LEARNING FOR LIFE

TEACHERS' GUIDELINE

HOW CAN YOU PRODUCE OXYGEN FASTER TO MAKE MARS HABITABLE?
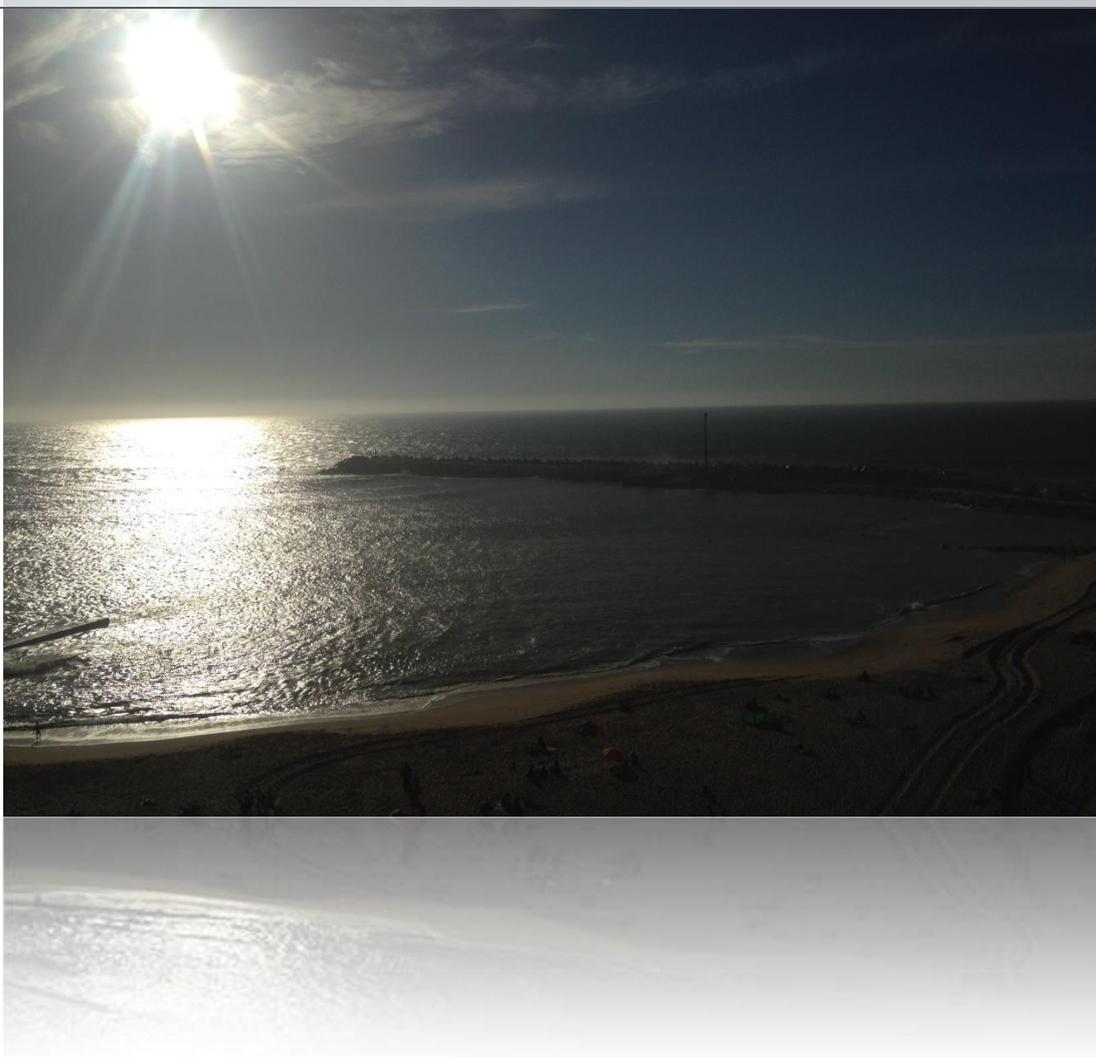
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PROJECT DETAILS

SCHOOL YEAR	2017-2018
SCHOOL YEAR LEVEL	8th (13-14 year old)
TERM	
SESSIONS	
TITLE	**"HOW CAN YOU PRODUCE OXYGEN FASTER TO MAKE MARS HABITABLE?"**
SUBJECTS	Mathematics, Physics-chemistry, Mother tongue, Arts, English
UNIFYING THREADS (DRIVING QUESTIONS)	What is the constitution of the Mars atmosphere? What factors influence the speed of a chemical reaction?

