

FOSSIL FUELS AND THEIR IMPACT ON THE ENVIRONMENT



Is the air we breathe healthy enough?

Authorship

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Generació Plurilingüe

Second Year
2018-2019

Fossil fuels and their impact on the environment

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Year 2
2018-2019

Identification of the GEP project

Title	Fossil fuels and their impact on the environment.
Authorship	Montse Bascuñana, Ester Gasset, Sonia Sierra
School	INS Maria Rúbies
Students' CEFR Level (A1, A2...)	A2
Grade	3 rd ESO
Content area(s)	Technology, English
Number of sessions (4, 6 or 9)	10
Teacher(s) involved	3
Key words	Fuels, pollutants, acid rain, greenhouse effect, environment

Template adapted from CLIL-SI 2015.

More information at: <http://grupsderecerca.uab.cat/clisi/>



1. OUR PROJECT

Introduction:

The topic of our project is part of the curriculum of Technology in 3rd ESO. It is included in the unit *Combustion engines*. It is also cross-curricular since environmental issues comprehend Science as well as Humanity.

Driving question:

Is the air we breathe healthy enough?

Final product: Publicise and raise awareness about the problems of fossil fuels and the benefits of alternatives, using different supports (posters to be hung in the car park of the school, article for a newspaper, a video advertising spot in the school web)



2. GOALS	2. HOW DO YOU KNOW STUDENTS ARE MAKING PROGRESS? <small>(assessment criteria)</small>
1. Describe types of fuel used in combustion engines and discuss the consequences of their use.	1.1. Students can give a scientific explanation of the problems caused by fossil fuel.
2. Formulate hypotheses regarding the processes and the effects of fossil fuel on the environment.	2.1. Students can use data, hypotheses and experimental tests to reinforce the scientific explanation of the problems caused by fossil fuel.
3.- Compare sources of power for vehicles and estimate how dangerous they are for the environment.	3.1. Students can distinguish, compare and evaluate types of fuel according to their impact on the environment.



<p>4. Justify alternative technologies to replace combustion engines and advise on the advantages of environmentally-friendly engines and technology.</p>	<p>4.1. Students can propose alternatives that avoid or minimize the impact of fuel on the environment.</p>
<p>5. Create a presentation with the results of the investigation process using the basic functions of word-processor, spreadsheet and multimedia presentation tools.</p>	<p>5.1. Students can present findings in a multimedia format.</p>

3. CURRICULUM CONNECTIONS SPECIFIC COMPETENCES AND KEY CONTENTS

Subject-matter curriculum		Foreign language curriculum	
Specific Competences	Key Contents	Specific Competences	Key Contents
<p>C1. Identificar i caracteritzar els sistemes físics i químics desde la perspectiva dels models, per comunicar i predir el comportament dels fenòmens naturals.</p>	<p>CC2.Model d'energia CC7.Model de canvi químic. CC27.Impactes mediambientals de l'activitat humana. Recursos naturals: renovables i no renovables.</p>	<p>C1. Obtenir informació i interpretar textos orals de la vida quotidiana, dels mitjans de comunicació i de l'àmbit acadèmic.</p>	<ul style="list-style-type: none"> • Estratègies de producció oral. • Estratègies d'interacció oral. • Lectura en veu alta. • Pragmàtica. • Fonètica i fonologia. • Lèxic i semàntica.

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			<ul style="list-style-type: none"> • Morfologia i sintaxi. • Estratègies verbals i no verbals per superar malentesos.
C5. Resoldre problemes de la vida quotidiana aplicant el raonament científic	CC2.Model d'energia CC7.Model de canvi químic.	C2. Planificar i produir textos orals de tipologia diversa adequats a la situació comunicativa	<ul style="list-style-type: none"> • Estratègies de producció oral. • Estratègies d'interacció oral. • Lectura en veu alta. • Pragmàtica. • Fonètica i fonologia. • Lèxic i semàntica. • Morfologia i sintaxi. • Estratègies verbals i no verbals per superar malentesos.
C7. Utilitzar objectes tecnològics de la vida quotidiana amb el coneixement bàsic del seu funcionament, manteniment i accions a fer per minimitzar els riscos en la manipulació i en l'impacte mediambiental	CC17. Objectes tecnològics de la vida quotidiana. CC19.Manteniment tecnològic. Seguretat, eficiència i sostenibilitat CCD27. Sostenibilitat: consum d'energia, despesa d'impressió, mesures d'estalvi, substitució de dispositius, etc.	C4. Aplicar estratègies de comprensió per obtenir informació i interpretar el contingut de textos escrits d'estructura clara de la vida quotidiana, dels mitjans de comunicació i de l'àmbit acadèmic	<ul style="list-style-type: none"> • Comprensió escrita: global, literal, interpretativa i valorativa. • Estratègies de comprensió escrita. • Pragmàtica. • Lèxic i semàntica.
C11. Adoptar mesures amb	CC17. Objectes tecnològics de	C8. Competència 8. Produir	• Adequació, coherència i

<p>critèris científics que evitin o minimitzin els impactes mediambientals derivats de la intervenció humana</p>	<p>la vida quotidiana. CC19.Manteniment tecnològic. Seguretat, eficiència i sostenibilitat CC27.Impactes mediambientals de l'activitat humana. Recursos naturals: renovables i no renovables. CCD27. Sostenibilitat: consum d'energia, despesa d'impressió, mesures d'estalvi, substitució de dispositius, etc.</p>	<p>textos escrits de diferents tipologies i formats aplicant estratègies de textualització</p>	<p>cohesió.</p> <ul style="list-style-type: none"> • Estratègies d'interacció escrita. • Producció creativa. • Ús de diccionaris. • Pragmàtica. • Lèxic i semàntica. • Morfologia i sintaxi.
<p>C Digitals. Utilitzar les funcions bàsiques de les aplicacions d'edició de textos, tractament de dades numèriques i presentacions multimèdia. Construir nou coneixement personal mitjançant estratègies de tractament de la informació amb el suport d'aplicacions digitals Realitzar comunicacions interpersonals virtuals i publicacions digitals Realitzar activitats en grup</p>			



utilitzant eines i entorns virtuals de treball col·laboratiu			
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4. 21st CENTURY COMPETENCES

Collaboration	X	Information, media and technology	X
Communication	X	Leadership & Responsibility	X
Critical Thinking and Problem Solving	X	Initiative & Self-direction	X
Others:			

5. KEY COMPETENCES

Communicative, linguistic and audiovisual competence	x	Digital competence	x
Mathematical competence	x	Social and civic competence	x
Interaction with the physical world competence	x	Learning to learn competence	x



Cultural & artistic competence	x	Personal initiative and entrepreneurship competence	x
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6. CONTENT (Knowledge and Skills)

CONTENT-RELATED KNOWLEDGE	CONTENT-RELATED SKILLS
<ul style="list-style-type: none"> - Fossil fuel: origin, extraction and processing/refining. - Types and effects of fossil fuel in motor vehicles. 	<ul style="list-style-type: none"> - Analyzing and describing the consequences of the use of fossil fuel in motor vehicles (acid rain, greenhouse effect and other effects). -Comparing sources of power for vehicles -Defining alternatives to the use of fossil fuel in vehicles. -Communicating ideas using word-processor, spreadsheets and multimedia presentation tools.

and

8. COMMENTS (optional)








9. ACKNOWLEDGEMENTS (optional)

Skills: R: reading , S:speaking, L: listening, W: writing, I: Interaction

Interaction: T-S: teacher-student, S-S: student-student, SG: small groups, WG: whole group, S-Expert, S-World

Assessment: PA: Peer assessment, SA: Self-assessment, TA: Teacher assessment, AT: Assessment tools

10. UNIT OVERVIEW

Session	Activities	Timing	Skills	Interaction	ICT	Assessment
						
1	Grouping	10 min.	I	WG		

Template adapted from CLIL-SI 2015.

More information at: <http://grupsderecerca.uab.cat/clisi/>



	What's going wrong in Pol's village? (Scenario presentation)	50 min.	R, S, I	SG		
2	Initial Assessment (KWL chart)	15 min.	W	T-S		SA
	Topic and Vocabulary presentation (jigsaw reading)	20 min.	R, I	SG		
	Topic And Vocabulary presentation (Table)	25 min.	W, I,S	SG		
3	Acid rain (Video comprehension)	25 min.	L, W,R	S-S		
	Acid rain (Acid rain cycle)	35 min.	W, S, R	S-S		
4	Greenhouse Effect (video)	15 min.	L, W	WG		
	Greenhouse Effect (reading)	20 min.	R	S-S, SG		
	Greenhouse Effect (Infographic)	10 min.	R	S-S, SG		
	Activities revision	15 min.	L, I	T-S, WG		
5	Warm up	5 min.	S	WG		
	Other pollutants (reading, matching)	20 min.	R, S	SG, WG		
	What fuel is more pollutant? (reading Bar Charts)	30 min.	R, W	S-S		
6	Formative Assessment (Mind Map)	60 min.	I, S	SG		PA

7	What is air quality like today?	30 min.	R, S, I	SG	X	
	Alternatives	30 min.	R, W	SG		
8	Final Product (work in class)					
9	Final Product (presentation)					
	Final Assessment (rubric)					
10	Teacher's Final Assessment (Plickers)					TA
	Final Self-assessment (KWL Chart)	15 min.	W	T-S		SA

11. SESSION PLANNING






SESSION 1: What's going wrong in Pol's village? (Scenario)

Objectives of the session:






Generate students' interest in a realistic situation

Encourage students to formulate a hypothesis which will lead to research.

