Primary Education Guide

"Living with the sun" Program

FUNDACIÓN AEDV PIEL SANA
ACADEMIA ESPAÑOLA DE DERMATOLOGÍA Y VENEREOLOGÍA

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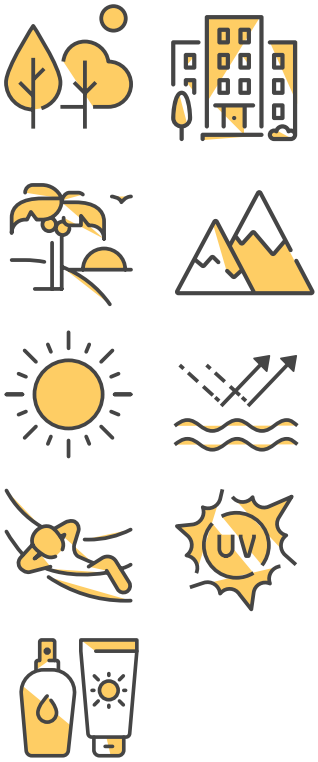
Index



1

Introduction

The sun is an indispensable source of life and, in small doses, has many health benefits. One of the most well-known is the synthesis of vitamin D, which regulates bone metabolism and is responsible for the mineralisation of our bones and teeth. However, it is also known that uncontrolled sun exposure can cause sunstroke and damage the skin, eyes and immunological system. In the skin, sun damage results in the appearance of redness (burn), spots and wrinkles (aging) and on occasion, tumours (skin cancer).

Childhood is especially vulnerable to sun damage. Boys and girls spend many hours each day exposed to it during outdoor sports and leisure activities. Their skin is very sensitive, and a burn can have lasting effects on their future health - we could even say that 'the skin has a memory'.

Teaching adequate photoprotection habits is the best strategy to avoid the risks associated with sun overexposure, and it is a responsibility that lies with health professionals, family members and educators alike. The school environment plays a key role in the early acquisition of healthy values and habits.

This guide aims to provide teachers with the best educational resources available to promote photoeducation in the classroom. By doing so, we hope to achieve our ultimate goal: ensuring that schoolchildren acquire responsible attitudes and self-care habits for their skin, to enable them to live healthily with the sun.

Justification

2.1. General objectives

This guide is designed to be an educational tool for teachers to carry out health education, and more specifically, everything related to sun exposure, stimulating students' interest in the subject and fostering the acquisition of healthy habits.

The teaching-learning program consists of four didactic units that pursue the following general objectives in three interdependent areas:

Students

Development of knowledge, attitudes and healthy habits relating to sun exposure.

Families

Involving families in the school's photoprotection project, making them active participants and co-responsible for the development of healthy behaviours in their daughters and sons.

Community

Publicising the project in the students' immediate environment involving as many agents as possible (health centres, local council...).

2.2. In relation to the curriculum

The new primary education guidelines are developed in articles 16 to 21 of Organic Law 2/2006, from May 3rd, after the amendment made by Organic Law 8/2013, from December 9th. The basic curriculum of the subjects corresponding to Primary Education has been designed in accordance with what these articles indicate in order to simplify their regulation, which has focused on the indispensable curricular elements.

In line with Recommendation 2006/962/EC from the European Parliament and Council on December 18th 2006 on the key competences for life-long learning, this Royal Decree is based on the fostering of competence-based learning, integrated in the curricular elements, to promote a renewal in teaching rationale and in the teaching and learning process. New approaches in learning and evaluation are proposed which suppose an important change in the tasks that the

students must solve, as well as innovative methodology approaches. Competence is a combination of practical skills, knowledge, motivation, ethical values, attitudes, emotions and other social and behavioural components that are mobilised together to achieve effective action. It therefore contemplates, as knowledge in practice, the knowledge acquired through active participation in social practices that, as such, can be developed both in formal educational contexts, through the curriculum, as well as in non-formal and informal educational contexts.

Primary Education is perhaps the most important teaching stage. A good Primary Education is essential for academic success in the entire population. It is necessary, therefore, for students to acquire in those first few years the knowledge and skills that will allow them to broaden their understanding later on through the study of the different disciplines.

The purpose of Primary Education is to provide students with speech and listening skills, reading, writing, calculus, problem-solving and geometry, the acquisition of basic cultural notions and the habit of coexistence, as well as those of study and work, an artistic sense, creativity and affectivity, in order to contribute to the full development of the students' personality and to prepare them to take full advantage of the secondary school cycle. This stage's teachings will seek the integration of the students' different experiences and learnings and will adapt to their individual rhythms.

Primary Education will seek to develop the students' capacities that allow them:

a) To know and appreciate the values and rules of coexistence, learn to act in accordance with them, and prepare for the active exercise of citizenship respecting and defending Human Rights, as well as the pluralism of a democratic society.

b) To develop habits of individual and team work, of continued effort and responsibility while studying, as well as attitudes of self-confidence, critical thinking, personal initiative, curiosity, interest and creativity in learning and an entrepreneurial spirit.

c) To acquire abilities for the prevention and for the peaceful resolution of conflicts, that allow them to develop autonomously in the family and domestic sphere, as well as in the social groups to which they belong.

d) To know, understand and respect cultural and personal differences, equal rights and opportunities for all, and the non-discrimination of people with disabilities.

e) To know and use the English language appropriately, valuing its potential for communication, and to develop reading habits as an essential tool for learning in other areas.

g) To develop basic mathematical competences and start solving problems requiring basic calculations, geometrical knowledge and estimations, as well as being able to apply them to situations in their daily lives.

h) To know the fundamental aspects of Natural and Social Sciences, Geography, History and Culture.

i) To start using information and communication technologies, beginning to think critically about the messages they send and receive through them.

j) To use different forms of representation and artistic expression and to begin constructing visual and audiovisual proposals.

k) To value health and hygiene, to know and respect the human body, and to use physical education and sport as a means to promote personal and social development.

l) To know and value animals and plants, adopting patterns of behavior that promote their care.

m) To develop their affective capacities in all areas of their own personality and in their relations with others, as well as an attitude contrary to violence, to prejudices of any kind and sexist stereotypes in particular.

The competencies of the curriculum will be the following:

1º Linguistic communication.

2º Mathematical competence and basic competences in science and technology.

3º Digital competence.

4º Learning to learn.

5º Social and civic competences.

6º Sense of initiative and entrepreneurial spirit.

7º Cultural awareness and expression.

The learning activities will be planned, whenever possible, so that they integrate more than one competence.

The development of linguistic communication, mathematical literacy and basic competences in science and technology will be prioritised.

Finally, with regards to diversity, it's worth noting that the educational intervention must take into account the students' own diversity, adapting the educational practice to their personal characteristics, needs, interests and cognitive style, especially given the importance of pace and maturation process in this age group.

3

Using the guide

The guide contains four didactic units. Each one focuses on a topic that relates to photoprotection, namely: the sun, the skin, the positive and negative effects of the sun and, finally, photoprotection measures.

All units have a common structure: first, the concept map of the same is presented and broken down in the different sections, then all the different activities are explained.

To begin with, the topic is presented briefly in the Introduction and the specific *Objectives* and *Contents* of the unit in question are outlined.

Next, we indicate the *Key Competences* that we aim to develop and that we consider to be highly relevant to any teaching-learning process.

Transversal elements are just as key, some of them being common for the four units and others more specific to the topic in question.

Another section that has been included in the common structure has been that of *Multiple Intelligences* (H. Gardner) because it is currently widely accepted that our educational system must go beyond prioritising traditional instrumental priority areas such as Language or Mathematics and integrate other equally important competencies such as musical abilities, visual skills, etc.

The project is directed towards the educational community in general, which is why the *Activities* have been planned for students, family and community alike.

Said activities are complemented with comics, informative videos for each unit, infographics for the classroom, introductory videos to the activities and a student workbook, which will collect some of the activities.

The activities have been designed by way of the following methodological principles:

- Cooperative learning, organising activities in the classroom to turn them into an equally sociable and academic learning experience. Students work in groups to perform their tasks collectively (Wikipedia).
- Flipped classroom, transferring certain learning processes outside the classroom and using class time, together with the teacher's experience, to facilitate and promote other processes of acquisition and knowledge practice within the classroom (theflippedclassroom.es).
- Meaningful learning, based on previous knowledge and experiences.
- Active participation and embracing experience, as an essential element for the internalization of learning.
- Manipulative activity, experimenting with objects and materials.
- Research-action, facilitating learning through discovery.
- Leisure activities, play being a source of motivation for students.

