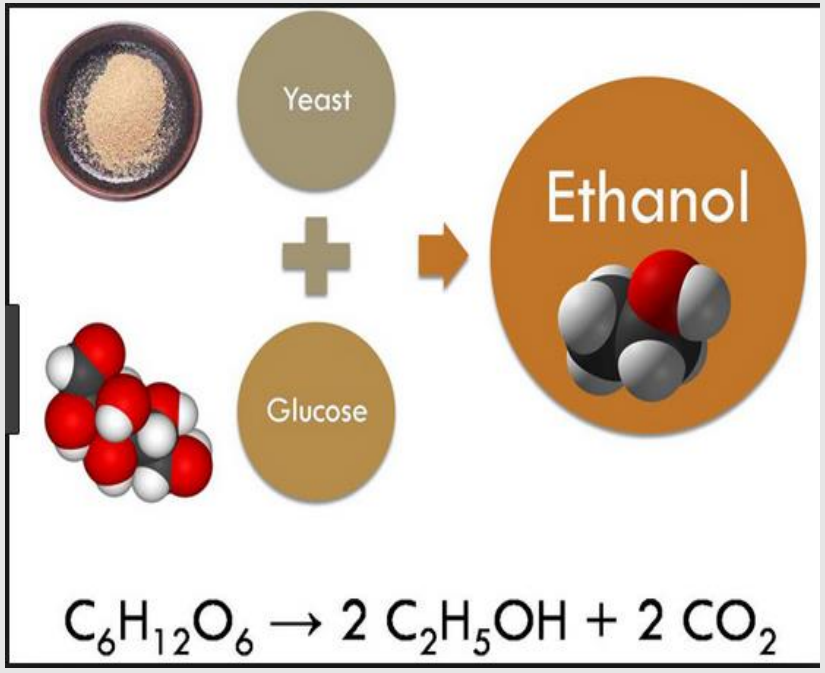
- When the temperature increases along with the alcohol content, the yeast cells are inhibited and bacteria increases. Their lactic acid production leads to a lowering of the pH, which causes bacteria to form acetic acid. The acetic acid kills the seed embryo and releases enzymes that break down proteins and carbohydrates. When the fermentation has ended, the seed is called cocoa bean



Example 3: Wine production by using genetic engineering methods

- Wine is fermented from grapes with high sugar content. The grape sugars are crushed and become a grape`s paste that can go through fermentation. During fermentation, the yeast cells break down the sugar to alcohol. The more sugar the grape`s paste contain, the higher the alcohol content of the wine. After 1-2 weeks the wine is drained from yeast tanks and thus separated from both yeast cells and other material. Some wines are then ready to drink, while others need to be stored for a number of years. While the wine is stored in bottles, biochemical processes continue to strive for tannic substances at a very slow rate.

Fig. Chemical reaction during fermentation process



Some enzymes produced from genetically modified microorganisms during the 21st century. These are enzymes that break down and form dyes that help the manufacturer to give the wine a special color. But these enzymes also causes the unpleasant taste of the wine.