Introduce the driving question,

	Content-obligatory language for the session:					
	Activities					
1.1	Grouping: The 5 strongest students (leaders) will form groups by choosing the other members	10	I	WG		
1.2	<p>Scenario: What is going wrong in Pol's village?.</p> <p>Through a realistic situation, presented in a spreadsheet document, students will carry out an investigation and formulate an hypothesis about what is happening in the village.</p> <p>They are provided with:</p> <ul style="list-style-type: none"> • Interviews. One for each member of the group. They can meet with students in other groups who work with the same interview (expert groups) to decide what information is useful and later explain to the group and share. • A list of Hints for the investigation to reinforce the interviews that the group will classify into useful, irrelevant and "we don't know" in a Venn diagram. • A simple map of the area. • A document to fill in with the results that brings them to formulate a hypothesis. <p>The hypothesis should conclude that all the problems in the village are due to the pollutants from the highway. This is the moment to introduce the driving question; "Is the air we breathe healthy enough?"to invite the student to work deeply on the topic.</p>	50 min.	R, S, I	SG, S-Expert		



SESSION 2: General concepts						
Objectives of the session: Understand the starting point of the project Discover the concepts of fossil fuels, acid rain and the greenhouse effect						
Content-obligatory language for the session: Fossil Fuels, Acid Rain, Greenhouse effect, coal, oil, gas, nitric acid, sulphuric acid, global warming						
Activities						
1.1	Initial Assessment (KWL chart) Students fill in the chart with what they K now about the contents of the project and with what they W ould like to know	15	W	T-S		SA
1.2	Topic and Vocabulary presentation (jigsaw reading) Students in groups put in order the strips of an introductory text of the concepts: fossil fuels, acid rain and greenhouse effect	20	R,I	SG		
1.3	Topic And Vocabulary presentation (Table) Students in groups fill in the table collaboratively with the information they remember from the text	25	W,I, S	SG		

SESSION 3: Acid Rain

Objectives of the session: Discover the phenomenon of acid rain and its effects

Content-obligatory language for the session: Acid rain, runoff water, precipitation, sulphur dioxide, vehicle exhaust fumes, factory emissions, pollutant oxides, water vapour

Activities:



1.1 Acid rain ([Video comprehension](#))
 Students previously attempt to answer a matching exercise with terms and their concepts which will be corrected after watching the video.
 After having watched the video, students deduce the formulas of sulphuric acid and nitric acid

25

L,W,
R

S-S






1.2 Acid rain ([Acid rain cycle](#))
 Students number the different steps in the acid rain cycle. When finished they get the teacher's feedback.

35

W,S
,R

S-S

SESSION 4: Greenhouse Effect

	Objectives of the session: Learn about the Greenhouse: what it is and its effects					
	Content-obligatory language for the session:					
	Activities					
1.1	Greenhouse Effect (video) First the teacher elicits some previous knowledge from the students on what a glass greenhouse is. Students watch a video to introduce the topic of the greenhouse and they answer the questions provided. It is revised with the whole group	15 min.	L, W	WG		
1.2	Greenhouse Effect (reading) Students read a text on the greenhouse and its effects. First they do it individually. Then they compare their answers with that of a classmate. And finally they reach an agreement with the other members of the group	20 min.	R	S-S, SG		
1.3	Greenhouse Effect (Infographic) The teacher shows the Infographic on the screen, so they all can check that their information corresponds to the one provided	10 min.	R	S-S, SG		
1.4	Activities revision	15 min.	L, I	T-S, WG		

	General comment/ sum up on the concept, how it works. Language revision to clarify key concepts are fully understood.					
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<p>SESSION 5: Other pollutants What fuel is more pollutant?</p> <p>Objectives of the session: Other pollutants: What fuel is more pollutant? : comprehension of information in charts.</p>						
Content-obligatory language for the session:						
Activities						
1.1	Warm up Comment on the different concepts they've been working so far	5 min.	S	WG		



1.2	<p>Other pollutants (reading, matching)</p> <p>This activity consists of two parts. In the first one, students are going to read information on other pollutants, once they learnt about Greenhouse Effect and Acid Rain in the previous lesson. Next, they are provided with a car flashcard, three clouds and a set of concepts. In the group, and according to what they have read, they have to stick the concepts/phrases in the clouds: name of the pollutant, effects and how it works. Then they present theirs to the rest of the group. Since some of the effects are quite similar between two of the pollutants (particulate matter and ozone) the idea is they agree to accept different organisation of the phrases. The role of the teacher is to monitor and help them to reach the final version. These CARS posters are going to be hung on the classroom's walls.</p>	20 min.	R, S	SG, WG		
1.3	<p>What fuel is more pollutant? (Reading Bar Charts)</p> <p>Students in group will read a text explaining four bar charts. They have to decide what chart represents each type of pollutant and what bar corresponds to each type of car (petrol, diesel and gas).</p> <p>At the end they agree an answer to the question.</p> <p>Answers are expected to be that all types fossil fuels cause pollution, although in different forms.</p>			S-G		

SESSION 6: Mind Map








	Objectives of the session: Raise student's self-awareness of the progress achieved about the project					
	Content-obligatory language for the session: Greenhouse effect, Acid Rain, Global Warming, Pollutants, Deforestation, Breath Diseases, Fossil Fuels, Diesel, Petrol, Gas, CO, CO ₂ , HNO ₃ , PM _{2,5} , SO ₂ , NO ₂ , HSO ₃ ,					
	Activities					
1.1	Formative Assessment (Mind Map) Students in groups will create a DIN-A3 mind map about the content of the project. They can use the terms from the cards given and optionally add other key words on the blank cards. Every group will present their mind map to the whole class.	60	I,S	S-G		PA

SESSION 7: What is air quality like today & Alternatives

Objectives of the session:

What is air quality today: Research information on the internet about air quality at real-time, and evaluate the impact on environment and health.

	Content-obligatory language for the session: Fossil fuel, alternative fuels, catalytic, ban, policy, law					
	Activities					
1.1	Students visit the website https://waqi.info/ that provides information about air quality at real-time. Students do this activity looking for information required from different cities, fill in a table with data and write advice for people living there.	15 min.				
1.2	Students are given a list of different web pages where they are going to be able to get general ideas on laws, car companies about alternatives on fossil fuel. The activity consists in completing a chart with information on action taken by the car companies, and laws/ recommendations by governments.	25 min.	I, S, R	SG		
1.3	Students complete the last part of the chart with information on what they could do. It is going to be a previous activity to start working on their final project	20 min.	I	SG		






SESSION 8: Final product

Objectives of the session:

Template adapted from CLIL-SI 2015.

More information at: <http://grupsderecerca.uab.cat/clilsi/>








	Content-obligatory language for the session:					
	Activities					
1.1	<p>Students design, publicise and raise awareness about the problems of fossil fuels and the benefits of alternatives, using different supports</p> <ul style="list-style-type: none"> <input type="checkbox"/> posters to be hung in the car park of the school <input type="checkbox"/> an article for a newspaper <input type="checkbox"/> a video advertising spot in the school web. <p>(each group choose a different support)</p> <p>Guide for the FP</p>	60	I	S-S	X	

SESSION 9: Final product (Presentation and assessment)

Objectives of the session:






Content-obligatory language for the session:

	Activities					
1.1	Students present the final product to the class and publicise it in the different media. The activity will be evaluated with a rubric .	60	w, l	SG	X	AT

SESSION 10: Final Assessment

Objectives of the session:

Content-obligatory language for the session:

	Activities					
1.1	Teacher's Final Assessment (Plickers). Questions for the plickers can be found in this document (in construction)					
1.2	Final Self-assessment (KWL Chart)					

	<p>Students fill in the KWL chart with what they have Learned about the contents of the project and compare it with what they wrote in the first session (What they Know and what they Would like to know)</p> <p>Can we answer the driving question?</p>					
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Template adapted from CLIL-SI 2015.

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**What's going wrong in Pol's
village?**



Pol is a 15 years old boy who lives in a little village at the foot of the Pyrenees.



Pol's father works as a teacher in the school and his mother is a doctor.



**Pol's grandparents also
live in the village.**





The village is near the mountains and is surrounded by fields and forests.

There are also two lakes in the nearby area.



The village is well known because of an important highway built some years ago.

It is a very important highway because it connects Spain and France.

Thousands of cars pass through it every day.



A toll near the village causes problems with traffic jams very often.