All the different activities have been formulated to facilitate the inclusion of children with special educational needs or learning difficulties. For this reason, the proposed activities are simple enough for each student to be able to perform them, sometimes needing to work collaboratively, thus helping us develop cooperation and empathy among the peer group. However, the teacher can modify (simplify or increase in difficulty) any proposed activity as required.

Finally, the conceptual map indicates the Evaluation Criteria that will help teachers assess the degree of achievement of the proposed objectives and will serve as a guide in the teaching-learning process itself.

In the workbook, two types of rubrics will be added at the end of each unit. The first is for self-assessment, so that students can evaluate themselves. The second one will be for teachers, so that students can be evaluated individually.

Definition: Rubrics are grading guides used in evaluating the performance of students who are asked to describe the specific characteristics of a product, project or work in several performance levels, in order to clarify what is expected of the student's work, to assess its execution and to provide feedback (Andrade, 2005; Mertler, 2001 through Fernandez, A Revista de Docencia Universitaria Vol.8 (n.1) 2010).

After the development of each activity, adaptations of the same will be provided for the different levels, as well as proposals for activities or workshops to be carried out with families or outdoors.

It is recommended for the units to be developed in the order we propose, since they are presented from the most abstract topic (the sun) to the most concrete (photoprotection). However, each teacher will decide on the sequencing of these as well as the activities according to the interests and needs of each group. Likewise, the timing will be up to them.

The guide should be understood as a useful working tool for the classroom.

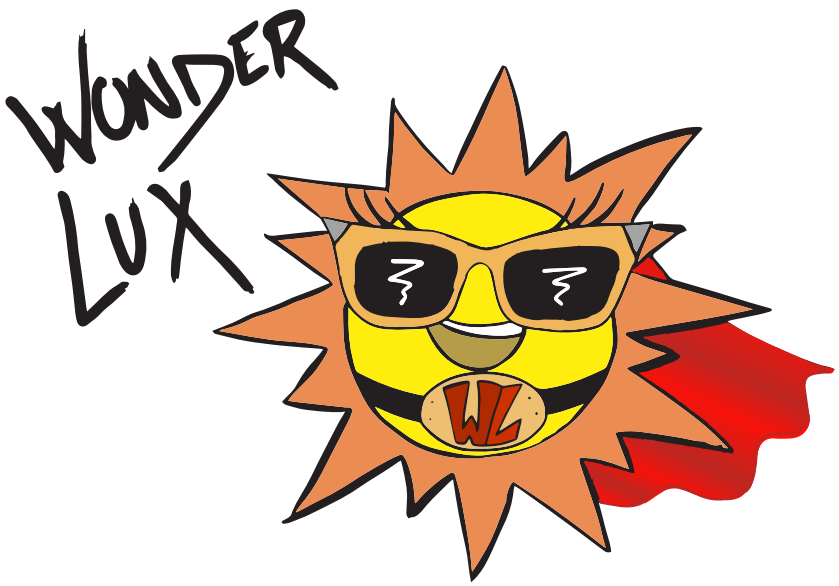
Didactic units

Intro Lux

Hello! I'm Lux. You probably know me as the Sun, but throughout history I have had several names, depending on the time, culture or place of the world in which they've called on me. For example, for the ancient Egyptians I was Ra, for the Mayans, Ak Kin, and for the Incas, Inti. And those are just a couple of examples. Besides having many names, you can see me on the flags of different countries, like those of Argentina, Nepal or Japan. Although I have lived for many years, in terms of the universe I'm a young star, since I'm about five billion years old, which places me roughly halfway through my life. When my life comes to an end, I will once again become a red giant, that is, a star colder and bigger than I am now (even though that's 400 times bigger than the moon, with a mass that is 333,000 times the Earth's).

As you will see I have a very interesting life. But let me give you some more information so you can get to know me a little better. For example, my rays are very fast. They move to a speed of 300,000 kilometers per second, so it takes them about eight minutes to reach your planet. Another interesting fact is that my outdoor temperature is about 6,000°C. Finally, the radiations that I emit are comparable to those of several million simultaneous atomic bombs.

Do you know why I explain all this to you? It's because your life and mine are closely linked. All these facts I have shared with you actually affect you in your everyday life, and that is why you will get to know me a little bit better as you work on this project. You will learn to take full advantage my benefits in a healthy way, while also taking care to protect yourself so you can enjoy me without risks.



Introduction

The Sun is essential to the development and evolution of life as we know it on planet Earth. It is a luminous star located in the centre of our planetary system, which other bodies orbit around (planets, asteroids, meteors, comets and dust).

According to experts, this large spherical ball of hot gas was formed about 4,600 million years ago and is responsible for providing adequate temperatures for life, intervening in processes such as the photosynthesis of plants, marking the boundary between day and night, defining meteorology and influencing the climatic processes of the different regions of the globe.

The importance of the sun for the human body is indisputable, both in its positive (synthesis of vitamin D, improved mood, improvement of the respiratory system, increased immune response...) and harmful aspects (sunburns, skin cancer...).

That is why it is essential that we learn a little more about this star that's been worshipped by countless groups and civilisations thoughout history.

Objectives

- Knowing what the Sun is.
- Knowing the movements of the Earth: rotation and translation.
- Knowing the seasons and how the Sun influences each one of them.
- Knowing what photosynthesis is and why it is important.
- Knowing the concept of shadows.
- Knowing the concepts of "sustainability" and "greenhouse effect".

Contents

- The Sun
- Earth movements: rotation and translation.
- Seasons and shadows.
- Photosynthesis.
- Greenhouse effect.
- Sustainability.

Key competences

- Linguistic communication.
- Mathematical competence and basic competences in science and technology.
- Digital competence.
- Learning to learn.
- Social and civic competences.

Transversal elements

- Reading comprehension, spoken and written expression.
- Learning and communication technologies.
- Entrepreneurship.
- Civic and Constitutional Education.

Multiple intelligences

- Linguistics.
- Logicomatematic intelligence.
- Spacial awareness.
- Interpersonal.
- Naturalist.

Subjects

- Environment knowledge.
- Language.
- Maths.
- Art.

Student activities

Introduction and motivation:

1. Presentation of the mascot "Wonder Lux".

- **1.1.** Talking about Lux with the students.
- **1.2.** Comic.

2. Presentation of the workbook.

- **2.1.** Drawing Lux in the workbook.
- **2.2.** Personal data file.

Development:

3. Video: The sun.

- **3.1.** Workbook (crosswords).

4. Video: The Earth and its movements (rotation and translation).

- **4.1.** Crafting activity about the movements of the Earth.

5. Video: Solar energy.

- **5.1.** Brainstorm about the videos.
- **5.2.** Creation of a solar oven.

6. Temperature measurement with stones.

7. Measuring shadows.

8. Myths about the sun.

9. Making a Viking Sundial.

10. Magnifying effect.

11. Video: Photosynthesis.

- **11.1.** Making a lapbook about photosynthesis.

12. Experiment with a flashlight and matches.

Closure:

13. Video: Architecture and the sun.

- **13.1.** Discussing the video.
- **13.2.** Design of a building that takes advantage of the sun's benefits.

14. Gaudí.

15. Rubric.

The sun

In this unit we will learn what the Sun is, what relationship the star of our solar system has with the Earth and its importance in the origin of the seasons and in the life of plants. We will define what the greenhouse effect is and we will talk about any related sustainability measures that are being carried out in our planet.

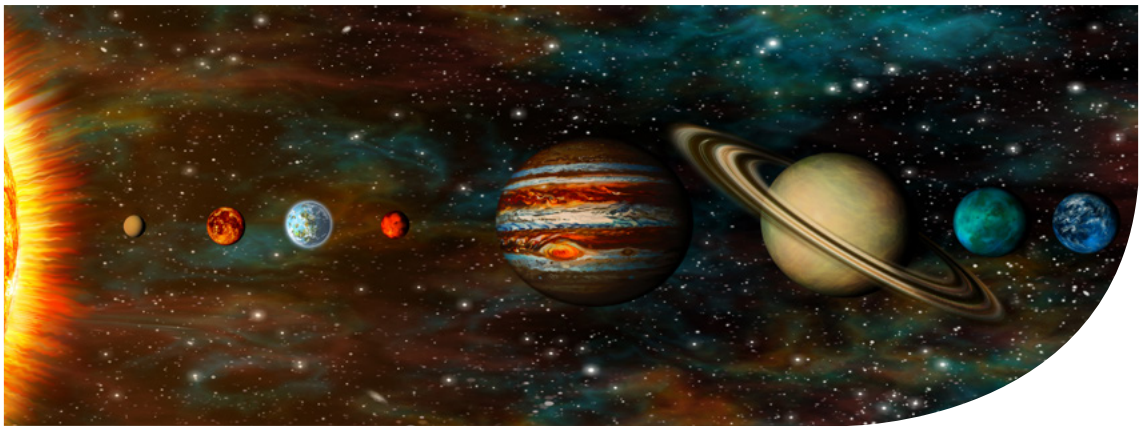
The solar system and the Sun

The solar system is made up of a star and the celestial bodies that rotate around it. Stars are like giant fireballs that emit light and heat continuously.