KEY COMPETENCES

A: TRANSVERSAL COMPETENCES

COMPETENCE (EU)	TASKS
1. Learning to learn	4
2. Sense of initiative and entrepreneurship	3-4-5-12-18
3. Social and civic	1-2-3-10-14-18-19

B: SUBJECT COMPETENCES

COMPETENCE (EU)	TASKS
4. Communicating in the mother tongue	11-15-17-18
5. Communicating in a foreign language	16-17
6. Digital	3-4-13
7. Mathematical, scientific and technological	6-7-8-9-18
8. Cultural awareness and expression	12

MULTIPLE INTELLIGENCES	INTELLIGENCE	TASKS
	1. Interpersonal	1-3-4-10-14-17-18-19
	2. Intrapersonal	3-4-5-10-14
	3. Visual-spatial	5-12-13
	4. Bodily-kinesthetic	
	5. Musical-rhythmic	
	6. Verbal-linguistic	2-11-15-16-17-18
	7. Logical-mathematical	9
	8. Naturalistic	6-7-8-18

DISCIPLINARY OBJECTIVES and CROSS-DISCIPLINARY OBJECTIVES What do we want students to understand? (COMPREHENSION GOALS)	DISCIPLINARY OBJECTIVES and CROSS-DISCIPLINARY OBJECTIVES
	MAIN OBJECTIVE: **Identify the factors that influence the speed of a chemical reaction** **0.General objectives** 0.1. To Work as a team and take responsibility **1.Mathematics** 1.1. Collect and process data 1.2. To define one math function to translate the collected data **2.Foreign Language (English)** 2.1. Learn specific vocabulary: percentage; Mars Speed; Reactions; Concentration; Catalysts … 2.2. Improve communicating and writing skills

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	3. Mother Tongue 3.1. To improve communicating and writing skills 3.2. To Improve and enrich vocabulary in mother tongue **4. Arts** 4.1. Analyse the comic strip as a graphic-verbal representation in the learning concepts 4.2. Illustrate in graphic / plastic support the sequence of story produced experimental activity **5. Physics-Chemistry** 5.1. Identify the factors that influenced the speed of chemical reactions 5.2. Interpret the variation of the speed of the chemical reactions in the control of the factors that change it **6. ITC** 6.1. Illustrate in digital support the sequence of the experimental activity
PROJECT PRESENTATION	A challenge will be proposed to the students, to construct a Comic Strip with a history related to identifying the factors that influence the speed of the chemical reaction. Presentation of the Comics in several school networks and in several spaces of the school and local community.
FINAL PRODUCT	A Comic Strip with a history related to identifying the factors that influence the speed of the chemical reaction

SEQUENCE OF TASKS

Tasks in bold are necessary, and the rest are optional. They depend on the teachers involved in the project and the school facilities.

A. PREVIOUS TASKS

1. **Task: Team dynamics**
2. **Task: Project presentation in library school and the social networks**
3. **Task: Team planning**
4. **Task: What I know - What I need to know**
5. **Task: Specify Comics design and appoint the responsibilities**

B. RESEARCH / DEVELOPING TASKS

6. **Task: What are the factors that can influence the speed of chemical reactions? (Brainstorming)**
7. **Task: How to speed up chemical reactions?**
8. **Task: How do factors influence the speed of chemical reactions? - Test the factors in the laboratory**
9. **Task: Treatment of data collected in the performance of the experimental activity**
10. **Task: Team planning assessment**
11. **Task: Construction of comic strip (plot, scenarios, characters...) on "How can you produce faster oxygen to make Mars habitable?"**
12. **Task: How to make a comic book?**
13. **Task: Construction of on-line Comics**
14. **Task: Team planning assessment**
15. **Task: Construction of the texts for the Comic Strip**
16. **Task: Learning vocabulary in English**

C. FINAL TASKS

17. **Task: Comics presentation**
18. **Task: Comics dissemination**
19. **Task: Final team planning assessment**