Sources

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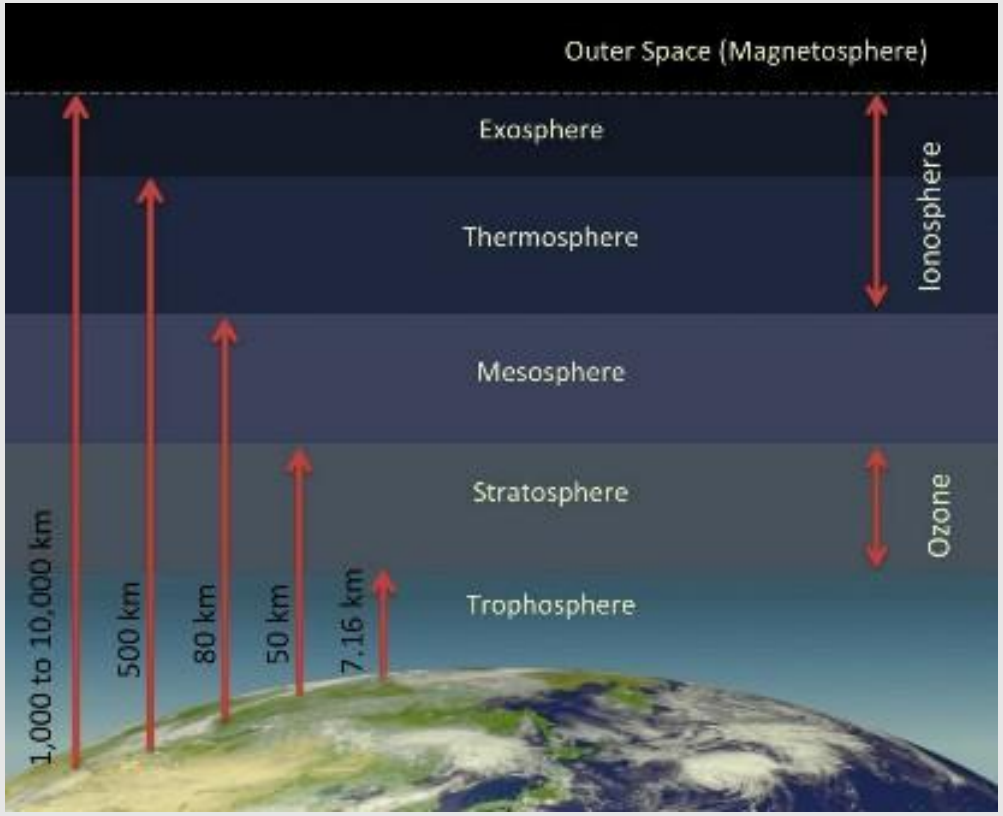
- https://www.google.com/search?q=Cocoa+and+chocolate+production&rlz=1C1GCEV_enSE862SE862&source=lnms&tbm=isch&sa=X&ved=2ahUKEwi4vYiJjdzoAhV8y8QBHTU5BRkQ_AUoAXoECAwQAw&biw=1366&bih=657
- https://www.google.com/search?q=fermentation+reaction+in+wine+production&rlz=1C1GCEV_enSE862SE862&source=lnms&tbm=isch&sa=X&ved=2ahUKEwjb7LPWjdzoAhVfwcQBHe1EC7UQ_AUoAXoECA0QAw&biw=1366&bih=657

Subject 5 : Physics_Global Climate Change

By: Marina Poposka, Republic of North Macedonia



Climatology is the scientific study of climate, scientifically defined as weather conditions averaged over a period of time.

According to Alexander von Humboldt (Prussian naturalist and explorer) the term climate is related with some specific feature of the atmosphere which depends of continuous mutual action of moving sea surface and heat radiation from dry areas on the Earth.

The main methods employed by climatologists are the analysis of observations and modelling the physical laws that determine the climate. The study are related with climate variability, mechanisms of climate changes and modern climate change.

Climate models are used for a variety of purposes from study of the dynamics of the weather and climate system to projections of future climate.

1- Earth atmosphere

- The Earth atmosphere consists of 5 layers:

- trophosphere (0-10)km, the area where we live;
- trophopause is the top layer of the troposphere (above the south and north poles - up to 5km and above the equator - up to 16km from the surface);
- stratosphere is up to 50km and ozone layer is in 11km-60km height;
- mesosphere (where the temperature is t= -90^{0}C);
- mesopause;
- thermosphere (where there is a low density);
- ionosphere (where there are gases and plasma);
- exospehere is up to 500km;
- magnetosphere extends in (3000km-16000km).

2 - Global Climate Change Causes

2. Global climate change causes There are many natural and anthropogenic impacts on global climate change.

•Aerosols - particles with diameter d=(10^{-4}-10^{-5})cm and with relatively short life - causes temperature change and local climate change;

•In the stratosphere there are small amounts of aerosols;

•Sulfur oxides: SO2, SO3, SO4 .