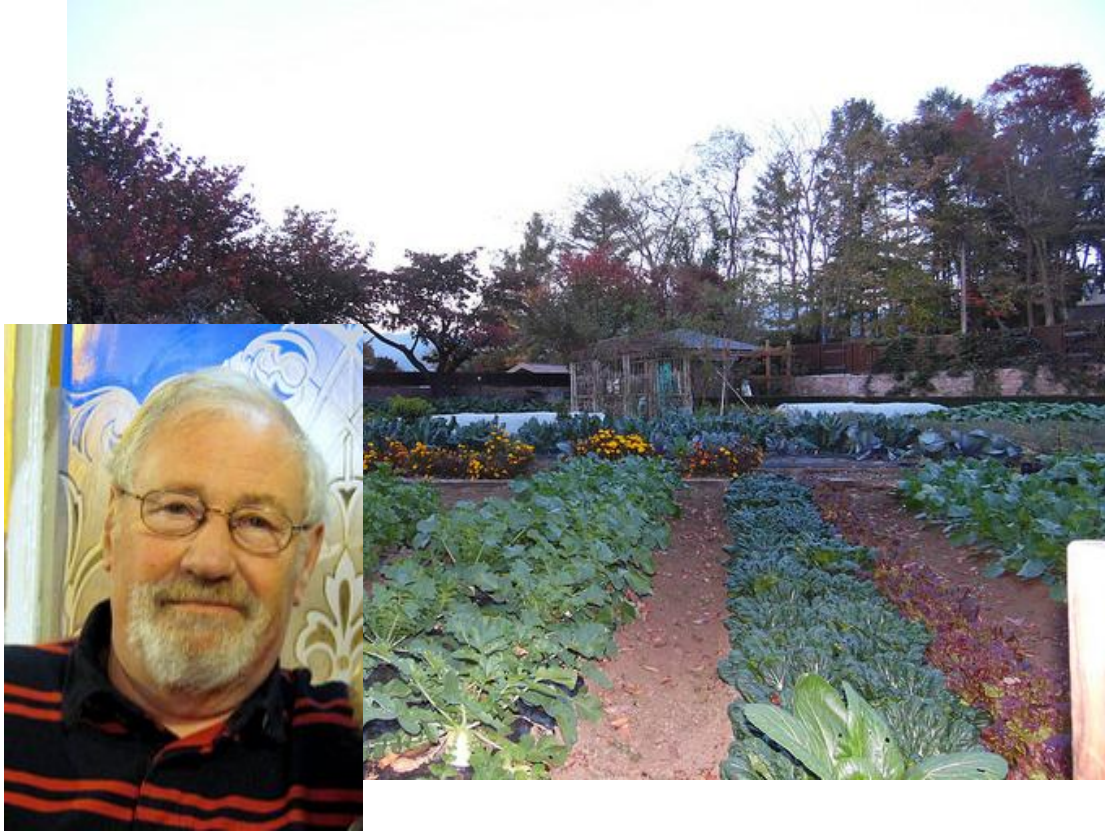
Pol's grandmother is an engineer who worked in the construction of the highway.

Now she is retired and loves spending time fishing at lakes.





She also likes trekking with her daughter (Pol's mother) in the forests near the village.



What Pol's grandfather likes most is taking care of the orchard that he inherited from his father.

Pol is sad because some days, during the school break, staying outside in the schoolyard is not allowed.



His father told him that it is because recently some students have been suffering from conjunctivitis, specially on foggy days.



Pol has decided to find out what's going wrong in the village and why there are so many people falling ill.



He's decided to start by interviewing his family...





WOULD YOU LIKE TO HELP HIM?

YOU ARE PROVIDED WITH:

- THE INTERVIEWS.
- A SIMPLE MAP OF THE AREA.
- SOME HINTS THAT POL TOOK DURING THE INVESTIGATION.

YOU HAVE TO ANSWER THIS QUESTION:

WHAT'S GOING WRONG IN POL'S VILLAGE?



Interview to the grandfather:

What do you like to do now that you are retired?

I like taking care of my orchard. In fact I spend most of my time there, growing vegetables.

How long have you had this orchard?

It has belonged to our family for years. My father used to farm it. He used to grow all types of vegetables: cabbages, tomatoes, potatoes, etc. Now I take care of it.

What types of vegetables do you plant?

I used to plant all types of vegetables to make salad, like tomatoes, onions, lettuce. But for some time now, onions and lettuce haven't grown anymore. I can only grow tomatoes.

So, you have to buy tomatoes and onions from the supermarket, haven't you?

Actually, I buy them from my friend Tommy, who has an orchard on the other end of the village.

What do you like to do in your freetime?

I like cars, so I usually go for a walk alongside to the highway and look at them. Only from time to time I can see an electric car.

Thanks, granddad.



Interview to the grandmother:

Hi, grandma!

You are an engineer. How was your job?

I used to work in the construction and maintenance of roads in the area. I liked my job.

What is the most important project you have worked in?

The most important project I worked in was the building of the new highway. It was a very important way to connect Spain and France. As you know, thousands of cars pass through it every day.

I can remember the day when the Prime Minister came to inaugurate the highway. It was in the year 2010.

What do you like to do now you don't have to work anymore?

I love fishing in the Old Lake.

What kind of fishes are in the lake?

Mainly northern pikes. I remember that years ago there were also trouts, but for some years now, there are no trouts, only pikes..

If you want to catch trouts, you have to go to the Pretty Lake, at the other side of the highway.

Thanks for your help, grandma. That's all!



Interview to Pol's mother:

You work as a doctor in the village. Which are the most common illnesses?

The most common are colds and flu in winter and insect bites in summer . But recently asthma and respiratory diseases have increased. Many people in the town have difficulties to breathe .

What do you like to do in your freetime?

I love trekking. There are some forests near the town and I like walking there.

What part of the forest do you like the most?

There is a forest in the South of the village where I used to go at the weekends, when you were a little child, do you remember?

Now I prefer going to that in the West, although it is further away from the town.

Pines in the south are becoming ill. Many of them have lost their leaves and stopped growing.

Do you like living here?

Yes, I like this town, despite this disgusting wind.



Interview to Pol's father:

Daddy, you have been teacher in the school since...

1993

Many days we can't stay outside the school during the break. Why is it not allowed?

We've realized that some of the students, after the breaks, went back to the class with eye redness. We had a meeting with parents and decided not to stay outside.

What does it depend on?

It depends on the weather. On foggy days it is more common. We also realized that it is also favoured on windy days.

Has it been happening for a long time?

It has been going on since 2010, but last years it increased. Before then, no one had suffered of conjunctivitis in the school

Thanks, dad for your information!

HINTS FOR THE INVESTIGATION

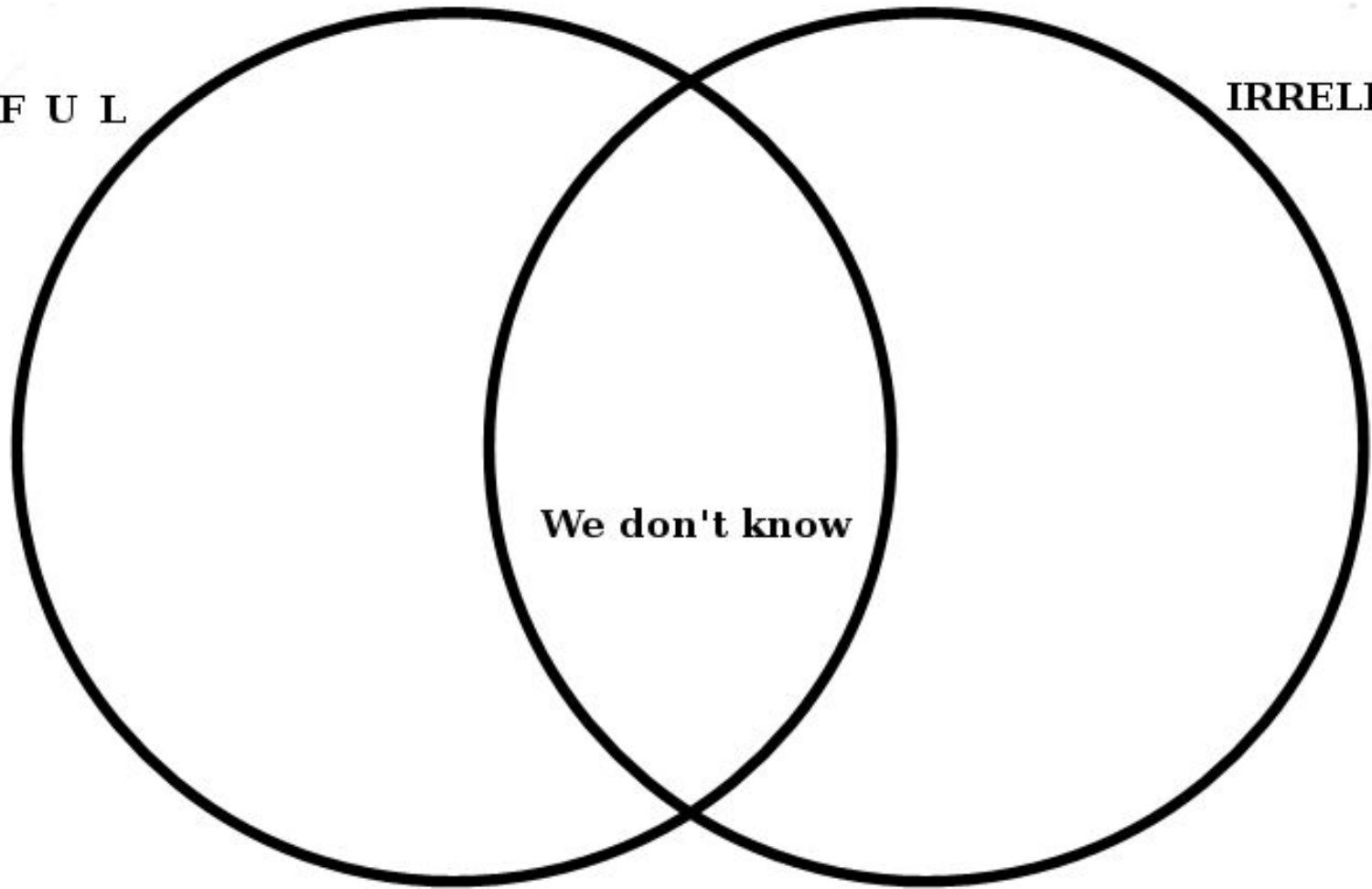
1. The village is located in the foot of the Pyrenees.	2. The area is known for the wind that often blows in south-east direction.
3. Pol's mother is the doctor of the village since 1992.	4. The Prime Minister came to the village the 17th January 2010 to inaugurate the new highway.
5. Only 1% of the cars driving in the highway are electric. The rest, use burning fuels.	6. Pol's grandmother likes fishing. In the past, she used to fish trouts. But now she fishes northern pikes (<i>Esox lucius</i>).
7. Many times there are traffic jams in the highway because of the toll near the village.	8. Grandmother is an engineer who worked in the construction of the highway.
9. In the forest the main trees are pines.	10. Pol's father is a teacher. He works in the schools since 1993.
11. For 2011 to now respiratory diseases have been increased.	12. Trouts can only live in water of pH7.
13. Pol's grandfather buys the lettuces to his friend Tommy since 2011.	14. The pines in the south of the forest have been ill since 2012. They have lost most of their needles.