The star of our system is the Sun, and the celestial bodies are eight planets, their satellites and others smaller bodies.

Although there are countless stars, the Sun appears bigger and brighter than any other because It is much closer to the Earth.

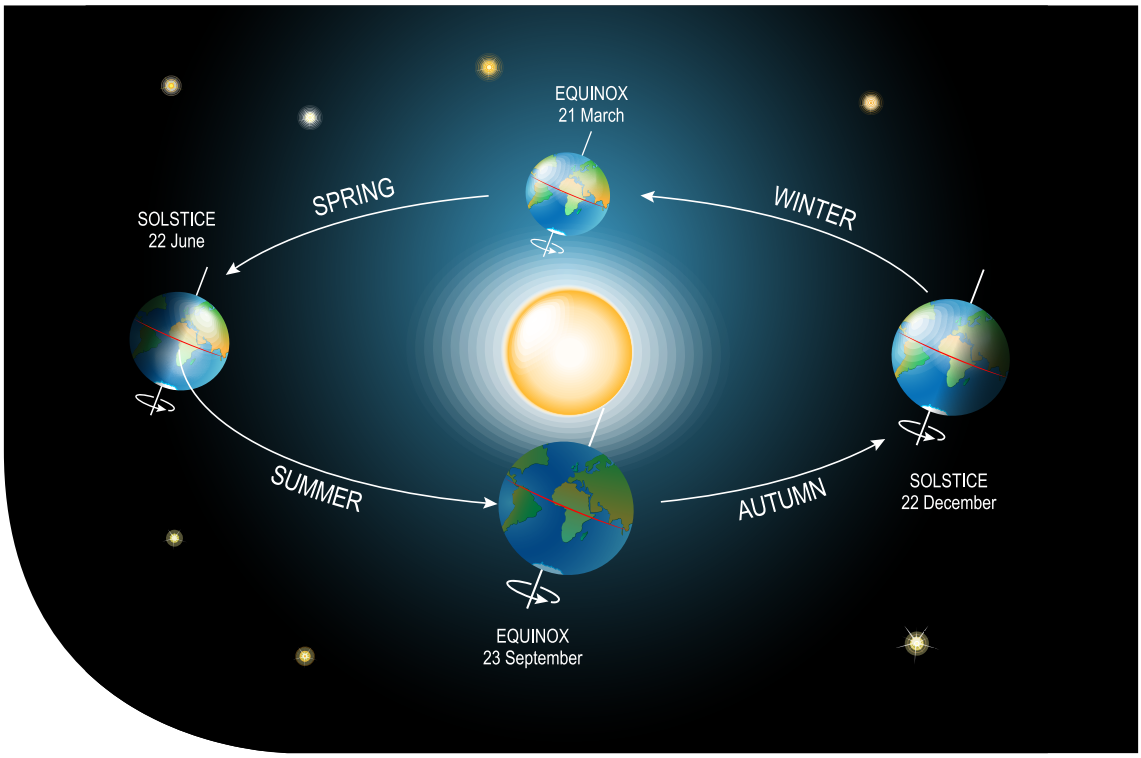
Life on Earth would not exist without the Sun.



Movements of the Earth

The movement that the Earth carries out around itself is called rotation. It is both constant and fast. The Earth takes **24 hours** to make a complete turn on itself. It is what we call a **day**.

We are not capable of perceiving this movement and it seems to us that the Sun is the one moving across the sky. It is, however, the Earth that is rotating throughout the day.



This rotation creates what we know as **days** and **nights**. It's day in the one half of the Earth which receives the rays of the Sun, and night in the other half. As the Earth turns on itself, dusk falls in the areas illuminated by the Sun while dawn breaks in the other side.

The Earth, besides turning on itself, traces an orbit around the Sun. This movement is called **translation**. The Earth takes **one year**, or 365 days, to go around the Sun fully.

The **translation** movement is what creates the four **seasons**: spring, summer, autumn and winter.

The **seasons** occur because the Earth's axis is tilted. This means that, throughout the year, the rays of the Sun arrive with different inclinations to the same part of the Earth. It's also the reason why days and nights have different lengths throughout the year.

Spring: at the beginning of spring, the days and nights have the same length. By the end, the nights start to get shorter. The temperatures are gentle, it rains frequently and many plants and flowers grow. After the winter, our skin may not have generated enough melanin to protect itself so it is important that we control sun exposure to avoid burns and skin lesions.

Summer: at the beginning of the summer, the days are the longest of the year. Little by little they get shorter. The temperatures are high, it rains little and much of the vegetation dries up. In this period of the year the Earth's axis is tilted in a way that positions the northern hemisphere facing towards the Sun. Its rays reach us more directly as they are perpendicular to the earth's surface and cause an increase in temperature.

Summer is the time of year when there are more sunburns because the sun happens to be stronger at a time when we are more likely to indulge in outdoor activities like going to the beach or the pool, walking in the mountains or playing outdoor sports. It is the season of the year in which we have to be most careful and protect ourselves well from the sun's rays.

Autumn: at the beginning of autumn, the days and nights have almost the same length. Later, the nights start getting longer. The temperatures at first are mild but, as it progresses, it becomes increasingly cold and some trees begin to lose their leaves. The sun, although it's not as hot as in the summer, continues to have a high impact on us, so it is important to take certain precautions.

Winter: at the beginning of winter, the nights are the longest of the year and, as it progresses, the days start getting longer once again. The temperatures are low and it can snow. Deciduous trees lose all their leaves. Unlike in summer, at this time of year the axis of terrestrial inclination positions the northern hemisphere furthest from the Sun. Solar rays are not as perpendicular and they reach us a little less, which explains the lower temperatures. In winter it is important to be careful when visiting snowy areas, especially in the high mountains, since the snow reflects the Sun's rays and if no precautions are taken, the skin can also burn easily.

Photosynthesis

Unlike animals, plants do not eat other living things, they produce their own food in a process called photosynthesis. That is why plants are called "producers" within the food chain.

Photosynthesis consists in the transformation of inorganic matter into organic matter thanks to solar energy.

To perform photosynthesis, a plant needs: sunlight, water, mineral salts and carbon dioxide.

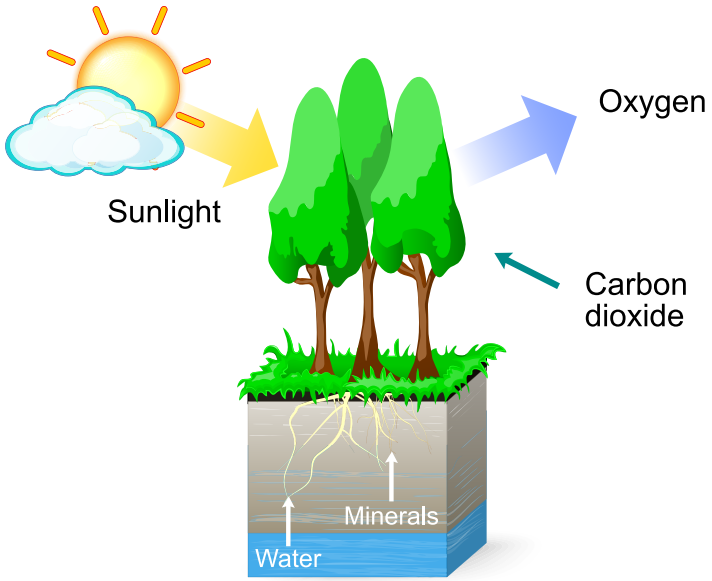
How does photosynthesis work?

1. The roots of the plant absorb water and mineral salts from the soil. These substances are mixed and form the raw sap, which rises through the conductive vessels of the root and the stem.
2. Leaves absorb carbon dioxide and sunlight. The cells' chlorophyll, responsible for the plants' green colour, captures the energy of sunlight.
3. On the leaves, raw sap is mixed with carbon dioxide and sunlight. This is how glucose or processed sap is created, the plant's fuel that is distributed to all its parts.
4. As a consequence of photosynthesis, the plant releases oxygen and water vapour into the atmosphere.