Volcanic eruptions impacts on the transparency of the atmosphere

3 - Oceans and cryosphere

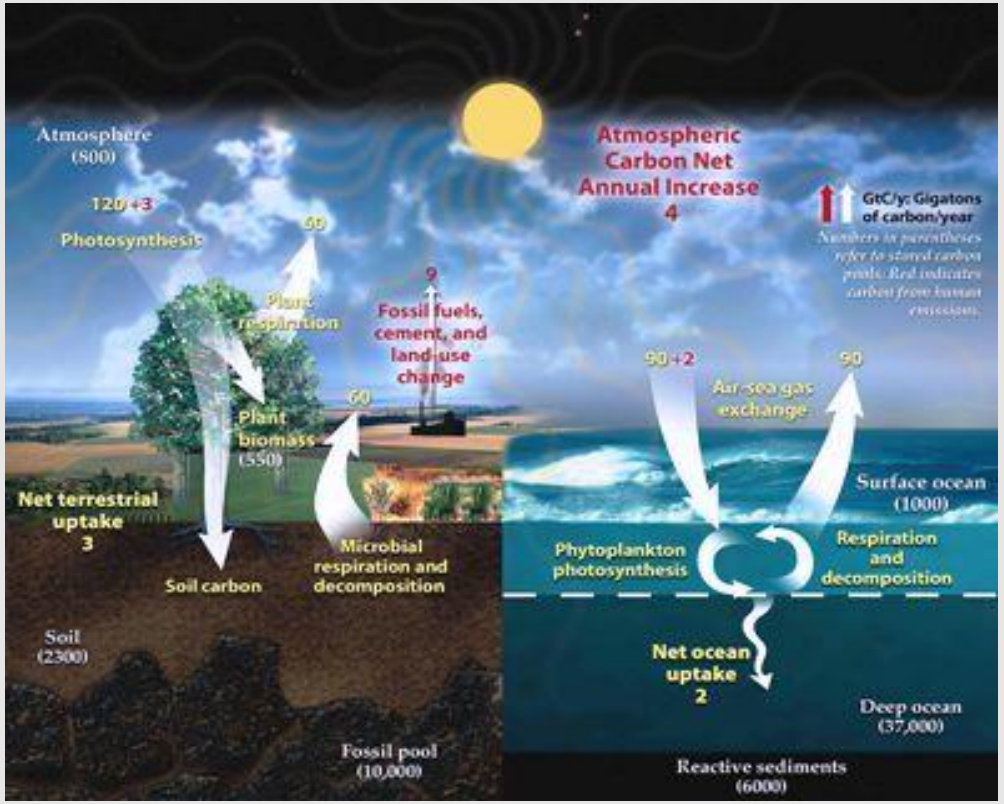
•Oceanes and seas are heat reservoirs - they are slow to warm and slow to cool and poorly reflecting the incoming radiation;
•Cryosphere (Greenland and Antarctica) - they have thermal influence on the air and water masses, increased albedo and absorption of gases.

4 - Acid rain

- Atmospheric gases, CO_2, SO_2, nitrogen oxides - NOx, NH_3;
- Acid rain have pH<5;
- Volcanic eruptions as a natural sources of sulfur oxides;
- The human is a 90% cause for emission of S and 95% for emission of N in the atmosphere;
- Cosmological impact (11-years cycle of the Sun influences dynamics of the processes in the stratosphere and ionosphere;

5 - Climate change - upcoming global threat

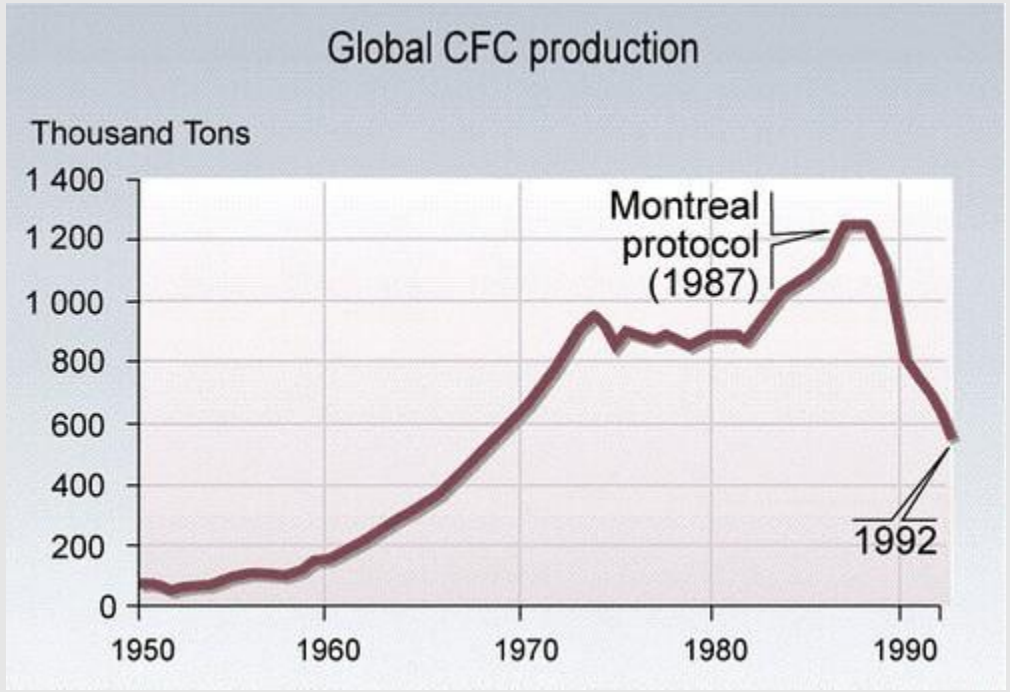
Life on Earth is possible because of the greenhouse effect;
Gases which trap heat energy in Earth atmosphere are: carbon dioxide CO2, methane CH4, water vapor, tropospheric ozone O3, nitrous oxide N2O.