<p>15. Onions from the grandparents field were the best in the village, but in 2012 he decided not to plant onions anymore.</p>	<p>16. Pol father likes eating salads.</p>
<p>17. Since 2011, children don't play outside the school because of the conjunctivitis.</p>	<p>18. Northern pikes can live in waters with a pH number of 4.5.</p>
<p>19. Ideally, soil for onions should have a pH level of 5.5 to 6.5, according to the National Gardening Association.</p>	<p>20. When certain fossil fuels are burnt in cars, gases like sulfur dioxide and carbon dioxide are produced.</p>
<p>21. In the town, there is a very nice sports center. It was build in 2017.</p>	<p>22. In an experiment, samples of onions plants were placed in appropriate cups with samples of water. After a month, growth of onions in water under pH 6.5 decreased.</p>
<p>23. The local festival is on the 15th of August</p>	

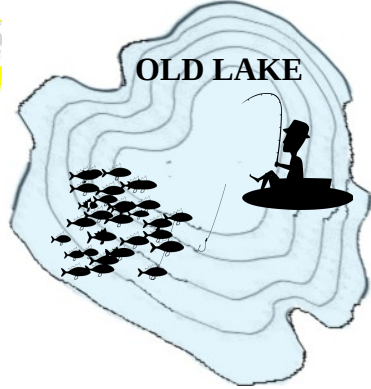
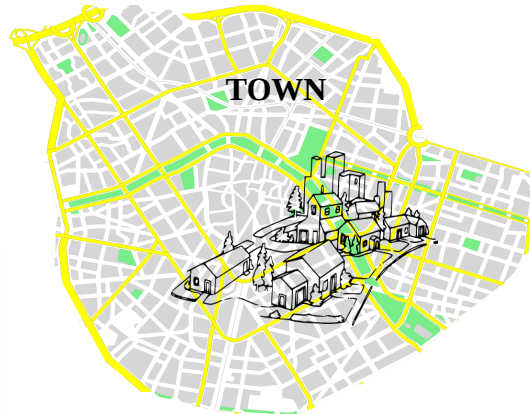
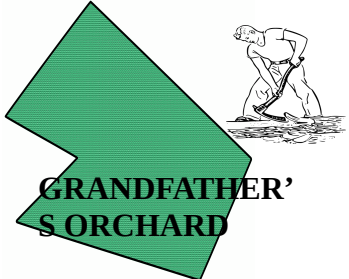
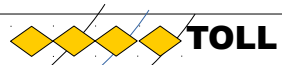
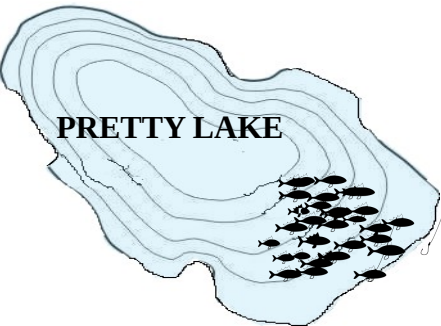
Classify the notes for the investigation into three groups: useful, irrelevant . You also have a group for those you don't know.

U S E F U L

IRRELEVANT

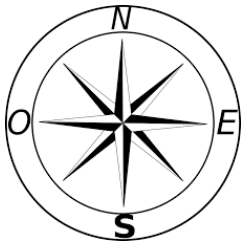


We don't know



HIGHWAY

Two parallel blue lines representing a road.



Group: _____

WHAT'S GOING WRONG IN THE VILLAGE? OUR INVESTIGATION

We want to explain why....

Some other things that state something going wrong from the interview are...

Useful information from the INTERVIEW for our investigation:

- 1.
- 2.
- 3.
- 4.

- 5.
- 6.
- 7.
- 8.

The HINTS to reinforce our investigation:

- 1.
- 2.
- 3.
- 4.

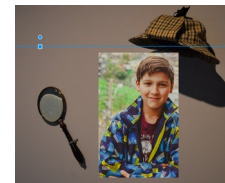
- 5.
- 6.
- 7.
- 8.

Apart from these statements, we already know that:

- 1.
- 2.

- 3.
- 4.

Our hypothesis is...



KWL Chart

Name: _____

Topic: _____

WHAT I KNOW

What do you think you already know about this topic?

WHAT I WANT TO LEARN

What do you wonder about this topic? write your questions below.

WHAT I HAVE LEARNT

After you complete this project, write what you have learnt.

FOSSIL FUELS

There are three major forms of fossil fuel: coal, oil and natural gas. All three were formed many hundreds of millions of years ago before the time of the dinosaurs - hence the name fossil fuels. The age they were formed is called the Carboniferous Period.

Coal is a fossil fuel and is the altered remains of prehistoric vegetation that originally accumulated in swamps. The energy we get from coal today comes from the energy that plants absorbed from the sun millions of years ago.

Oil was formed from the remains of animals and plants that lived millions of years ago in water.

The remains were covered by sand. Heat and pressure turned layers into what we call crude oil today.

On our planet natural gas is mainly located on rock pores that constitute the higher part of the Earth's crust and result from chemical and physical processes that have taken place during the history of the Earth.

ACID RAIN

Acid rain is the combination of vapour with pollution.

When fossil fuels are burnt, they release Sulphur Dioxide and Nitrogen Oxides, which mix with water vapour in clouds and make dilute sulphuric acid and nitric acid. This finally falls as acid rain.

The main causes of acid rain are cars and power stations.

EFFECTS OF ACID RAIN

The water from seas, lakes or rivers becomes more acidic and wildlife can be seriously damaged. It erodes stone buildings.

Also, acid rain can damage and eventually kill trees and plants by attacking soil nutrients, roots and leaves.

GREENHOUSE EFFECT

Fossil fuels contain **carbon** from plants and animals that died millions of years ago. When we burn fossil fuels, the carbon reacts with **oxygen** in the air to make **carbon dioxide**. Carbon dioxide is a **greenhouse gas** which traps **the heat** in the Earth's **atmosphere** like a blanket.

Greenhouse gases let the Sun's light in but do not let all of the heat produced by the sunlight back out. As more and more carbon dioxide goes into the atmosphere, the Earth gets warmer and warmer.

CONSEQUENCES OF THE GREENHOUSE EFFECT

Human action has increased the presence of these gases in the atmosphere causing them to retain more heat and to increase the **temperature** on the planet. This is what we know as **global warming**.

This warming is radically altering the earth's **climate system**, including its land, atmosphere, oceans, and **melting ice** in the polar regions.

Fill in the table to summarise what you have learnt from the text/s.

<i>FOSSIL FUELS</i>	<i>ACID RAIN</i>	<i>GREENHOUSE EFFECT</i>
	<i>EFFECTS OF ACID RAIN</i>	<i>CONSEQUENCES OF THE GREENHOUSE EFFECT</i>



ACID RAIN - Video - matching task

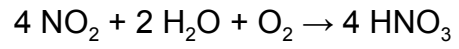
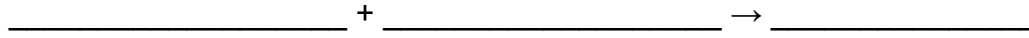
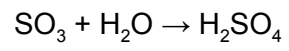
1. Before watching the video, try to match each term on the left with its corresponding concept on the right.
2. After watching, finish matching up the parts.
3. You can watch a second time to check the information.

TERM	CONCEPT
<ol style="list-style-type: none">1. Acid rain2. Forms of acid rain3. Reaction in the atmosphere4. Runoff water from acid rain5. Harm to forests6. Reduced use of fossil fuels	<ol style="list-style-type: none">A. Damage to trees' leavesB. A reduction in the pollutants that cause acid rainC. Snow, fog and dry materialsD. Precipitation with high levels of nitric acid (HNO_3) and sulphuric acid (H_2SO_4)E. Sulphur dioxide (SO_2) and nitrogen oxides (NO_x) mixing with water (H_2O) and oxygen (O_2) to form sulphuric acid (H_2SO_4) and nitric acid (HNO_3).F. Toxic habitats for aquatic animals

VIDEO: *What is Acid Rain?* | National Geographic

VIDEO LINK <https://youtu.be/1PDjVDIrFec>

Write the chemical name for each substance in these equations



ANSWERS

Acid rain ----- Precipitation with high levels of nitric acid (HNO_3) and sulphuric acid (H_2SO_4)

Forms of acid rain ----- Snow, fog and dry materials

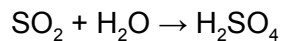
Reaction in the atmosphere ----- Sulphur dioxide (SO_2) and nitrogen oxides (NO_x) mixing with water (H_2O) and oxygen (O_2) to form sulphuric acid (H_2SO_4) and nitric acid (HNO_3).

Runoff water from acid rain ----- Toxic habitats for aquatic animals.