Shadows:

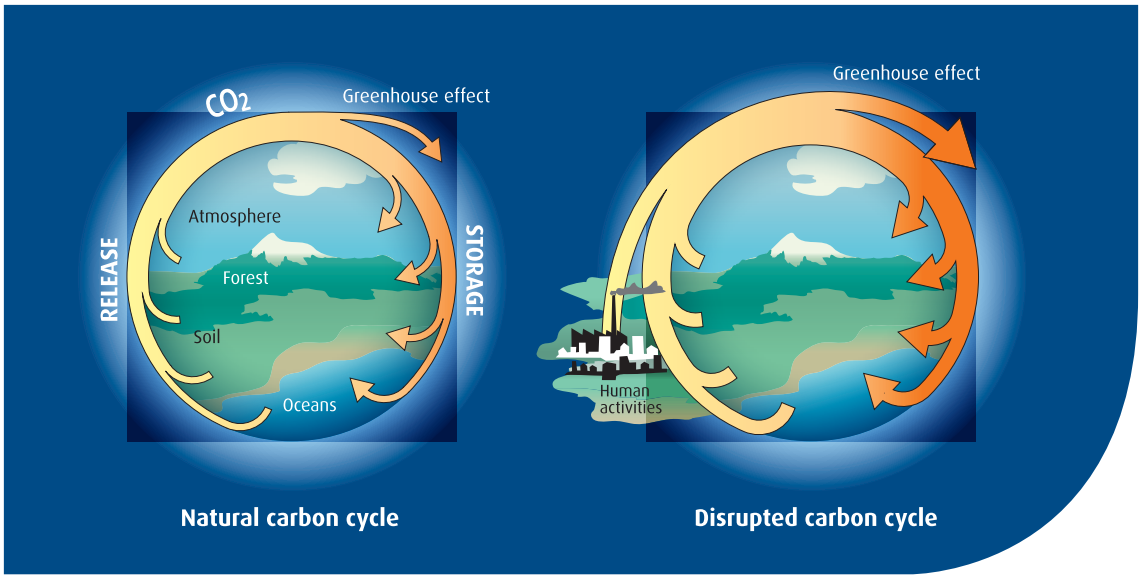
Light spreads in a straight line. Opaque objects do not allow light to go through them. So when it stumbles upon an opaque object, light bounces and, wherever it hasn't been able to reach, shadows are created. The shaded areas allow us to be outdoors without sun rays coming directly at us. Placing ourselves in a shaded area is a good protective measure against the sun, especially in the middle of the day when its rays are strongest. The shadows from trees are ideal because they protect us from the sun while still allowing air to go through between their leaves.

The greenhouse effect:



You have probably heard about global warming or climate change. These phenomena are direct consequences of the greenhouse effect, which is why it is important to look at it closely.

As you know, the Earth's atmosphere is composed of various gases. These gases, together with the clouds, create a filter for solar radiation, allowing only a portion of this radiation to reach the Earth's surface. Once the Earth has warmed up, it returns part of this radiation into the atmosphere. Another part of this radiation is retained by greenhouse gases (carbon dioxide, methane, water vapour...), causing the Earth's temperature to rise. This phenomenon is the greenhouse effect and it is a natural part of life.



So, if it is a natural phenomenon, why does it have negative consequences?

Humans have broken the natural balance of greenhouse gases by emitting CO2 into the atmosphere in an uncontrolled way. Polluting activities are generally related to the burning of fossil fuels and include:

- Electricity consumption.
- Transportation.
- Heating.
- Air conditioning.
- Deforestation.

Sustainability of the planet

Characteristic of the development that ensures the needs of the present without compromising the needs of future generations.

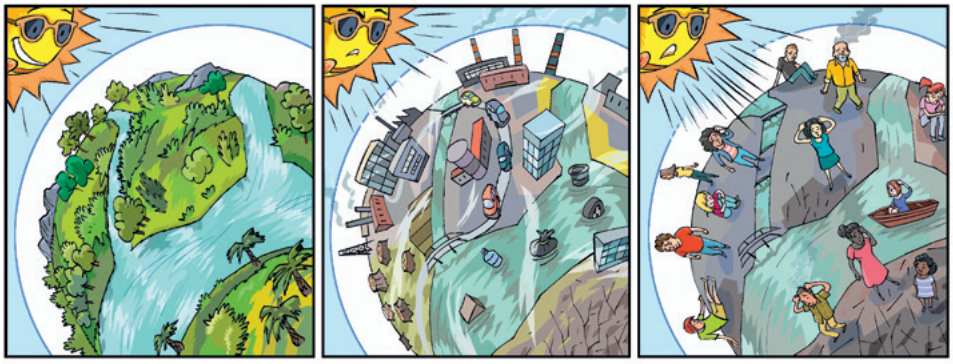
To avoid the imbalance of the greenhouse effect, many countries on the planet gathered in Kyoto (Japan) in 1997, where they committed to a series of measures that would have as a main consequence the reduction of polluting greenhouse gases in the atmosphere. According to some calculations, it is expected that the surface temperature of the planet will increase between 1.4 and 5.8ºC by 2100, although winters are expected to be colder and more violent. This is what is known as "global warming". The treaty not only involved the commitment to reduce greenhouse gas emissions, but also promoted sustainable development, by which to foster the use of alternative energy sources and thus gradually reduce the Earth's warming.

What can you do to contribute to the sustainability of the planet?

- Recycle.
- Shower instead of taking a bath.
- Do not leave the mobile charger plugged in if you are not charging your phone.
- Do not overheat your home more than necessary.
- Use public transport or non-polluting transports, such as bicycles.
- Collaborate with reforestation projects in your area or plant your own plants.
- Turn off electrical lights or appliances at home when not in use.

Activities

Activity 1. **Comic: Lux presentation**



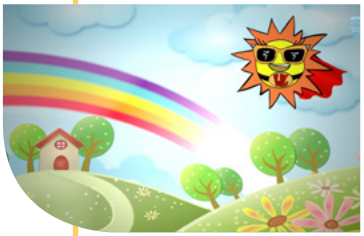
Discuss with the students:

- Who is Lux?
- How does Lux sneak in?
- Where does Lux go through to get here?
- What happens when Lux sneaks in?
- What is the ozone layer?
- What is the ozone layer for?

Draw Lux in the students' workbook.

Resources: Comic n.1 in digital format. Activity workbook.

Activity 2. **Video: The sun**



Play the video "The sun" for the students. In this video we present Lux and allow him to tell us about the solar system, the translation and rotation movements of the Earth, the seasons...

Talk to the students about what they already knew, and what they have now learned.

Activity workbook: fill out the activity sheet.

Resources: video Unit 1: solar system, sun and movements. Activity workbook (https://youtu.be/VthU6_qzm_w)

Optional: *flipped classroom* methodology.

Activity 3. **Rotation and translation movements**

- Explain the movements of the Earth.
- Play the video "The Earth and its movements," which explains the movements of rotation and translation.

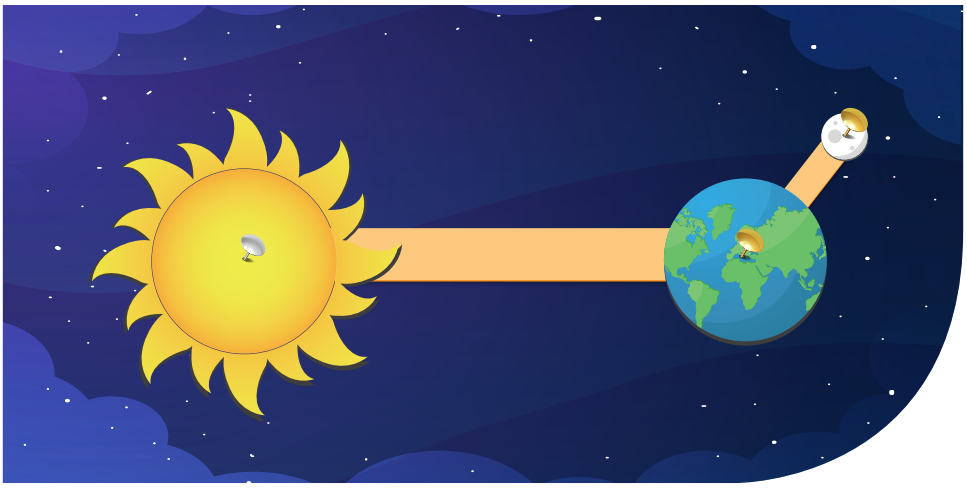
Present a crafting activity in which these movements are represented along with the relationship between the Sun, the Earth and the Moon.

How do we do it:

- We draw and paint the Sun, the Earth and the Moon.
- We paste them on a piece of card, to give them stiffness, and cut them out.
- We cut some strips of card, make holes in them and join them together with the bookbinders.

Resources: Video "The Earth and its movements" (https://youtu.be/th79sDCAh0Q).