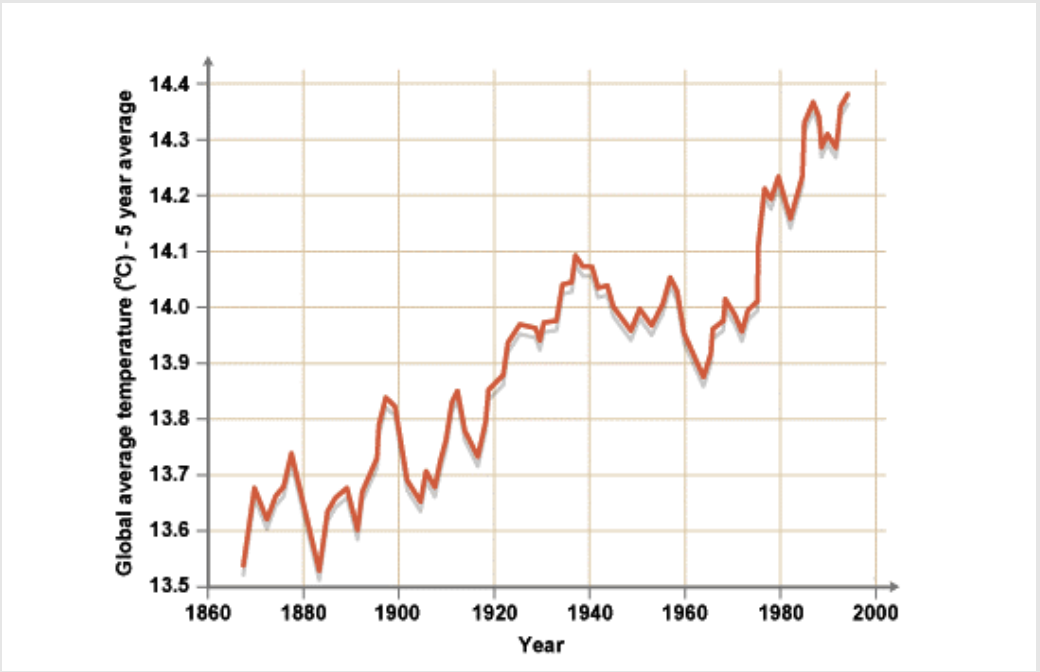


6 - Why do we expect climate change?

Industrialization as a factor;

Increased concentration of CFCs - Chlorofluorocarbons.





7 - Historical data for climate and some predictions for its change in the future

- Svante Arrhenius (Swedish scientist), 1896;
- The Earth warmed up by $0,5^0$C in the last 100 years (according to world scientific community, 1995);
- The temperature of the air on Earth will increase by $(1\text{-}3,5)^0$C until 2100;
- Global worming influence the life on Earth.

Suggested links for students:

- https://www.youtube.com/watch?v=cNwWjC1TNJw
- https://www.youtube.com/watch?v=QLteLZNXmyI
- https://www.youtube.com/watch?v=G4H1N_yXBiA

Subject 6 : Chemistry lesson_Global Warning

By
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What does the global warming of earth or greenhouse gases mean?

- Do the impact of
- Ozone (O3)
- Methane (CH4)
- Water vapor (H2O)
- Carbon monoxide (CO)
- Carbon dioxide (CO2)
- Nitrous oxide (N2O)
- Sulfur hexafluoride (SF6)
- is it an important factor in this issue or something else?