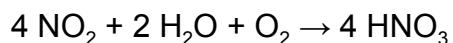
Harm to forests ----- Damage to trees' leaves

Reduced use of fossil fuels ----- A reduction in the pollutants that cause acid rain

Write the chemical name for each substance in these equations

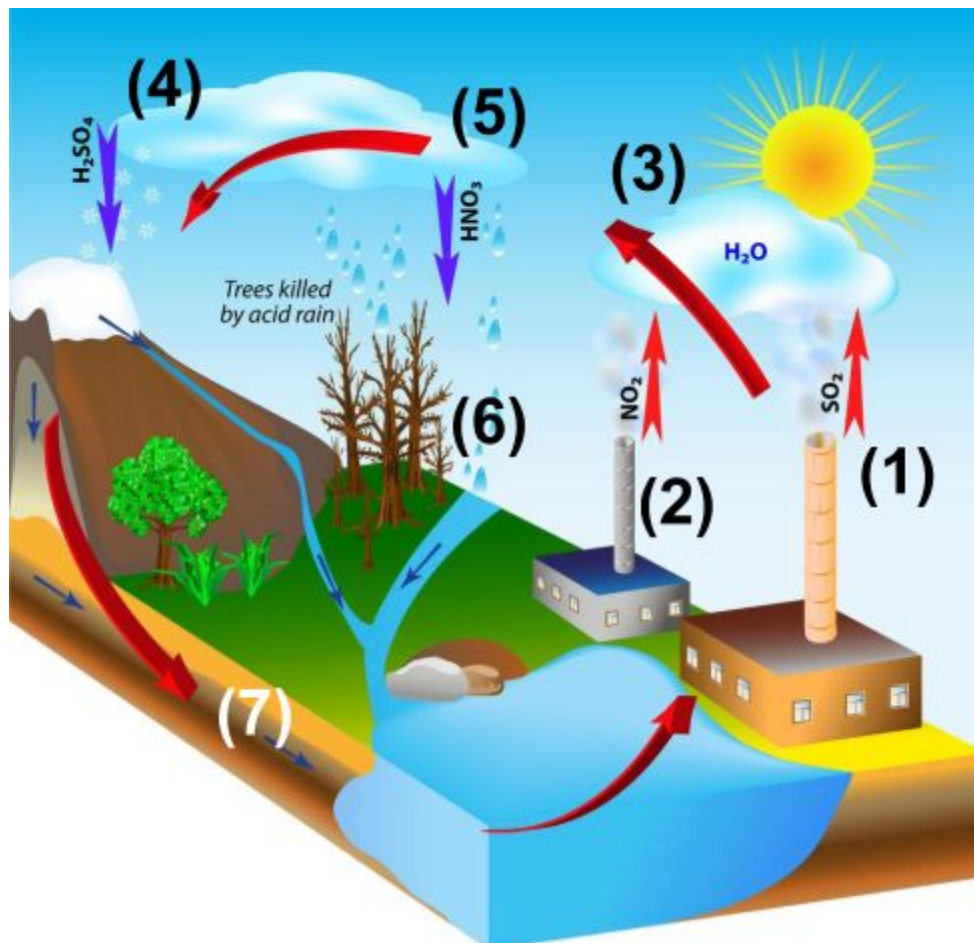


Sulphur dioxide + water \rightarrow sulphuric acid



Nitrogen dioxide + water \rightarrow nitric acid

THE ACID RAIN CYCLE



TASK. Match each of the descriptions below to each numbered stage in the acid rain cycle as shown in the above infographic.

- A. Acid rain damages the leaves on trees.
- B. Fossil fuels contain sulphur. This is burnt in a factory or power station, emitting sulphur dioxide.
- C. Precipitation containing nitric acid is the result of pollution from traffic and industry.
- D. Rain containing sulphuric acid may fall far from the source of pollution.
- E. Runoff water from acid rain pollutes rivers and lakes, harming aquatic life and the rest of the food chain
- F. The pollutant oxides mix with water vapour in the air and form acids in the clouds.
- G. Vehicle exhaust fumes and factory emissions contain oxides of nitrogen, forming a brown gas.

ANSWERS

1. B. Coal contains sulphur. This is burnt in a factory or power station, emitting sulphur dioxide.
2. G. Vehicle exhaust fumes and factory emissions contain oxides of nitrogen, forming a brown gas.
3. F. The pollutant oxides mix with water vapour in the air and form acids in the clouds.
4. D. Rain containing sulphuric acid may fall far from the source of pollution.
5. C. Precipitation containing nitric acid is the result of pollution from traffic and industry.
6. A. Acid rain damages the leaves on trees
7. E. Runoff water from acid rain pollutes rivers and lakes, harming aquatic life and the rest of the food chain.

Watch the video and answer the following questions individually.

https://www.youtube.com/watch?v=BPJJM_hCFj0

1. What is the change our planet is experimenting?
2. What are its effects?
3. How do you call these changes?
4. How does a greenhouse work?
5. What would happen if the greenhouse effect did not exist on planet Earth?
6. Humans have increased the number of particles which are in the atmosphere. Why is this dangerous to humans?
7. What is the main consequence of it?

Now let's read the text and the Infographic to check and complete the answers. Later get in small groups and comment together, before the final group revision.

THE GREENHOUSE EFFECT

The atmosphere, a thin layer of gases around the Earth, maintains the planet's temperature at a level suitable for the development of life. Every day, the Earth receives radiation basically from the sun. The radiation consists of visible light, ultraviolet (UV), infrared (IR) and other invisible lights to the human eye. Part of this radiation is reflected back out to space. The exchange of incoming and outgoing radiation that warms the Earth is often referred to as the greenhouse effect because a greenhouse works in the same way. Incoming UV radiation easily passes through the glass walls of a greenhouse and is absorbed by the plants and hard surfaces inside. Weaker IR radiation, however, has difficulty passing through the glass walls and is trapped inside which warms the greenhouse. This effect lets tropical plants live inside a greenhouse, even during a cold winter.

But everyone agrees that human action has increased the presence of these gases in the atmosphere - mainly carbon dioxide (CO₂) and methane (CH₄) -, resulting in the increase of the temperature on the planet. This is what is known as global warming.

Some greenhouse gases come from natural sources, for example, evaporation adds water vapor to the atmosphere. Animals and plants release carbon dioxide when they breathe. Methane is released naturally from decomposition. Volcanoes release greenhouse gases, so periods of high volcanic activity tend to be warmer.

Most of the CO₂ that people put into the atmosphere comes from burning fossil fuels. Cars, trucks, trains and planes all burn fossil fuels. Many electric power plants do, as well. Another way humans release CO₂ into the atmosphere is by cutting down forests. People add methane to the atmosphere through farming and fossil fuel production such as coal mining and natural gas processing.

CONSEQUENCES OF THE GREENHOUSE EFFECT

The increase in the average temperature on Earth is changing living conditions on the planet. Let's find out about the main consequences of this phenomenon:

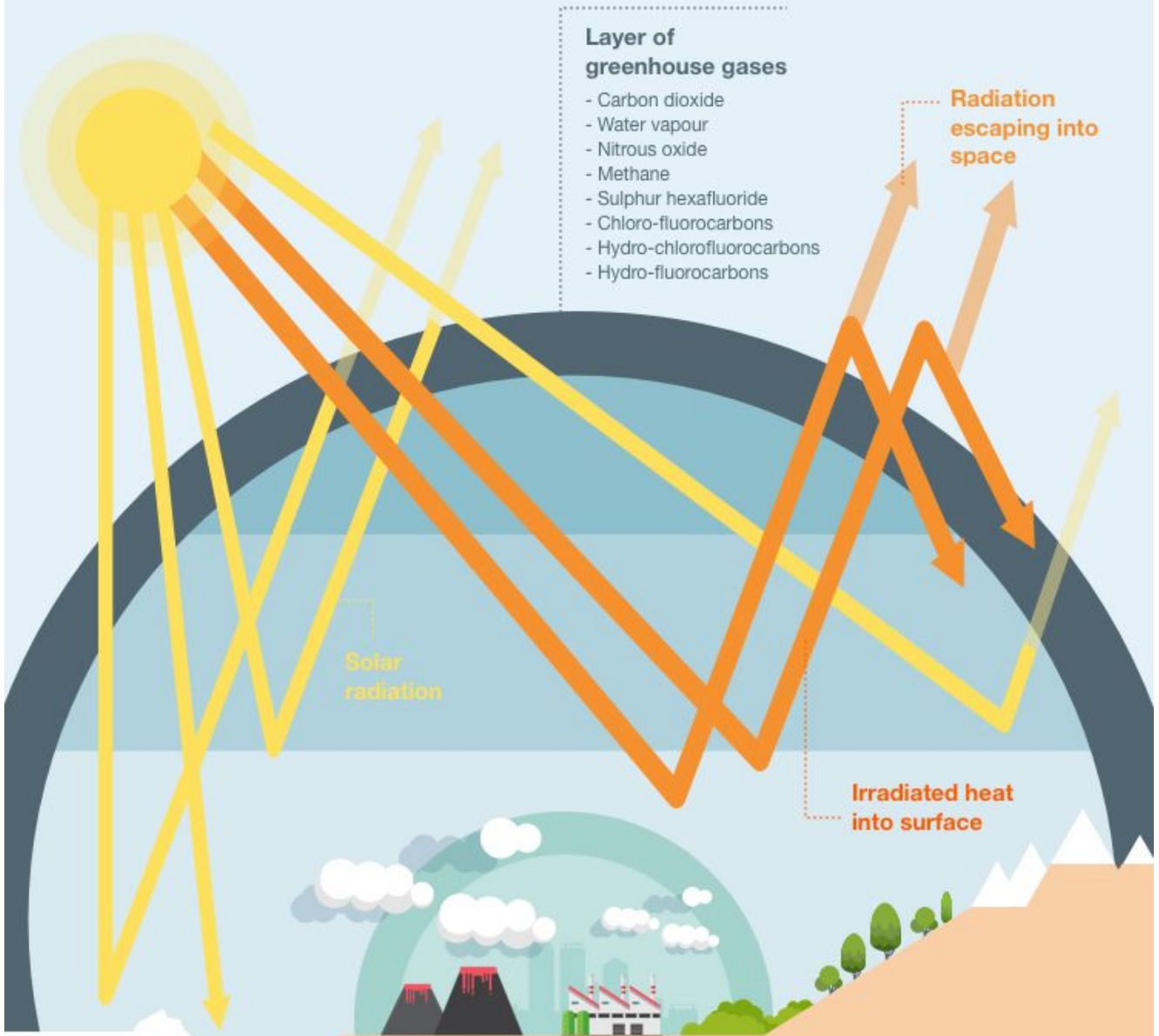
- glaciers and ice caps melt faster than usual. The meltwater drains into the oceans, causing sea levels to rise. So people living in certain areas will see how they become flooded. Some others depend on the melting of the glaciers to survive. If they disappear, they will disappear too.