Materials: multi-coloured card, bookbinders, scissors, paint.



Activity 4. **Solar energy**

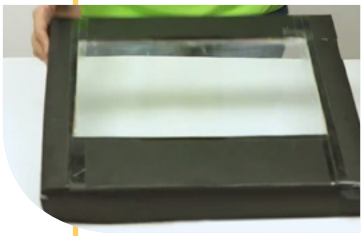
Play the video on the creation of solar energy. Discuss it with the students, asking questions about:

- Kinds of solar energy.
- Places where it is used.
- What it is used for.
- Why it is being used more and more.

Create a solar oven:

1. Place a cardboard box inside a larger one. Make sure there is a gap of at least 2.5 cm all around and fill it with pieces of newspaper, which will serve as an insulator.
2. Line the inside of the smallest box with black cardboard to absorb heat.

3. Cover each top flap of the cardboard box with a reflective material such as aluminum foil. Make sure it stays flat around the reflector and correct any wrinkle or fold. Secure the material with glue or tape on one side of each reflector (mirror).



4. Secure each flap-reflector at an angle of 45°. The safest and easiest way to do so is by joining the flaps-reflectors at the widened upper corners (for example, adding foil lids for joining the corners).

5. Place the oven in full sunlight, fill the smallest box with food (cheese to melt, marshmallows, chocolate...) and wait for it to cook. It is better to cook the food in jars or in a pot, as small and dark as possible. Experiment with the cooking times and by changing the location and way of positioning the box. You will probably need to move the box several times while cooking in order to receive enough sunlight.

Resources: "Solar energy" video (https://youtu.be/8N80h94pVas).

Materials for the solar oven: two cardboard boxes (one must fit inside the other), foil, black card, newspaper, glue, tape, scissors, black pot or jars, food to be heated.

Activity 5. **Colour and heat**

With stones: The students paint two stones, one black and one white. They measure the temperature of each one and then leave them in the sun. Measure the temperature once again 15 minutes later and discuss the results.

Alternative with bottles: The students paint two bottles, one in white and one in black. Then they place a balloon covering the mouth of each bottle and leave them in the sun. After half an hour, notice that the balloon of the bottle painted in black is more inflated than that of the white bottle and discuss the results of the experiment.

Materials: Video with description of the experiment (https://youtu.be/5fI-Kiqjkqs). Stones, thermometer, black and white paint, brushes, water bottles, balloons.

Activity 6. **Measuring shadows**

Stand in the sun at three different moments of the day (early in the morning, at midday and, if possible, in the afternoon or shortly before leaving), and observe how our shadow is reflected according to the time.

A fixed location is chosen in the playground where 2 or 3 students are to stand. The rest of the class draws (with chalk or on paper roll that's fixed to the ground with tape) the shadow of the students located in the sun, projected during the three moments of exposure.

Observe and discuss how the shadow changes location and size as the hours of the day go by.

Resources: chalk, continuous paper, pencil, measuring tape and, as a physical space, the playground.

Activity 7. **Myths about the sun**

Read the story "Why has the sun never married?". The students can look for other myths and legends in which the sun intervenes and, in the next session, they can write a new story in which the different characteristics of the Sun presented in these stories come once again into play.

Resources: story "Why has the sun never married?", adaptation of a Bulgarian legend (https://www.mundoprimaria.com/mitos-y-leyendas-para-ninos/sol-nunca-se-ha-casado/).

Activity 8. **Viking compass**

Create a Viking compass. "Mysteries of history" (MONTENA), Georgia Costa, p. 104 and 105.

"In 1948, a group of archaeologists discovered a wooden disc fragment with strange markings in a monastery in Greenland. The markings on the disc didn't

appear to be natural scratches, they could in fact be used to define the position of the Sun. Apparently, the Vikings were not only great warriors, they also invented a kind of primitive compass to help guide themselves in their journeys".

Resources: To make a Viking Sundial you need:

- A sheet/plate of wood or plastic, as long as it's hard and flat.
- A nail or pin.
- A pencil.
- Sunlight.
- Patience.

Carefully cut the wood or plastic to give it a circular shape. Then place a nail in its centre, making sure the tip points upwards perpendicularly.

Place your homemade compass somewhere sunny and mark the position of the nail's shadow throughout the day. Once you've made a few markings, join them with a line: the point where the shadow passes closest to the nail indicates where the North is. Etch another line that goes from the base of the key to this point. If you are ever lost in the middle of the sea, all you need to do is place your solar compass in a flat spot and turn it until the shadow touches the curved line. Then, you will look for the second line that you have marked, which goes from the key to the point where the shadow is closest: that is where North is."

Activity 9. **The sun's rays**

Play the video or explain to the students the experiment of burning a paper with the help of a magnifying glass. You can paint a piece of black paper and see how it burns long before the white.

Then you can perform the experiment of burning a paper or blowing up a balloon using a magnifying glass. It's important to explain the dangers of the magnifying glass effect, both for the skin and in the prevention of fires.

Resources: paper, pencil, magnifying glass, balloon. Video of the experiment in which a piece of paper burns under a magnifying glass (https://youtu.be/GYYf7ihQHEw).

Activity 10. **Photosynthesis**

Once the video with photosynthesis' technical information has been played, we will ask our students to produce a lap-book about this topic.

Description of the *lap-book* methodology:

- ➔ It's an expandable cardboard support that is used to present a theme. There are different templates.
- ➔ Inside it, you can incorporate photos, stickers, labels, envelopes with information inside of them, flaps, drawings or diagrams.

Once finished, each student can then present their *lap-books* to the rest of the class.

Activity 11. **Architecture and the sun**

Students will see videos that explain the close relationship between certain architectural works and the sun. This should give way to a lively discussion about them, after which they will design a building that takes advantage of the sun's many benefits.

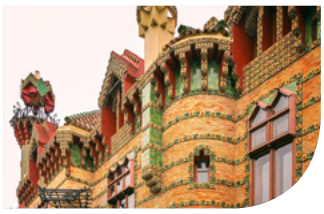
Resources: videos about different buildings, "Heliodome" (http://fahrenheitmagazine.com/conciencia/heliodome-una-casa-bioclimatica/) y "Walkie Talkie" (https://elpais.com/sociedad/2013/09/06/actualidad/1378497960_813562.html).

Activity 12. **Gaudí and light**

Light was something that always worried Gaudí. Despite living at the beginning of the 20th century and not having great technological advances, renowned architect Antoni Gaudí knew how to equip his buildings with great luminosity through materials, volumes and colors.

Casa Milà, for example, is a wavy building that's full of corners. When lit by the sun, it makes one wonder if it really is a piece of architecture or rather more like a sculptural work. Gaudí used to say that architecture's purpose was to put light in order, whereas sculpture's purpose was to play with it. He considered the sun to be the best painter. And since the light changes according to the time, his works also changed colors and shades with it.

Stained glass windows, skylights, walls of fantastic shapes, edges and corners that were able to maintain natural and uniform lighting throughout the day... Gaudí found many and innovative ways to take advantage of sunlight. Thanks to the way he laid out his materials, his study of natural light sources and knowledge of chromatic tones, Gaudí made every work shine with a light of its own.



Read aloud with the students. Look up in the dictionary any unfamiliar words, especially if related to light.

Discuss with the students:

- Do you know any work by Gaudí?
- Have you visited any of Gaudí's works?

Search for images of Gaudí's different works and investigate their creation and process. Discover the purpose of light in these spaces.

Split the class into teams, and propose that each group invents a sculpture or building where light is capable of:

- Changing the color of the objects.
- Illuminate areas without electric light.
- Warm up a room in winter, or keep a space cool.
- Carry out any other special purpose.

Resources: text about Gaudí and the light.

Information and images about the works of Gaudí that we can search online.

Learning assessment

At the end of the unit, you will find a rubric in the workbook where the students can record the level of knowledge acquired.

Some ideas for the rubric:

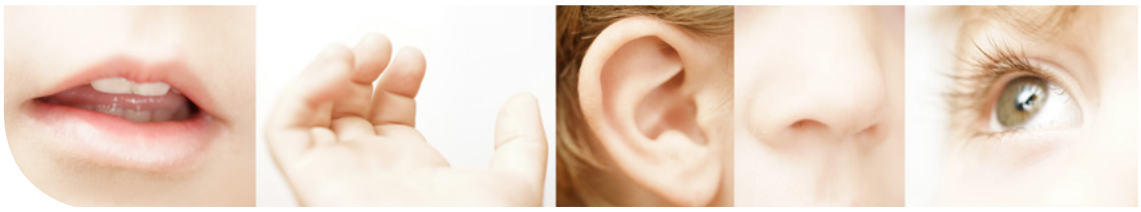
- I know about the solar system.
- I know what and where the sun is.
- I know about the rotation movement and its effects.
- I know about the translation movement and its effects.
- I know about the seasons and how the sun affects them.
- I know about the photosynthesis process and its relationship with the sun.
- I know about shadows and their relationship with the sun.
- I know about the greenhouse effect and its relationship with the sun, as well as its consequences.
- I know about the concept of sustainability of the planet and its importance.