- Global warming is the ongoing rise of the average temperature of the Earth's climate system and has been demonstrated by direct temperature measurements and by measurements of various effects of the warming.
- Global warming due to the greenhouse effect is a problem associated with possible global climate change caused by rising levels of so-called greenhouse gases in the atmosphere. The effect of the greenhouse was discovered by Joseph Fourier in 1824 and the first to quantitatively investigation this effect was Svante Arrhenius in 1896.
- The more greenhouse gases there are, the more heat is trapped. This is called a greenhouse effect.

Greenhouse gases - Greenhouse gases are natural when in the right amount and in this case they are of great benefit to the Earth. They provide life on Earth, but ...When the emission of greenhouse gases is uncontrollably high, then the temperatures rise too fast and they are a higher than allowed, it disrupts the natural balance in the system.

For this imbalance of the globe contribute exhaust fumes from chimneys of factories, motor vehicles, wastewater, etc.

What is Ozone (O3)? - Ozone is a "natural filter" for protection from the harmful UV radiation of the sun's rays. The ozone layer is located 10-35 km. from the Earth's surfice with a thickness of only 3 mm. Ozone in the stratosphere is formed by the action of ultraviolet rays (200-250 nm) from the Sun on an oxygen molecule and it also decomposes under the action of the increasing emission of halogen derivatives of methane (freons) which are obtained by decomposition primarily by plastic tables.

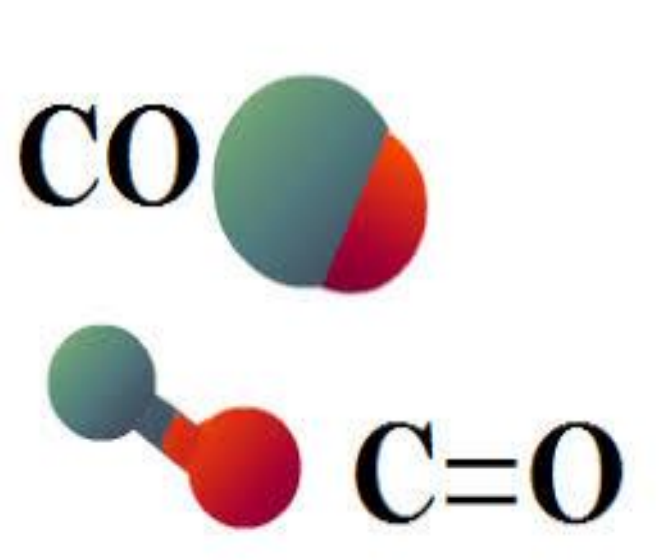
Ozone also appears in the troposphere (the lowest part of the Earth's atmosphere), here in small quantities it acts refreshingly, but in larger quantities it is a pollutant that contributes to the formation of photochemical smog for increased heating of the Earth's surfice.

•Methane (CH4) causes 4–9% of the total greenhouse effect. It is the simplest hydrocarbon, colorless gas, without odor and taste. It is not flammable, but very explosive. In nature, it increases by 2% per year, mostly by attacking termites on trees where cellulose decomposes to 165 million tons of methane and 55 million tons of carbon dioxide, which scientists are seriously concerned about it.

Its natural sources are also the wetlands. Methane emissions can vary significantly from one country or region to another, depending on many factors such as climate, industrial and agricultural production.

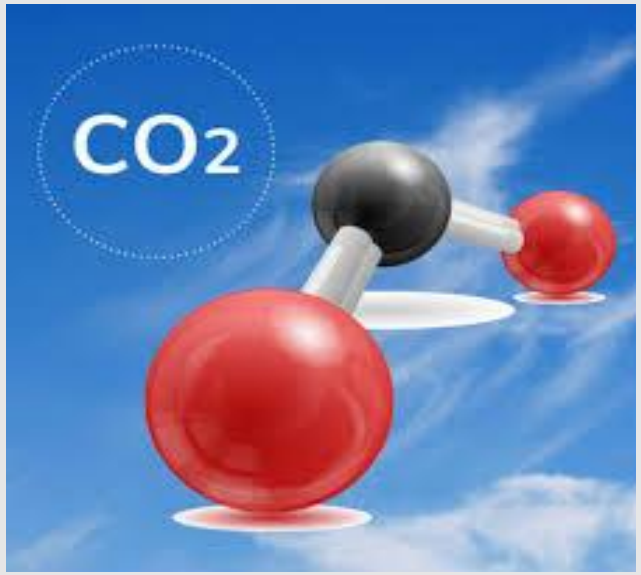
Namely, one ton of methane has the same effect on global climate change as 21 tons of CO_2.