→ changes in precipitation, such as rain and snow. And as a consequence some habitats will also change. This will threaten animals, plants and humans adapted to certain conditions to survive.

Greenhouse effect

Do you know how it is produced?

Numerous gases that are part of the atmosphere **absorb the Earth's infra-red radiation**, producing an **increase in the temperature** of the surface of our planet and the atmospheric layer that surrounds it.



Evolution of CO₂

CO₂ is the gas that contributes the most to the greenhouse effect. We present the history of emissions in the world during the last decade.



Source: International Energy Agency (IEA)

CO Carbon Monoxide

This poisonous gas is very dangerous since it is odorless, colorless and tasteless. That's why it is commonly known as the Silent Killer. It is produced by cars. It interferes with oxygen transportation in the blood as it gets attached to hemoglobin. It is produced when fuel burns with a lack of oxygen, and so CO is produced instead of CO₂. If you breathe too much of this gas, you can die. What is more, CO poisoning is fatal within a short period of time. Everyone is at risk of CO poisoning but especially: infants; elderly people, especially those with a chronic heart disease; people suffering from anemia; or people with breathing problems.

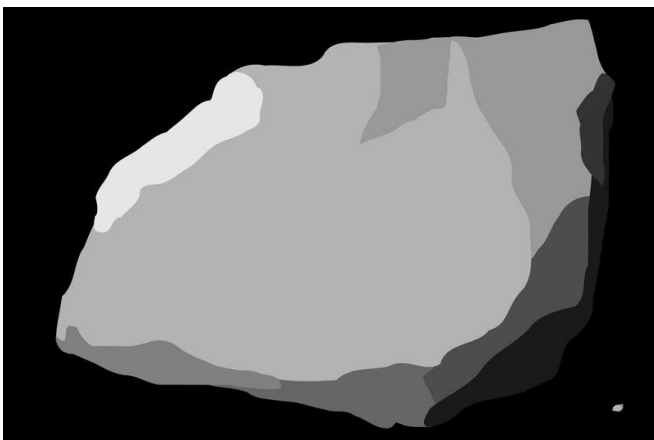
Some of the effects of breathing this gas are: headache, dizziness, weakness and clumsiness, nausea and vomiting, quick irregular heartbeat, chest pain, hearing loss, blurry vision or disorientation.

There is a slight difference between diesel and petrol engines. The first use more oxygen, so this kind of poisoning is more typical of petrol engines. Present laws environmental laws (Euro 6) permit 1000mg/km for petrol cars and 500 mg/km for diesel.

PM_{2.5} Particulate Matter

The Particulate Matter (PM_{2.5}) also known as floating dust are air pollutant. They can be originated naturally (volcanic eruptions, soil erosion, sea salt, etc) or by humans (industrial processes, road transport, agriculture, among others). If the particles are bigger, they may get down by gravity or washed out by rain. But the finer particles can remain in the atmosphere longer and be transported long distances. When there is a high concentration of the particles in the air, visibility is reduced. This can happen when there is little wind.

Particles in the PM_{2.5} size range are able to travel deeply into the respiratory tract, reaching the lungs. Exposure to fine particles can cause short-term health effects such as eye, nose, throat and lung irritation, coughing, sneezing, runny nose and shortness of breath. Exposure to fine particles can also affect lung function and worsen medical conditions such as asthma and heart disease. Studies also suggest that long term exposure to fine particulate matter may be associated with increased rates of chronic bronchitis, reduced lung function and increased mortality from lung cancer and heart disease. People with breathing and heart problems, children and the elderly may be particularly sensitive to PM_{2.5}.



Ozone is a gas. When found in the higher layers of the atmosphere, stratosphere, it protects the earth's surface against the

harmful solar UV radiation. However, when it is found in the lower layers, troposphere, it becomes a really poisonous pollutant. This usually takes place in summer, when temperatures are hotter, by the influence of the sunlight on air polluted with NO_2 and volatile organic compounds.

Ozone is a powerful oxidant and as a result it can cause some health effects, depending on the concentration in the air, the exposure time, the sensitivity of the persons and their level of activity.

People most at risk from breathing air containing ozone include people with asthma, children, older adults, and people who are active outdoors, especially outdoor workers. In addition, people with certain genetic characteristics, and people with reduced intake of certain nutrients, such as vitamins C and E, are at greater risk from ozone exposure.

Long-term exposure to ozone is linked to aggravation of asthma, and is likely to be one of many causes of asthma development. Long-term exposures to higher concentrations of ozone may also be linked to permanent lung damage, such as abnormal lung development in children. Also eye, nose and throat irritation, as well as coughing, difficulties to breath, headaches, nausea, etc. These effects have been found even in healthy people, but can be more serious in people with lung diseases such as asthma. They may lead to increased school absences, medication use, visits to doctors and emergency rooms, and hospital admissions.

CO Carbon Monoxide

- ★ body oxygen distribution
- ★ death, extreme cases
- ★ poisoning
- ★ physical discomfort

It interferes with oxygen transportation in the blood as it gets attached to hemoglobin

PM_{2.5} Particulate Matter

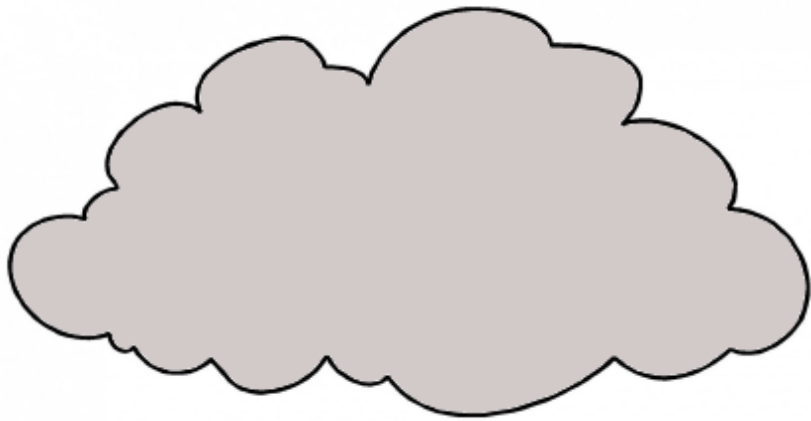
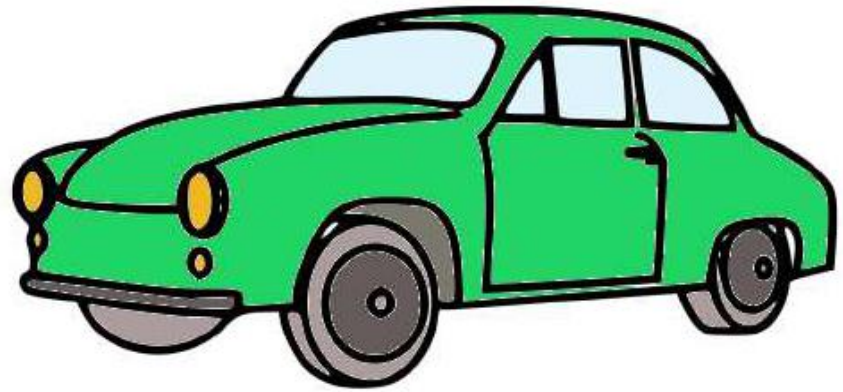
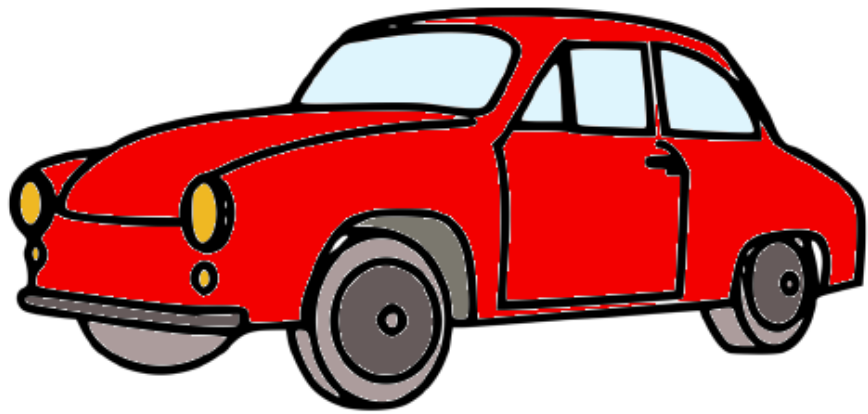
- ★ problems with the respiratory tract
- ★ irritation of body parts
- ★ worsen respiratory diseases
- ★ increase mortality from cancer and heart diseases