The skin

In this unit, we will study and learn more about our skin, our body's biggest organ, which is also responsible for our sense of touch. We will also discover what phototypes are and how food can influence our skin's health.

Human beings and animals relate to our environment and to other living beings thanks to the senses. The senses are mechanisms that the body uses to collect external information and help us perceive what is happening around us. Each sense has a main sensory organ, responsible for capturing different types of stimuli: images, sounds, smells, flavours or changes in temperature, among others.

Human beings have five senses



How do we perceive things?

When one of our senses experiences a stimulus or a sensation (feels), our brain interprets this information (perceives) and produces an answer.

Sensory receptors, nerve cells that are found in the organs of the senses, capture the external stimuli. These stimuli are transformed into signals or impulses that are transmitted to the brain through the nerves.

The brain interprets this information and formulates a response, which it sends through our nerves to the appropriate organs (called effectors).

The organs execute the answer.

Touch

Touch is the sense that allows us to capture various types of stimuli, such as changes in temperature and pressure, the softness or roughness of a material or even pain.

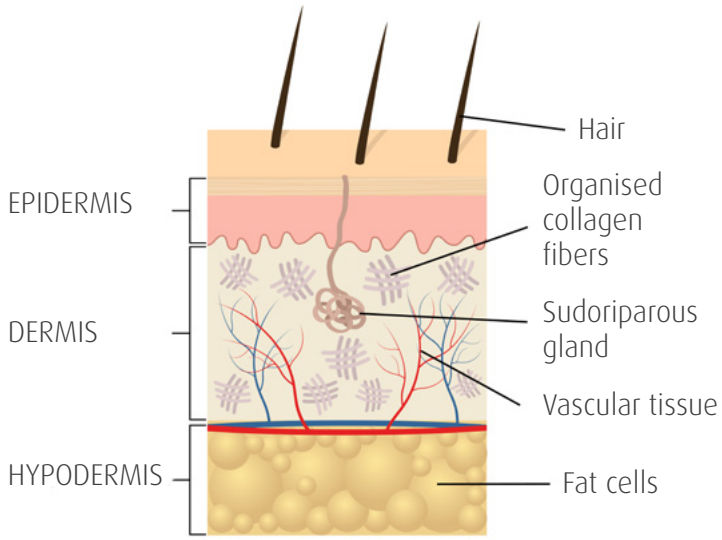
The organ in charge of our sense of touch is the skin, a membrane that covers our entire body and is covered by specialised sensory receptors.

To help the skin stay young and in good condition to resist sunlight, it is important to have a healthy and varied diet. Foods rich in antioxidants are particularly helpful, and basically consist of those with large doses of vitamins A, C and E. These types of foods help the body in many ways, such as by:

- Reducing inflammation.
- Reinforcing the immune system.
- Rejuvenating the skin's appearance.
- Reducing the risk of cancer.
- Offering cardiovascular protection.
- Supporting ocular tissues.

This organ is made up of different layers:

Epidermis: the outer layer of the skin that protects the body.
Dermis: the part of the skin where blood cells, hairs and sweat glands are located.
Hypodermis: the inner layer that connects the skin with muscles and bones.



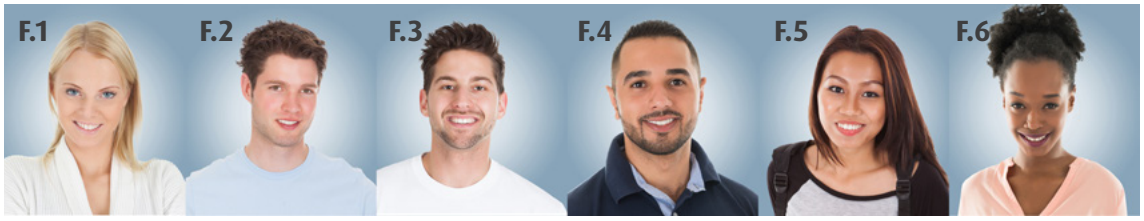
How does our sense of touch work?

The receptors inside the dermis capture everything that comes into contact with our skin, even the temperature and movement of the air, and send the signals through the nerves and the spinal cord to our brain.

The brain formulates an answer.

What are phototypes?

A phototype determines a skin's reaction capacity to solar radiation. There are 6 different phototypes that range from very white skins (phototype 1), which are easily burned and never tan, to very dark skins (phototype 6) that are always dark-brown or black and never burn.



When we go out in the sun, our organism synthesises melanin, which is a brown pigment that is in the skin and absorbs the sun's radiation (that's why we tan). People with low phototypes must be more careful with the sun because the amount of melanin they produce is low, which means they do not tan and burn more easily

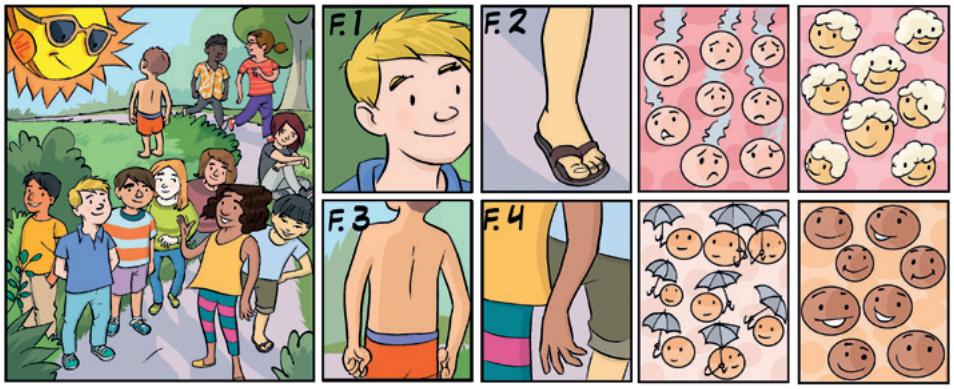
The importance of food. Hydration and antioxidants.

The heat that the sun emits causes the water in our skin to evaporate and produces dehydration, so it is essential to rehydrate and drink water often, especially when performing outdoor sports activities.

In addition, the sun is a powerful oxidant and to counteract its negative effects it is advisable to consume a varied diet. Fruits and vegetables contain many vitamins and substances with antioxidant properties that vary depending on the color. One of the main antioxidants that has protective effects against the sun is beta-carotene, an orange pigment found in fruits such as peach or in vegetables such as carrots.

Activities

Activity 1. **Comic**



In these strips we can see children with different skin phototypes. For example, the blond boy with the blue shirt has a phototype 1 (F1) and the dark-skinned boy with the yellow shirt has a phototype 4 (F.4). The cells in their skin have different behaviors and needs: for example, skin cells with phototype 1 are easily damaged after sun exposure. Cells from phototypes 2 and 3 still need protection from the sun by staying in the shade or using sunscreen so that there is no excessive damage. On the other hand, skin cells from phototype 4 usually have a better reaction to the sun.

Discuss with the students:

- ➔ What are these little faces?
- ➔ Why is Lux observing them?
- ➔ What do their expressions mean?
- ➔ Why are they different colours?

Draw the differents kinds of skin cells and fill speech bubbles with phrases they could say.

Resources: Comic 2 in digital format. Workbook.

Activity 2. **Video: The skin**

Play the video "The skin" to the students. In it, Lux talks about our skin as an organ, as well as our sense of touch, antioxidant food, and the different phototypes...

Talk to the students about what they already knew, and what they have now learned.

Workbook: fill out the activity sheet.

Recursos: video Unit 2: The skin. Workbook. (https://youtu.be/v9mGD9NEuas)

Activity 3. **Humanae Project**

Tell the students about the Humanae project:

Angélica Dass is a Brazilian artist who lives and works in Madrid. She has been acclaimed internationally for her Humanae project, a collection of portraits that reveal the true beauty of human colour. The project has been presented in numerous exhibitions and conferences in all continents. Through her participation in TED Global (Vancouver, 2016), the main message of the project has managed to reach a very large audience in different parts of the world. Dass holds a degree in Fine Arts from UFRJ (Brazil) and has completed a Master's Degree in Photography at EFTI (Spain). In 2014 she was selected by Time Magazine as one of the nine Brazilian photographers to follow.

Based on this project, students can draw a self-portrait and paint it as closely as possible to their skin tone. Then an exhibition can be organised to showcase all the self-portraits.