Carbon monoxide (CO) – (smoke) gas is formed by incomplete combustion of fuels, wood, oil, perfumes in insufficient of oxygen.



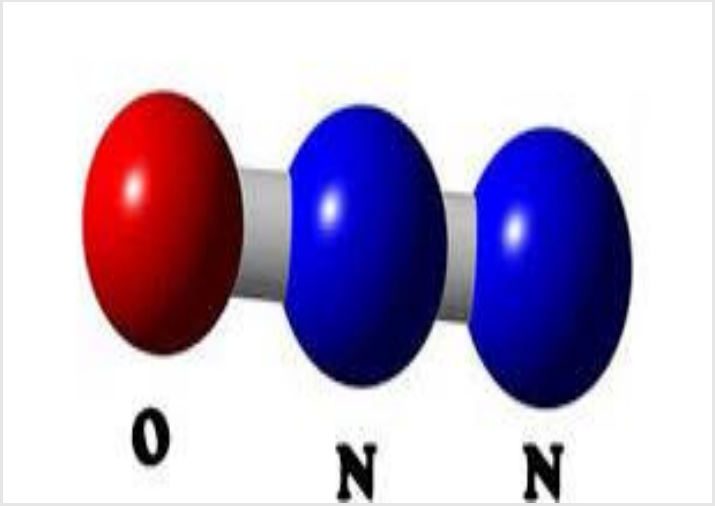
It is found in the air in traces, something more in volcanic gases, it is also found in meteors. Most of all, it is caused by human inattention, most often as a result of anthropogenic gas pollution from factory chimneys, stoves and internal combustion engines.

•Carbon dioxide (CO2) is a colorless and odorless gas. It does not burn, it is heavier than air. Carbon dioxide is produced during the combustion of organic compounds, volcanic eruptions and the process of photosynthesis …



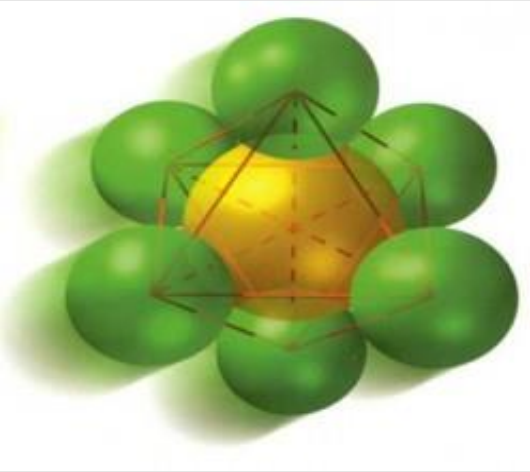
Starting in 1750. human activities have significantly increased the concentration of CO_2 in the atmosphere. It has been measured that the atmospheric concentration of CO_2 is 100 ppm higher than in the pre-industrial period.Carbon dioxide is the main greenhouse gas responsible for more than half the warming of the globe.

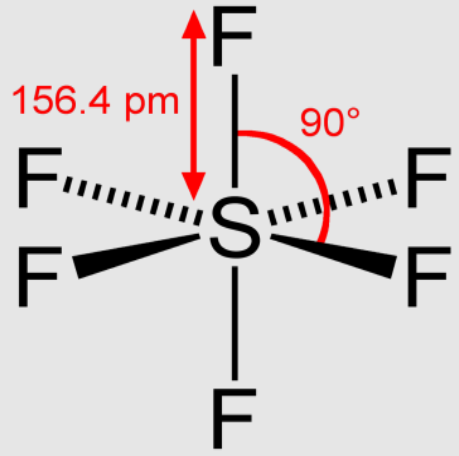
- Nitrous oxide (N2O) creates a 300 times greater greenhouse effect than CO2. It is mainly created by microbial change of nitrogen contained in the soil natural process of denitrification, exhaust gases, etc.



The average N_2O concentration in the troposphere is about 300 ppb and has a residence time of 10 years.

•Sulfur hexafluoride (SF6) is very inert (lazy) gas, 5 times heavier than air and does not come out of the container in which it is placed. Lightweight objects in this gas can float as if placed in water. It is used in high voltage equipment in heavy industry, gas for filling windows for sound protection and car tires.