INDICATORS

MAIN OBJECTIVE

The Student indicates the factors that influence the speed of a chemical reaction

0. General objectives

0.1.1. The student achieves team objectives

0.1.2. The students achieves individual objectives

0.1.3. The student fulfils his/ her responsibilities

1. Mathematics

1.1.1. The student is able to collect, organize and process the data

1.1.2. The student is able to construct tables, graphs, diagrams or lists for visualization of results

1.2.1. The student is able to identify one math function to translate the collected data

2. Foreign Language (English)

2.1.1. States the names about the factors that influence the speed of chemical reactions: percentage; Mars; Speed; Reactions; Concentration; Catalysts…

2.1.2. Expresses technical verbs in the foreign language

3. Mother Tongue

3.1.1. The student demonstrates improvement in communication and writing skills

3.1.2. The student uses new words related to factors that influence the speed of chemical reactions: Speed; Reactions ; Concentration ; Catalysts …

4. Arts

4.1.1. The student identifies comics as a graphic-verbal representation of learning concepts

4.1.2. The student is able to illustrate in the graphic / plastic support the sequence of the story produced in the experimental activity

5. Physics-chemistry

5.1.1. The student identify the possible factors that can influence the speed of chemical reactions

5.1.2. The student explain correctly how factors influence the speed of chemical reactions

6. ITC

6.1.1. Development of comics using various computer tools

TOOLS:

- **Rubrics**
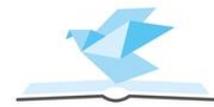
- Checklist; "3T - TEAM PLANNING_Task3_Portugal.xlsx"; "cartoons_evaluation.xlsx".

- The table filled in by each student

- Report with a qualitative analysis of the Comics

- **Reflections and evidences**

Reflection (Tasks: ''10. Task: Team planning assessment; 14. Task: Team planning assessment; 19. Task: Final team planning assessment'')

Protocols (see annexes: "Activity Objective-catalyst.docx; Activity Objective - Concentration.docx; Activity Objective - light.docx; Activity Objective - temperature.docx".
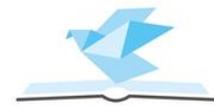
TASKS

PREVIOUS TASKS

1. Task: Team dynamics*		**Sessions:** 20 min	
COMPETENCES	Social and civic	**INTELLIGENCES**	Interpersonal
GOALS	Learning to work in teams		

*(Attention: If the student group persists from the previous task, it will not be necessary to implement this task)

Task description:

We will suggest a team dynamics so that students get to know each other.

Teacher's notes:

In order to know each other, the teacher will ask students several questions and everyone will have to write down their answers. Then, students will talk about their answers in groups.

Example: **WHO AM I?**

Objectives: To make known group members quickly, in a relatively non-inhibiting environment.

How to make:

1- Each one receives a sheet entitled "Who am I?"
2- For 10 minutes each one writes five items in relation to himself, that facilitate the knowledge.
3- The written sheet will be affixed to the participants' blouses.
4- The members of the group circulate freely and quietly around the room to the sound of soft music as they read about each other and let others read what he wrote about himself.
5- Soon after gathering 2 to 3 colleagues, with whom they would like to talk to get to know each other better. At this point you can ask questions that you would ordinarily not ask.

Evaluation:

A. What was the exercise for?
B. How do we feel?
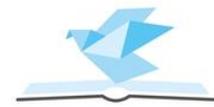
2. Task: Project presentation		**Sessions:** 25 min	
COMPETENCES	Social and civic	**INTELLIGENCES**	Verbal-linguistic
GOALS	To motivate students		

Task description:

Schools may invite an element from an organization related to the planetarium or from an astronomy centre to present the project. From issues such as:

"But is it that in the whole cosmos there is only one planet that meets all the conditions for life?

Why is it that places like Mars, Europe and Titan are most promising for the pursuit of Life?" The students debating with the guest examine "how can we control habitability on other planets?"

A challenge will be given to the students to make a small comic book with the findings on: "How can you produce Oxygen faster to make Mars habitable?".

At the end a comic strip will be built to introduce the school community. The comic strip can be distributed by the astronomy centres and planetariums of the region.