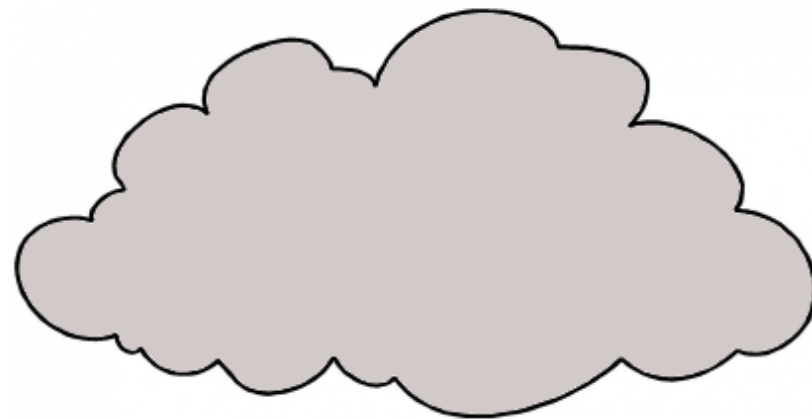
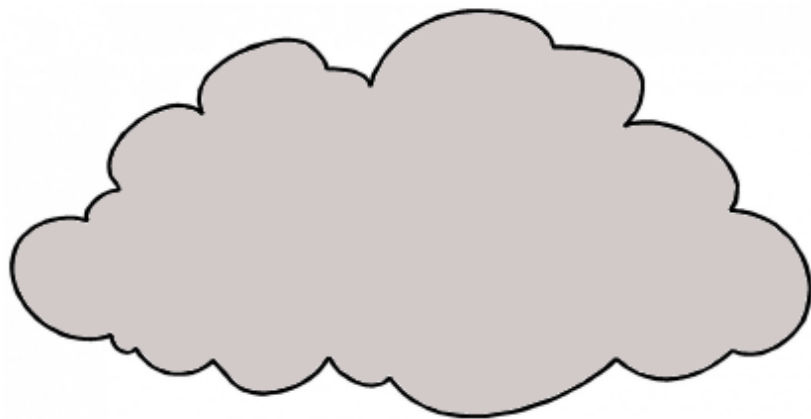
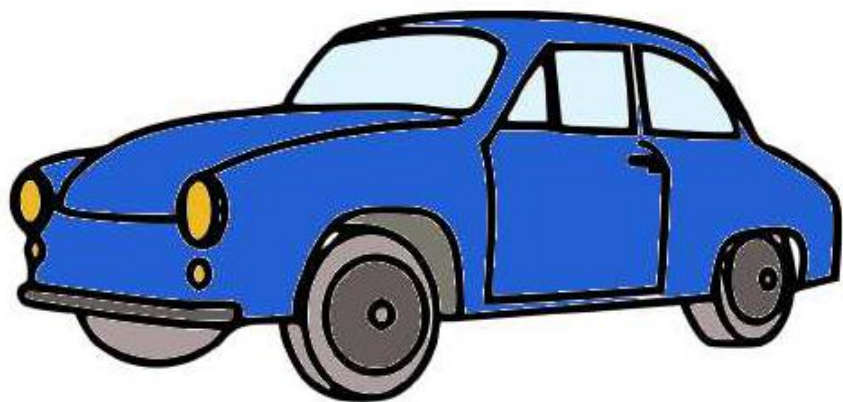
They travel deeply into the respiratory tract

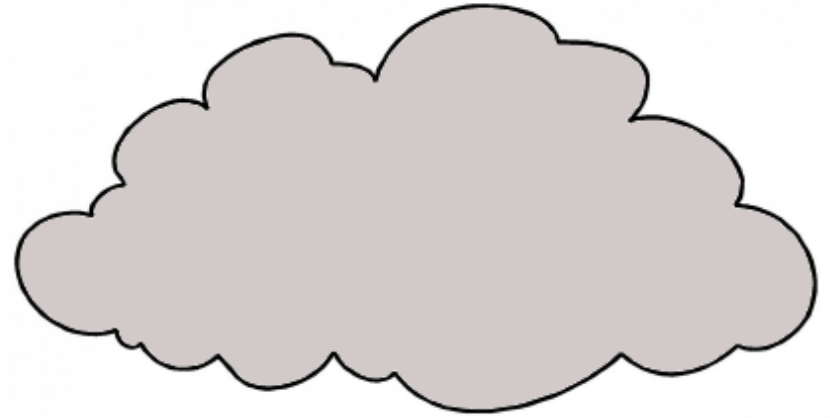
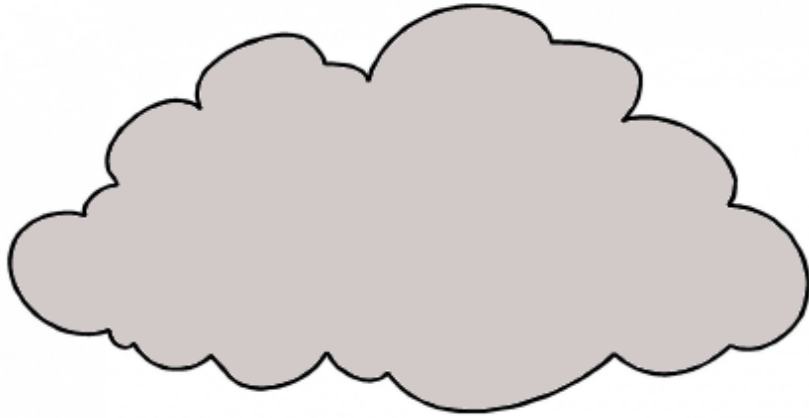
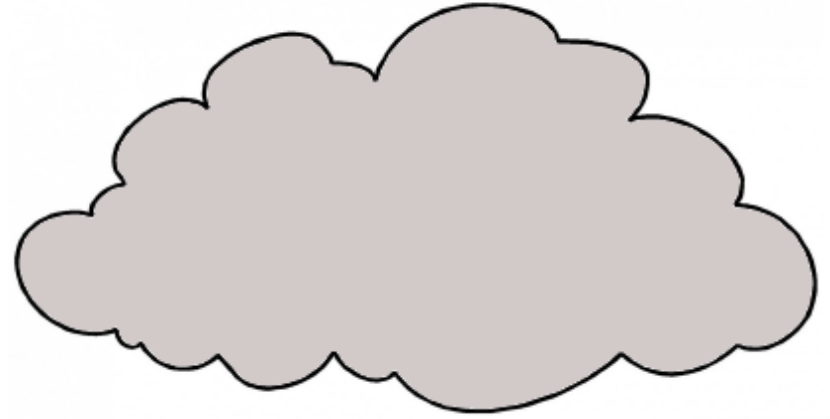
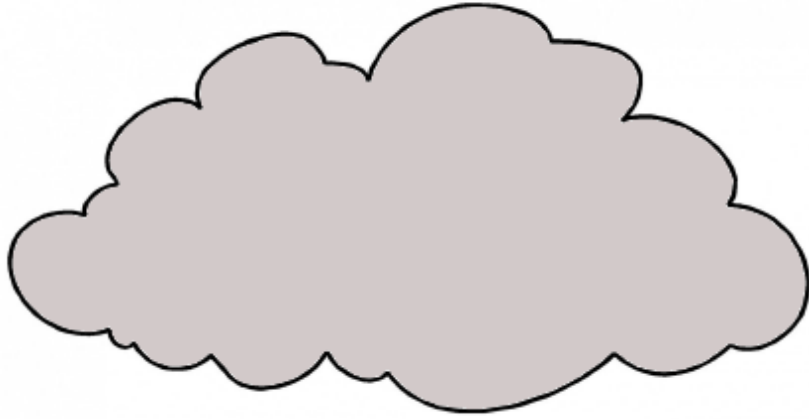
O₃ Ozone

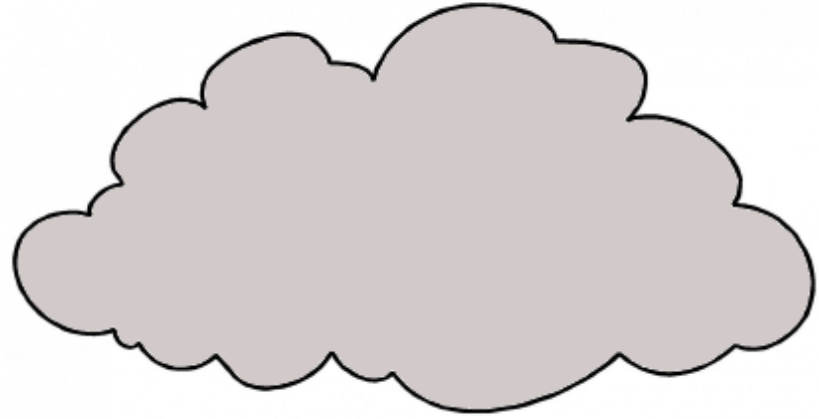
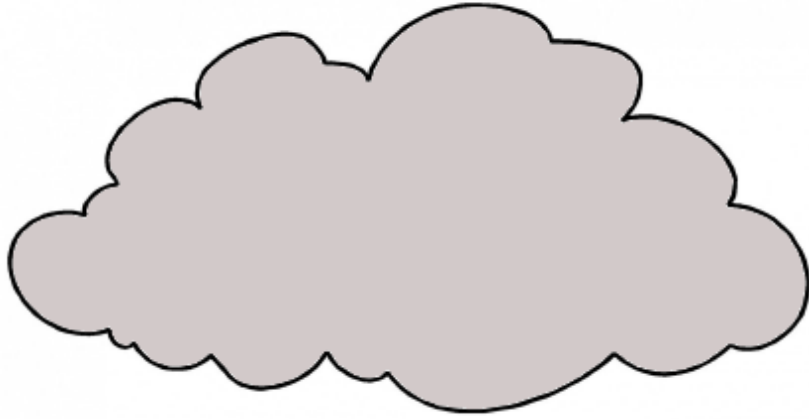
- ★ aggravation of asthma
- ★ breathing difficulties
- ★ irritation of body parts
- ★ lung underdevelopment

It oxidizes substances and it reaches lungs and the respiratory tract









TASK

Create a mind map about **fossil fuels and their consequences**. You can use the terms below together with your own ideas. An oral presentation of your mind maps will follow.