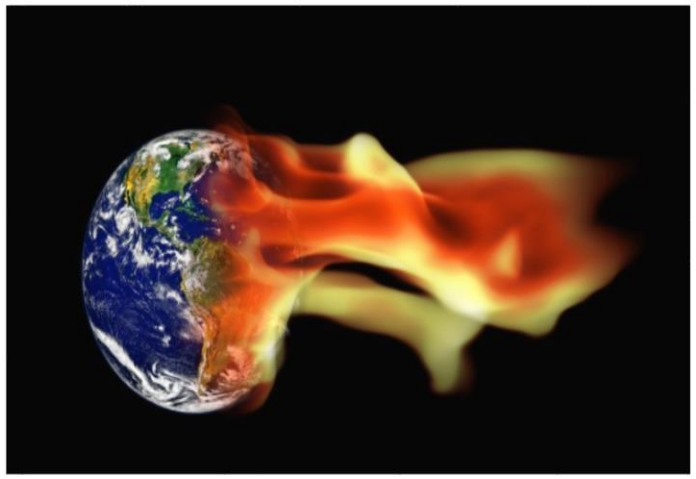
SF6 is the greenhouse gas with the highest potential. One ton of SF6 burdens the atmosphere to the size of about 23,900 tons of CO2.

The consequences of global warming are as follows:

- temperature rise to 1.5-4.5. 0C at 100-150 years
- melting ice on the polar parts of the planet Earth
- sea level rise (melting ice causes sea levels to rise and flood some islands and coasts)
- weather disasters: increased number of droughts and fires, increased clouds, floods, hurricanes ...
- impact on human health: deadly heat waves, air pollution, allergies and asthma
- extinction of animal species

What is the challenge of human? What should we do?

For the first time in Earth's history, humans may have a decisive role to play in the future of the country's survival and climate change. EVERYONE of us has an equal responsibility to protect the pollution in our immediate area.



Homework for students

The students should write the chemical reactions of the greenhouse gases and each student can research information for one of greenhouse gases.

Suggested links for students:

- www.warmheartworldwide.org/climate/change
- https://www.scienealert.com
- https://www.youtube.com/watch?v=oJAbATJCugs
- https://www.youtube.com/watch?v=sTvqIijqvTg

Subject 7 : Scientific or realistic_that is the question

By Cate Lallemand, Reunion Island

Activity 1 : Let's discover different types of energy field

Watch the extract from Star Wars : A New Hope and answer these questions.

•1-Luke's father did not fight in the war. What did he do ? What was he ?
•2-Did Obiwan fight in the war ?
•3-What was he once ? (once : avant)
•4-How did Obiwan qualify Luke's father ? Fill in the blanks.
•' He was the best …… in the galaxy and
•a …… …….. and he was a ……..
•5- What did Luke's father want him to have when he would be old enough ?
•6- How did Obiwan qualify it ? Fill in the blanks.
•'An elegant …… for a more …… age.'
•7- Who killed Luke's father ? Make a sentence.
•8- Define 'The Force'. What is it ? Fill in the blanks.
•'It's an e…….. f……. created by all l…….. t……
•It s……ds us and p……..tes us.
•It b……ds the galaxy together.'

Activity 2 : Discover an electrical field

- Describe the picture and give as many details as you can. How is that possible ? What tool are they using ?

What is an electric field ?

What is making electricity conducive ?

Activity 3 : Read this text :

James Clerk Maxwell (13 June 1831 – 5 November 1879) was a Scottish scientist in the field of mathematical physics.[4] His most notable achievement was to formulate the classical theory of electromagnetic radiation, bringing together for the first time electricity, magnetism, and light as different manifestations of the same phenomenon. Maxwell's equations for electromagnetism have been called the "second great unification in physics"[5] after the first one realised by Isaac Newton.

With the publication of "A Dynamical Theory of the Electromagnetic Field" in 1865, Maxwell demonstrated that electric and magnetic fields travel through space as waves moving at the speed of light. Maxwell proposed that light is an undulation in the same medium that is the cause of electric and magnetic phenomena.[6] The unification of light and electrical phenomena led to the prediction of the existence of radio waves.