Teacher's notes:

When we present the project we need to motivate the students. The presentation of the project needs to be appealing. It is very important to create a special atmosphere to attain motivation. This is the moment when we can boost their interest.

The teachers that will take part in the project will also be present in the project presentation, explaining their role in the project.

3. Task: Team planning		**Sessions:** 45 min	
COMPETENCES	Social and civic Sense of initiative and entrepreneurship Digital	**INTELLIGENCES**	Interpersonal Intrapersonal
GOALS	Learning to work in teams and to control teamwork		

Task description:
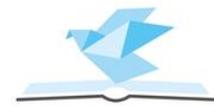
Each team will define its team planning, which will consist of three parts: team objectives, individual objectives and responsibilities.

Team objectives:

All teams will have objectives: Each team will be responsible for their own task concerning "How can you produce Oxygen faster to make Mars habitable?" and will be responsible, as well, to add their presentation in the Comics.

Individual objectives:

Each student will have 2 individual objectives: one about their role in the task and another about the deadlines accomplishments.

Responsibilities:

Responsibilities will be assigned by the teacher.

Assessment tools (rubrics…):

- Checklist;

3T - TEAM PLANNING_Task3_Portugal.xlsx

Teacher's notes:

Checklist Example:
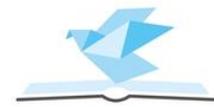
Date:	Work Checklist (Name):			Classe:	N.º:	
Did you...	**Check** Yes No		**Evaluation** 🙂 😐 🙁			**Comments**
Personal Objectives: 1. 2. 3.						
Team Objectives: 1. 2. 3.						
Responsibilities: 1. 2. 3.						
Self-evaluation: 1. I stay focused while doing my work 2. I did work I am proud of 3. I am confident that I did my best 4. 5.						

4. Task: What I know – What I need to know		**Sessions:** 30 min	
COMPETENCES	Learning to learn Sense of initiative and entrepreneurship Digital	**INTELLIGENCES**	Interpersonal Intrapersonal
GOALS	Learning to work in teams		

Task description:

Each team will consider what they already know about the task and what they need to know in order to carry it out.

What I know (in this column you take note of what you already know about it ...)	What I need to know (in this column you take note of the aspects or details you need to know ...)

Teacher's notes:

The teacher will pay special attention to students' answers, and based on these answers he/she will suggest suitable tasks to carry out the project.

5. Task: Specify the parts of Comics and appoint the responsibilities			**Sessions:** 30 min
COMPETENCES	Sense of initiative and entrepreneurship	**INTELLIGENCES**	Interpersonal Visual-spatial
GOALS	Learning to work in teams		

Task description:

After specifying the amount parts of Comics, each team will designate one member of the group to take part of another team who will do the final version of the Comics.

In order to do that, it is necessary that all the students reach an agreement.

RESEARCH / DEVELOPING TASKS

6. Task: What are the factors that can influence the speed of chemical reactions? (Brainstorm)			**Sessions:** 1 h
COMPETENCES	Mathematical, scientific and technological	**INTELLIGENCES**	Naturalistic
GOALS	Identify possible factors that can influence the speed of chemical reactions		

Task description:

Students will be asked to indicate factors that may influence the rate of chemical reactions. They will be recorded in the table and discussed.

7. Task: How to speed up chemical reactions?			**Sessions:** 1 h
COMPETENCES	Mathematical, scientific and technological	**INTELLIGENCES**	Naturalistic

GOALS	Identify factors that can influence the speed of chemical reactions

Task description:

Students will explore a video on the factors that influence the speed of chemical reactions.

Teacher's notes:

Sites to explorer:

https://ed.ted.com/lessons/how-to-speed-up-chemical-reactions-and-get-a-date

https://www.youtube.com/watch?v=cqSfrhSAA7Y

https://www.youtube.com/watch?v=NhdtqnEfa9w

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

8. Task: How do factors influence the speed of chemical reactions? - Test the factors in the laboratory		**Sessions:** 90 min	
COMPETENCES	Mathematical, scientific and technological	**INTELLIGENCES**	Naturalistic
GOALS	Check how the factors affect the speed of the chemical reaction		

Task description:

Perform the experimental activities according to the indicated protocols (see annexes: Activity Objective - catalyst.docx; Activity Objective - Concentration.docx; Activity Objective - light.docx; Activity Objective - temperature.docx)

Assessment tools (rubrics…):

The evaluation will be done through the conclusion obtained after the experimental activity.