Greenhouse effect	Acid Rain	Fossil Fuels
NO ₂ (Nitrogen oxide)	SO ₂ (Sulphur dioxide)	HSO ₃ (Sulphur acid)
Diesel	Petrol	Gas
CO ₂	PM _{2,5}	CO
HNO ₃ (Nitric acid)	Global warming	Pollutants
Deforestation	Breath diseases	

WHAT IS AIR QUALITY LIKE TODAY?

Air Quality Index

The Air Quality Index is a way for the government to alert people to the quality of the air and how bad the air pollution is in an area or city. They use colors to help you determine if you should go outside.

- Green - the air is good.
- Yellow - the air is moderate
- Orange - the air is unhealthy for sensitive people like the elderly, children, and those with lung diseases.
- Red - Unhealthy
- Purple - Very unhealthy
- Maroon - Hazardous

You can visit this website <https://waqi.info/> in order to find out this information at real-time.

Visit that web and:

- Record the data of :
 - Pollutants from your city (or the nearest station to your city)
 - Some station in Barcelona city.
 - A city in green.
 - Pollutants from a very polluted city.

(Use always the highest level of the day)

- Reproduce fill in a table like this in your computer:

Date:.....Hour;.....						
City	NOx	SOx	CO2	CO	PM2.5	O3
LLeida						
Barcelona						

Look for a picture of the city in red and write a little report to describe how unhealthy the air is today.

(Give some advice to somebody living there)

The group should save the document in pdf format and name **today_surname** of one person of the group, Share it with the teacher and give him/her permissions only to comment.

ALTERNATIVES

Go to these webpages and read the information on them so you can get a general idea on governments' policies and laws, and car manufacturer's alternatives to fossil fuels. Then go around the classroom, pick up the sentences and classify them in the first two columns of the chart. Green colour refers to positive action/ aspects; red colour is for negatives aspects; black ink is for general information

[Earth 911](#)

[Going Green](#)

[Electric cars](#)

[UK car companies advice fossil fuels](#)

[Catalytic](#)

[Catalytic converter](#)

[Catalytic converter: pros and cons](#)

[Euro emissions](#)

[Legislation: Berlin](#)

[Banning](#)

[European Laws on alternatives to fossil fuels](#)

[European Environment Agency](#)

[Alternative fuels and advanced vehicles](#)

Once you have completed the first part of the chart, it's your turn. What can you do? Imagine you have to buy a new car. What considerations are you going to take into account to choose the best option? You can use the information you already have in the chart.

ALTERNATIVES

Go to these webpages and read the information on them so you can get a general idea on governments' policies and laws, and car manufacturer's alternatives to fossil fuels. Then go around the classroom, pick up the sentences and classify them in the first two columns of the chart. Green colour refers to positive action/ aspects; red colour is for negatives aspects; black ink is for general information

[Earth 911](#)

[Going Green](#)

Hybrid cars are among the first mass-produced eco-friendly vehicles. They are relatively affordable and easy to maintain, as they use a traditional gas engine to back up the electric operation.

Biofuel cars have been found to reduce carbon emissions by 74 percent compared to traditional petroleum fuels.

Hybrid cars still use fossil fuels

Biofuel in cars is only a 20% whereas the 80% is still diesel

Electric cars get their energy by burning fossil fuels

[Electric cars](#)

Efficient use of the energy you put in their batteries

At present they still have a greater environmental impact since they pollute when electricity is generated. But it seems advancement is being done to improve the situation.

[UK car companies advice fossil fuels](#)

Batteries for electric cars are quite expensive

There are many options to fossil fuels for cars but they are still being developed and have many downsides

Electric cars are currently the most commercially available solution with many models

Catalytic

Catalytic converter

Catalytic converter: pros and cons

An antipollution device in an automotive exhaust system that contains a catalyst for chemically converting some pollutants in the exhaust gases, as carbon monoxide, unburned hydrocarbons, and oxides of nitrogen, into harmless compounds.

It does not work until the engine is hot. So it does nothing when you start the engine.

It works well at high temperatures.

It reduces the emissions of harmful compounds

Euro emissions

Euro 1 (1992): fitting catalytic converters to petrol cars to reduce carbon monoxide (CO) emissions

Euro 2 (1996): limited more carbon monoxide emissions. Included the combined limit for unburned hydrocarbons and oxides of nitrogen for both petrol and diesel vehicles.

Euro 3 (2000): modified the test procedure to eliminate the engine warm-up period and further reduced permitted carbon monoxide and diesel particulate limits. Euro 3 also added a separate NOx limit for diesel engines and introduced separate HC and NOx limits for petrol engines.

Euro 4 (2005): concentrated on cleaning up emissions from diesel cars, especially reducing particulate matter (PM) and oxides of nitrogen (NOx). Some Euro 4 diesel cars were fitted with particulate filters.

Euro 5 (2009): tightened the limits on particulate emissions from diesel engines and all diesel cars needed particulate filters to meet the new requirements. There was some tightening of NOx limits too (28% reduction compared to Euro 4) as well as, for the first time, a particulates limit for petrol engines – applicable to direct injection engines only.

Euro 6 (2014): The Euro 6 standard imposes a further, significant reduction in NOx emissions from diesel engines (a 67% reduction compared to Euro 5) and establishes similar standards for petrol and diesel.

Legislation: Berlin

Banning of diesel cars to improve the city pollution by giving incentives to the drivers

Lowering speed limits on important routes to cut pollution

Banning

By next decades, many countries are working on bans for the production of gas and diesel cars

Only 10 countries are selling the 95% of electric cars

European Laws on alternatives to fossil fuels

There are general Renewable Energy directives for all the EU countries, that all of them must follow. At the same time each country organises the steps to follow to fulfill the directives.

European Environment Agency

Alternative fuels and advanced vehicles

There are many possible alternatives to fossil-fuel-run vehicles

The alternatives still aren't fully developed

Once you have completed the first part of the chart, it's your turn. What can you do? Imagine you have to buy a new car. What considerations are you going to take into account to choose the best option? You can use the information you already have in the chart.

GOVERNMENT'S ACTION	CAR MANUFACTURER'S ACTION	OUR ACTION

FINAL PRODUCT (work in groups)

Now that you have learnt about the effects of fossil fuels, it's time to participate actively in promoting the reduction of use of these types of fuels.

You decide what type of support you are going to use. It could be:

- posters to be hung in the car park of the school
- an article for a newspaper
- a video advertising spot in the school web

Whatever you decide as a support, your product should include:

- Some scientific explanation of the problems caused by fossil fuels in the environment.
- Some evaluation of the different types of fuels according to their impact on the environment.
- Some of the consequences on health.
- Alternatives to minimize the impact on the environment.

You can also include data to reinforce your statements.

You should follow these steps:

1. A list of the main ideas you want to communicate.
2. Make a plan (it can be a storyboard or something similar)
3. Action!

RUBRIC FINAL PROJECT

	4	3	2	1
Technical aspects (the framework)	Project is attractive and meets all requirements very well and the student has submitted an outstanding piece of work with all supporting graphics (charts, pictures, photographs, diagrams and tables).	Project meets all requirements sufficiently. It is fairly attractive, and includes some supporting graphics and data, though these may be somewhat lacking.	Partially meets some of the requirements, Not all criteria met. Not enough detail evident in some aspects.	Has not met the requirements at all Written presentation lacking in many aspects Lacking detail evident in most aspects
Language	Use of very varied vocabulary and grammar appropriate for the audience and free from significant mistakes.	Use of varied vocabulary and grammar that is appropriate for the audience. Mostly accurate language.	Use of varied vocabulary that is occasionally a little too simple or a little too hard for the audience. Mistakes may be frequent.	The vocabulary is not varied OR is routinely inappropriate for the intended audience. Mistakes may impede comprehension seriously.
Communication	Fluid body language which helps the audience follow. Correct intonation and pace. Natural discourse.	Movements or gestures that enhance articulation. Mostly correct intonation and pace.	Very little movement or descriptive gestures. Hesitation. Some reading and not very natural.	No clear structure in the presentation. Tension and nervousness. Incorrect pace and intonation.

LIST OF QUESTIONS FOR PLICKERS:

The greenhouse effect is caused by:

CO₂ (carbon dioxide)

NO₂ (nitrogen dioxide)

CO (carbon monoxide)

PM2,5

The pollutant oxides mix with water vapour in the air and form...

Acid rain

Greenhouse effect

Radioactive gas

Ozone gas

What is the formula for sulphuric acid?

H₂O

HNO₃

H₂SO₄

SO₂

Global warming is...

Cooler springtime and summer weather

The main cause of deforestation

The increase of the planet's average temperatures

The cause of longer winters

One of the alternatives to minimize the effects of car pollutants is...

Use less powerful engines

Install catalytic converters before exhausting gases

Promote old cars instead of modern ones because those engines were less pollutant.

All the answers are right.

How is CO₂ put into the atmosphere?

From burning fossil fuels

Cutting down forests

Eating meat

Answers A and B are correct

As a consequence of the Greenhouse Effect (tick the correct):

Ice caps will melt

Snow and rain precipitations will keep the same
Glaciers will disappear
Sea levels will lower

Negative aspects of electricity as an alternative are (tick the correct):

Electric cars are more expensive to buy
Batteries can be used only for a limited number of kilometres
It reduces pollution

The most important pollutant produced by Diesel cars is:

CO₂
NO₂
PM₁₀
CO

One of these pollutants is commonly produced in petrol cars and not so commonly produced in diesel ones:

CO₂
NO₂
PM₁₀
CO

One of these sentences about fossil fuels is not true:

All the fossil fuels produce pollution in different ways.

Because they are renewable sources of energy, these fuels are going to exist forever.

Fossil fuels were formed from the remains of animals and plants that lived millions of years ago in water.

Coal, gas and oil are fossil fuels.

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