Resources: official website of the Humanae project (http://humanae.tumblr.com/about).

Materials for the activity: Paper roll and sheets, drawing and painting materials.

Activity 4. **Phototypes**

Classify all the students in the classroom according to their phototype.

Make a mural with the students' photos.

Involve the entire educational community (teacher, families, non-teaching staff...) to participate in the classification with their own photos.

Materials: paper roll, photos.

Activity 5. **Who is who?**

With the students, make a homemade version of the "Who's who?" game including either their own pictures or those of famous characters from their favorite series/films. The goal is to observe the skin, eyes and hair characteristics from the people in the different pictures and use them to identify their different phototypes.

Materials: photographs, card, scissors, glue...

Activity 6. **Knowing our skin**

Play the video "People with a unique skin colour" (https://youtu.be/V-0dvJ-UiJc) to the students, where several models that have attracted a great deal of attention for being different are presented.

Afterwards, the students are split into pairs. The exercise consists in observing each other's arms, face and neck, and fill in the workbook sheet in order to study the different stains and marks on our skin.

Resources: teacher's theory. YouTube video (https://youtu.be/V-0dvJ-UiJc).

Materials: workbook sheet with the different characteristics (location, type: freckle, mole or scar, colour, size and number).

Activity 7. **Aging**

The students will look for images of people of different ages and phototypes in magazines that can be brought from home, and with them, will make a mural classifying them by age. They will also be asked to provide a current picture of themselves.

Activity suggestion: It would be interesting to find images of the same people throughout their lives to be able to observe the differences between them according to the age with which they appear in the images (actors, politicians, well-known characters...).

The students are to observe the characteristics and the changes that the skin undergoes with the passing of time: wrinkles, moles, changes of color, loss of elasticity, etc.

Then, it is time for them to work with their own photo. We advise for it to be a size A4 or similar. Place a sheet of tracing paper on it and draw the wrinkles and changes that may appear during its aging process.

Resources: teacher's theory.

Materials: magazines, photographs, tracing paper, paint/pens.

Activity 8. **Matching textures**

Students are to create a card game of different textures. This can be achieved by sticking glass paper of different weights, fabrics, plastics, sand and threads to the cards.

Including many similar textures will make the activity more challenging, because students will have to match them while blindfolded.

They can play in small groups or individually and make a set to take home.

Materials: cards, glass paper of different weights, fabrics, plastics, sand, threads, etc.

Activity 9. **Discovering an intruder through touch**

Split the classroom into groups of four. In each of them, one student is blindfolded and asked to touch the arms of two of his/her companions, trying to memorise the characteristics of their skin. When the game begins, he/she is to touch the skin of the three companions in order to identify the third one whose skin he/she has never felt before – that's the intruder.

The activity is done in turns so that everyone can participate.

Materials: a blindfold.

Learning assessment

At the end of the unit, you will find a rubric in the workbook where the students can record the level of knowledge acquired.

Some ideas for the rubric:

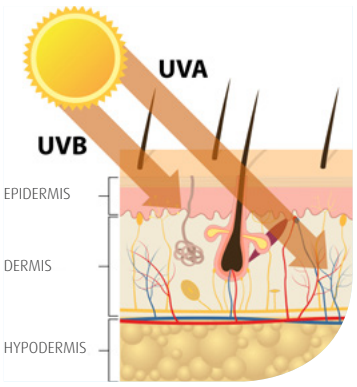
- I know about the sense of touch.
- I know about the skin and its components, the main organ associated with the sense of touch.
- I know how the skin works.
- I know about phototypes and the characteristics we use to classify them.
- I know about the importance of antioxidant foods and what these are.

Positive and negative effects of the sun

In this unit we will learn about the positive and negative effects of the sun and how to measure the radiations that affect the Earth. We will see how these relate to vitamin D and to the appearance of certain diseases of the skin.

How is solar radiation measured? What do UVI, UVA and UVB stand for?

The ultraviolet index, UVI, measures the intensity of ultraviolet radiation that reaches the surface of the Earth.



UVB radiation is only able to penetrate the epidermis. When UVB radiation affects our skin it stimulates melanin synthesis in melanocytes. Melanocytes pass this melanin to the keratinocytes to defend them from UV radiation. It causes a slower and lasting tanning of the skin, but it can cause redness and burns.

UVA radiation penetrates the entire dermis, and accounts for 95% of the ultraviolet radiation received (this type of radiations can go through clouds and glass). It generates an instant tan as well as a slower, more lasting one. It's known for causing sun allergies, stains and aging of the skin.

The combination of these two radiations is the main cause of the appearance of melanoma and other skin cancers such as basal cell carcinoma and squamous cell carcinoma.

Positive effects of the sun

The Sun is essential to life on Earth. In the human body, moderate exposure to ultraviolet radiation triggers multiple biological and biochemical reactions that positively affect our health.

Endorphins are substances that are produced by some organs of the body in front of situations of excitement, pain or infatuation. They also occur in response to certain external stimuli, such as spicy foods or chocolate, and also when exposed to the sun. **They provide a feeling of well-being and analgesia, which is the disappearance of any sensation of pain**.

In addition, the sun is a fundamental **source of vitamin D** for humans. In fact, a lack of vitamin D has been linked to many diseases and also plays an important role in the predisposition to infections and some cancers.

Our regular diet can only provide a portion of the recommended daily requirement of this vitamin. We can get vitamin D from some foods such as blue fish, milk or eggs. But sun exposure is what allows our body to synthesize the remaining vitamin D, in fact it is the direct action of ultraviolet B radiation on our skin that causes it to produce vitamin D. Vitamine D is essential for the correct function of the muscular system and the growth and strength of our bones. However, recent studies show that this vitamin can play an important role in other ways, playing a role in protecting the body from certain diseases such as diabetes, hypertension, and various tumors and infections.

Keep in mind that not all people produce the same amount of vitamin D on the skin. Dark-skinned people need 6 to 10 times more sun exposure time than their fair-skinned counterparts to obtain the same levels of vitamin D.

Finally, it has recently been shown that exposure to the sun **helps regulate our circulatory system by acting favourably on blood pressure**.

Negative effects for our health

Despite its beneficial effects, exposure to solar radiation is not a risk-free practice, especially if the recommended limits are exceeded. Excessive exposure to ultraviolet radiation can lead to short- and long-term effects, especially for the skin and eyes, which are the most exposed organs.

The most frequent **acute effects** are skin and eye burns (keratitis and conjunctivitis). The immune system can also be affected, reducing the natural defenses of the skin and increasing the risk of infections, as well as the appearance of herpes and allergic reactions. Sunburns or skin reddening caused by the sun may seem just a temporary irritation, but in reality can cause lifelong lasting damage. In fact, sunburns that occur in childhood or adolescence increase the risk of skin cancer in adulthood. That's why it is said that "the skin has a memory".

The chronic effects of the sun include skin cancer and premature skin aging, and in the case of the eyes, the development of cataracts and retinal macular degeneration.

Skin cancer is the most frequent tumour in the human body. Its incidence increases year after year at a rate higher than that of any other malignant tumor and, given the current solar exposure habits of the population, there's no reason to expect this growth rate to slow down in the coming years.



According to the World Health Organization:

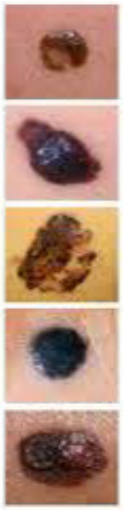
- The number of skin cancers has doubled since the beginning of the 80s.
- 2 to 3 million new non-melanoma skin cancers are diagnosed per year.
- 66,000 people die every year around the world due to melanoma.

The sun produces cancer on our skin through two mechanisms: it diminishes its defenses and induces modifications in the genes of our skin cells.

There are numerous types of skin cancer, but there are three more frequent variants (more than 90% of the total): basal cell carcinoma and squamous cell carcinoma, derived from keratinocytes, are the most common and have locoregional aggressiveness; malignant melanoma, a tumor derived from melanocytes, is much less frequent but even more aggressive, with the ability to spread and cause damage to other parts of the body and endanger the patient's life.

We use the **ABCDE** rule to detect melanomas. When we look at a mole, we have to keep in mind if its shape has changed, if it is different from the rest, if it has different colours, if it bleeds or itches, if it's like a wound that doesn't seem to heal, or if it keeps growing progressively.

Finally, sun exposure in high temperature days can produce a so-called heatstroke. It's a dangerous phenomenon in which the body temperature exceeds 40º and from which it is also necessary to protect oneself.