Answer the questions about Clerk Maxwell

1. Who was James Clerk Maxwell ?
2. What did he formulate about electricity and magnetism ? Explain. (2/3 lines)
3. How did they call his equation for electromagnetism ?
4. What did Maxwell demonstrate in his book "A Dynamical Theory of the Electromagnetic Field" in 1865 ?
5. What was the prediction afterwards (après cela)?

Final Test : Describe this scientific phenomenom. Is it realistic ? Use what we learnt to clarify your viewpoint.

Subject 8 : PE_Orientation races at school

By Christine Boyer-Payet, Reunion Island

The orientation race is a collective race, against the clock, on known or unknown ground, marked by beacons which the students must discover in a compulsory order or not by the route of their choice, using a map and possibly sometimes a compass.

- **What is the interest for the students?**

It is a fun activity allowing the students to show both their physical abilities, their ability to find directions on a map, and his ability to count quickly in mathematics.

Activity : an orientation race during a PE and sports cycle.

- In groups of three, perform 4 courses of 4 tags. Two races following a star-sharped direction (fetch a beacon, then return to the starting table, and so on), and two courses in Global Butterfly (fetch 4 beacons at once and return to the starting table), these 2 last courses will be timed.
- Students have an hour and fifteen minutes maximum to complete these 4 different races. A time limit will therefore be written on their answer sheet, as well as the starting and finishing hour for the timed races.

Use of Mathematics in Physical and Sports Education

- Half an hour before the end of the lesson, the students make teams and calculate their marks themselves. The answer sheet includes 1 point for a correct tag. There will therefore be a maximum of 16 correct tags. Students should use proportionality to calculate this grade out of 20.
- Regarding the timed races, the teacher writes the starting hour and the arrival hour of the team on the answer sheet. Students must calculate by subtraction the time taken to travel the 4 tags, and this, on 2 routes.

Control sheet for students

Name	Course A				
	Course B				
departure time	Course C				
arriving time	Course D				
Total Time			correct answers		

Schedule for the timed races

between 2 min and 2 min 30	**10 points**	**between 3 min 46 and 4 min**	**5 points**
between 2 min 31 and 2 min 45	9 points	between 4 min 01 and 4 min 30	4 points
between 2 min 46 and 3 min	8 points	between 4 min 31 and 4 min 45	3 points
between 3 min 01 and 3 min 30	7 points	between 4 min 45 and 5 min	2 points
between 3 min 31 and 3 min 45	6 points	Beyond 5 minutes	1 point

9- Ressources and weblinks for students.

1.http://www.matematyka.wroc.pl/doniesienia/o-podziale-nut

2.https://pl.wikipedia.org/wiki/Nuta

3.http://www.daktik.rubikon.net.pl/akustyka/spis_akustyka.htm

4.http://pl.wikipedia.org/wiki/Szereg_harmoniczny_(muzyka)

5.https://towarzystwo.edu.pl/assets/prace_matematyczne/zglinski2011.pdf

6.Sz. Jeleński, Śladami Pitagorasa, WSiP Warszawa 1988

7. https://www.jumo.se/sv_SE/industry/food/applications/dairy/milk-processing/cheese-production-process.html

8.https://www.google.com/search?q=Cocoa+and+chocolate+production&rlz=1C1GCEV_enSE862SE862&source=lnms&tbm=isch&sa=X&ved=2ahUKEwi4vYiJjdzoAhV8y8QBHTU5BRkQ_AUoAXoECAwQAw&biw=1366&bih=657

9.https://www.google.com/search?q=fermentation+reaction+in+wine+production&rlz=1C1GCEV_enSE862SE862&source=lnms&tbm=isch&sa=X&ved=2ahUKEwjb7LPWjdzoAhVfwcQBHe1EC7UQ_AUoAXoECA0QAw&biw=1366&bih=657 http://www.biologydiscussion.com/dna/dna-structure-function-packaging-and-properties-with-diagram/16966

10.http://www.sun.ac.za/english/faculty/science/CAF/units/dna-equipment

11.https://www.youtube.com/watch?v=cNwWjC1TNJw

12.https://www.youtube.com/watch?v=QLteLZNXmyI

13.https://www.youtube.com/watch?v=G4H1N_yXBiA

14.www.warmheartworldwide.org/climate/change

15.https://www.scienealert.com

16.https://www.youtube.com/watch?v=oJAbATJCugs

17.https://www.youtube.com/watch?v=sTvqIijqvTg