- cartoons_evaluation.xlsx

9. Task: Treatment of data collected in the performance of the experimental activity	**Sessions:** 30 min
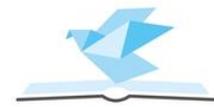
COMPETENCES	Mathematical, scientific and technological	INTELLIGENCES	Logical-mathematical
GOALS	Collect, organize and process the data obtained To define one math function to translate the collected data		

Task description:

Students will do the processing of collected data and build graphs:

- Temperature as a function of time;

- Concentration as a function of time;

- With light / without light as a function of time;

- With and without catalyst as a function of time.

Assessment tools (rubrics …):

The evaluation will be done through the results obtained after the activity.

- cartoons_evaluation.xlsx

10. Task: Team planning assessment		**Sessions:** 15 min	
COMPETENCES	Social and civic	INTELLIGENCES	Interpersonal Intrapersonal
GOALS	Learning to work in teams		

Task description:

We will assess all the objectives established in the 3rd task, individual and team objectives as well as the responsibilities to reflect upon the things we are doing well and the issues that must be improved.

Assessment tools (rubrics…):

Students' will self-assess the objectives and responsibilities established in team planning (see Checklist Example 3ª Task):

- Checklist;

- 3T - TEAM PLANNING_Task3_Portugal.xlsx

11. Task: Construction of comic strip (plot, scenarios, characters…) on "How can you produce faster oxygen to make Mars habitable?"			**Sessions:** 2 h	
COMPETENCES	Communicating in the mother tongue	**INTELLIGENCES**	Visual-spatial Verbal-linguistic	
GOALS	Analyse the comic strip as a graphic-verbal representation in the learning concepts Illustrate in graphic / plastic support the sequence of story produced experimental activity			

Task description:

Students will create the plot, scenarios, characters... with a view to building the comic strip.

Assessment tools (rubrics …):

The evaluation will be done through the results obtained after the activity, using:

- cartoons_evaluation.xlsx.

Teacher's notes:

Sites to explorer:

www.tes.com/teaching-resource/features-of-a-comic-strip-6393987

https://www.wikihow.com/Make-a-Comic

12. Task: How to make a comic book?			**Sessions:** 8 h	
COMPETENCES	Cultural awareness and expression Sense of initiative and entrepreneurship	**INTELLIGENCES**	Visual-spatial	
GOALS	Analyse the comic strip as a graphic-verbal representation in the learning concepts Illustrate in graphic / plastic support the sequence of story produced experimental activity			

Task description:

Students describe events through comic book methodologies:

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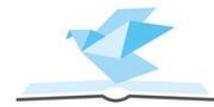
- They illustrate a story.

- Make the Frames (Drawings) in Comic Strip

- They draw a comic strip.

Assessment tools (rubrics…):

The evaluation will be done through the results obtained after the activity.

- cartoons_evaluation.xlsx

Sites to explorer:

http://www.creativebloq.com/comics/guide-create-publish-comic-book-71515975

https://www.youtube.com/watch?v=1Nb_ZDvoWEg

https://www.youtube.com/watch?v=m_nevXPyh0w

https://www.youtube.com/watch?v=UVRBKja5fEk

https://www.youtube.com/watch?v=lK-yBU9k27w

13. Task: Construction of on-line Comics		**Sessions:** 6 h	
COMPETENCES	Digital	**INTELLIGENCES**	Visual-spatial
GOALS	Illustrate in digital support the sequence of the experimental activity Know how to use various computer tools for the development of Comics		

Task description:

Students will explore the various computer tools for the development of comics.

Students will develop various comics (group or individual).

Assessment tools (rubrics …):

The evaluation will be done through the results obtained after the activity.

- cartoons_evaluation.xlsx
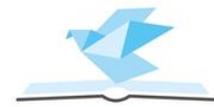
Teacher's notes:

Use "Toondoo" (http://www.toondoo.com) or Pixton (www.pixton.com) (for example)… Online cartoon makers are easy to use and will save you a lot of time.

14. Task: Team planning assessment			**Sessions:** 45 min
COMPETENCES	Social and civic	**INTELLIGENCES**	Interpersonal Intrapersonal
GOALS	Learning to work in teams		

Task description:

We will assess all the objectives established in the 3rd task, individual and team objectives as well as the responsibilities to reflect upon the things we are doing well and the issues that must be improved.

Assessment tools (rubrics…):

Students' will self-assess the objectives and responsibilities established in team planning (see Checklist Example 3ª Task):

- Checklist;

- 3T - TEAM PLANNING_Task3_Portugal.xlsx

15. Task: Construction of the texts for the Comic Strip			**Sessions:** 1 h
COMPETENCES	Communicating in the mother tongue	**INTELLIGENCES**	Verbal-linguistic
GOALS	To improve communicating and writing skills To Improve and enrich vocabulary in mother tongue		

Task description:

All the texts built in this task will be the basis for the comic book production. New words should be pointed out to search for their meaning (for example, in dictionaries, encyclopedias ...)

Assessment tools (rubrics…):
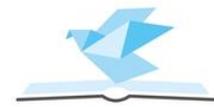
The evaluation will be done through the results obtained after the activity.

- cartoons_evaluation.xlsx

16. Task: Learning vocabulary in English			Sessions: 2 h
COMPETENCES	Communicating in a foreign language	**INTELLIGENCES**	Verbal-linguistic
GOALS	Learn specific vocabulary: percentage; Mars; Speed; Reactions; Concentration; Catalysts … Improve communicating and writing skills		

Task description:

Students will build and translate texts for comics.

Recourse to dictionaries for translation.

Assessment tools (rubrics…):

The evaluation will be done through the results obtained after the activity.

- cartoons_evaluation.xlsx

FINAL TASKS

17. Task: Comics presentation			Sessions: 2 h
COMPETENCES	Communicating in the mother tongue Communicating in a foreign language	**INTELLIGENCES**	Verbal linguistic Interpersonal
GOALS	To explain what students have worked on and learn throughout the making of Comics		

Task description:

The students will propose some spokesmen chosen from those who participated in the preparation of the Comics, to present the project to parents. Students should try to organize it as much as possible and invite more people than their parents.

Assessment tools (rubrics…):
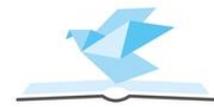
Report with a qualitative analysis of the Comics: Evaluation of scientific content (Mathematics, Physical-chemical). The construction of sentences and the use of correct scientific terms (English; Mother tongue). Use of the main commands of the different software used to construct the Comics (ITC). Quality of the Comics (Mathematics; Physical-chemical; Arts; English; ITC).

The evaluation will be done through the results obtained after the activity.

- cartoons_evaluation.xlsx

Teacher's notes:

Teachers guide the process of choosing the spokespersons (cultural diversity, gender ...). Teachers invite other personalities / institutions.

18. Task: Comics dissemination			Sessions: 1 h	
COMPETENCES	Sense of initiative and entrepreneurship Social and civic Communicating in the mother tongue Mathematical, scientific and technological	**INTELLIGENCES**	Interpersonal Naturalistic Verbal linguistic	
GOALS	To improve communicating and writing skills in the mother tongue			

Task description:

Students will have to prepare in the classroom what they will say when the comic strip is released.

Students will identify the appropriate places where they can disseminate the booklet.

After identifying the places, the students will be divided into groups to complete the task. All groups need to participate in the activity.

Teacher's notes:

Appropriate places where the flyer can be released:

- Libraries

- Town hall

- Environmental organizations
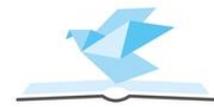
19. Task: Final team planning assessment			Sessions: 1 h	
COMPETENCES	Social and civic	**INTELLIGENCES**	Interpersonal	
GOALS	Learning to work in groups			

Task description:

Students will self-assess the objectives and responsibilities established in team planning.

Assessment tools (rubrics…):

Students' will self-assess the objectives and responsibilities established in team planning (see Checklist Example 3ª Task):

- Checklist;

- 3T - TEAM PLANNING_Task3_Portugal.xlsx

Afterwards the students will do a reflection on the things they did well or not.