Asymmetry
Asymmetric

Border
Irregular border

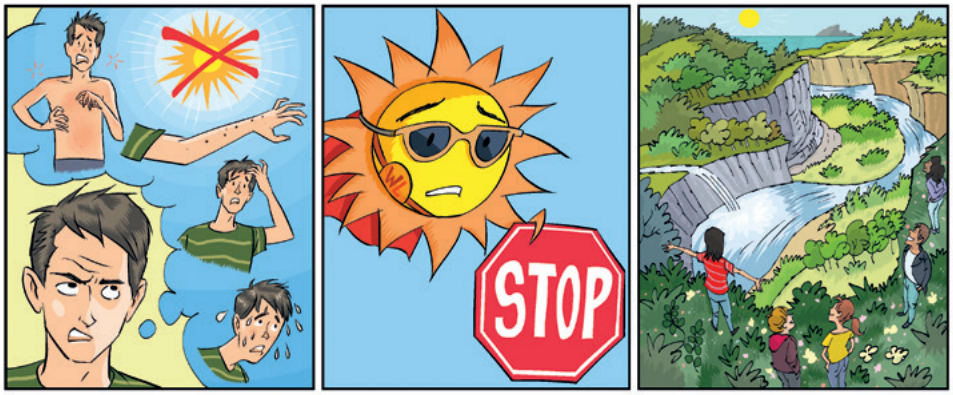
Colour
Non-uniform colour

Diameter
greater than 6 mm

Evolution

Activities

Activity 1. **Comic**



Discuss with the students:

- What are the effects of the sun?
- What are the negative effects of the sun?
- What are the positive effects of the sun?
- Did you already know all these effects?
- Which ones do you think are more important? Why?

Ask students to fill the workbook's positive and negative effects table and draw the one they think influences or affects them most.

Resources: Comic 3 in digital format. Workbook.

Activity 2. **Video: "Positive and negative effects of the sun"**

Play the video "Positive and negative effects of the sun" to the students. In this video, Lux explains the positive and negative effects of the sun on our planet.

Talk to the students about what they already knew, and what they have now learned.

Workbook: fill out the activity sheet.

Resources: video Unit 3: "Positive and negative effects of the sun." Workbook. (https://youtu.be/NkVFMgftfdE).

Activity 3. **Tanning through history**

Let's look at how the perception of tanned skin has evolved throughout recent history. Show illustrations with the different uses that have been given to the sun throughout history, according to the fashion or customs of the time. Students can give their opinion on what they think is happening in every illustration. Once everyone has had the chance to participate in the debate, the accompanying texts can be revealed, but out of order. The next task can be carried out in the workbook, and consists in uniting each paragraph to its corresponding illustration.

Resources: digital images and workbook.

Throughout history, having fair skin was considered a symbol of distinction among the upper classes, the aristocracy and the royal families. That's where the term "blue blood" comes from, which refers to having a skin so pale that blue veins can be seen through it.

In contrast, the lower classes usually had darker skin for most of the year, mainly because most work was carried out outdoors and under the sun without wearing any protection. This prevented tanning from being too popular.

In the early twentieth century, scientific research revealed the many benefits of the sun on human health. Thus, sun therapies started to get prescribed, consisting in taking so-called "sun ray baths" to combat diseases such as anemia or depression, and strengthen bones. In spite of the benefits that the sun brought, high society members continued to resist tanned skin, as it was still a symbol of either belonging to the lower classes or being treated for some kind of illness.

But there came a time when it was decided that being pale was no longer attractive. And among the most exclusive circles, tanned skin became fashionable as something not only healthy but also attractive. One of the culprits of this change in fashion was the seamstress and designer Coco Chanel. After having spent a holiday on board a cruise through the Mediterranean, she returned to Paris with skin bronzed by the sun.

Coco was a true trend-setter of the time and everything she did, said or designed spread like wildfire from one day to the next. This caused legions of her fans to imitate her tan straight away, and for the look to spread amongst the elite

Activity 4. **UV Index**

Make a chart with UVI data from different countries or cities around the world such as Spain, Finland, Australia, Mexico and Algeria.

We'll teach the students about the UV Index and help them consult several websites such as that of the AEMET (http://www.aemet.es/es/eltiempo/prediccion/radiacionuv/ayuda y http://sunburnmap.com/es/).

Students will consult the UV index each month or each season of the year at the same time of day and make a note of the data in a table in order to make a graph of the whole year.

Resources: http://sunburnmap.com/es/
http://www.aemet.es/es/eltiempo/observacion/radiacion/ultravioleta?datos=mapa

Activity 5. **Experts**

Once the different positive and negative effects of the sun have been learned, students will conduct a group research activity by choosing one of the effects and performing a mural, lapbook, video or presentation and thus become true experts on the chosen topic. Later they will present it to the rest of the class so everyone

can share the acquired knowledge and learn even more about the positive and negative effects of the sun.

Materials: computers, websites, cards and photographs.

Activity 6. **Aging workshop**

The New England Journal of Medicine published in the 2012 a striking image in which you could see the effect of the sun on the left side of a trucker's face who, for almost thirty years, had exposed it to the UVA rays coming in through the window of his vehicle.

Comparative images of how the sun ages the skin are shown to the students. A debate follows on how the sun affects the skin. Then they will work on two photos of themselves, enlarged to A4 size. First, they will depict the effects of natural aging on one of the pictures by drawing wrinkles on it. In the second picture, the goal will be to depict the effects of excessive sun exposure.

Recursos: Two A4-sized photographs of each pupil.

Study about aging in twins / Dr. Bahman Guyuron *The New England Journal of Medicine*

Activity 7. **The myths of the sun, true or false**

In this activity, different myths and fake news related to the positive and negative effects of the sun will be presented and the students will have to determine whether they are "true or false."

Myths:

➔ You can't get burned on a cloudy day.

FALSE. Even if the clouds cover the sun, ultraviolet radiation still goes through them and is strong enough to damage our skin.

➔ If I'm not hot when I'm in the sun, it means I'm not burning.

FALSE. The heat sensation has nothing to do with the intensity of ultraviolet radiation, which is responsible for burns.

➔ The sun only damages the skin, not the eyes.

FALSE. Ultraviolet radiation can lead to cataracts and other kinds of eye disorders.

➔ The higher the altitude, the greater the risk of getting burned.

TRUE. At higher altitudes, ultraviolet radiation must go through fewer layers of the atmosphere before reaching us, consequently we have a much less powerful barrier against it.

➔ Being in the water keeps you from getting burned.

FALSE. Water dims UV radiation slightly, but it also keeps you cooler, masking the sensation of warmth that can sometimes alert us to a burn.

➔ When shadows are short, the sun is at its most dangerous.

TRUE. When shadows are short it is because the sun is in its highest position, and for that reason solar radiation is more direct and more intense.

➔ The sun is only dangerous in the summer.

FALSE. The intensity of UV radiation depends on other factors that have nothing to do with the season of the year, such as the altitude and latitude of the place in which you are located or the reflection of the light on the ground, which is different in places where the ground is covered with sand (as in the deserts) or snow.

➔ The negative effects of solar burns are cumulative.

TRUE. The skin has a memory. The ability of the human body to protect and repair damages produced in the body by UV radiation decreases throughout life.

➔ Red-haired and fair-skinned people are especially sensitive to UV radiation.

TRUE. People with this combination of skin and hair colour are the most sensitive population group.

Resources: Workbook.

Activity 8. **Flashlight and matches experiment**

Perform this experiment with the students: light a match and hold it at a distance of 10-15 centimeters from the wall. Now turn on the flashlight and face it towards the match: you will see that only the shadows of your hand and the match can be seen on the wall, but not the flame's.

Explanation: fire has no shadow because it does not impede in any way the passage of light through it.

Materials: matches and flashlight.

Learning assessment

At the end of the unit, you will find a rubric in the workbook where the students can record the level of knowledge acquired.

Some ideas for the rubric:

- ➔ I know the definitions of UVI, UVA and UVB and the differences between them.
- ➔ I know about the positive effects of the sun.
- ➔ I know the definition of endorphins.
- ➔ I know the definition of vitamin D.
- ➔ I know about the negative effects of the sun.
- ➔ I know the definitions of sunburn, melanoma and skin cancer.
- ➔ I know about the ABCDE rule to detect melanomas.
- ➔ I know the definition of photo aging.
- ➔ I know the definition of heat stroke.

Photoprotection

In this unit we will learn what photoprotection is and what means we have at our disposal to live with the sun and enjoy its healthy effects without running any risks.

Photoprotection

The term photoprotection refers to all the strategies that help us prevent the damage our skin suffers as a result of exposure to UV radiation.

There are two types of photoprotectors: those provided naturally by our body and the external ones.

Photoprotectors naturally provided by our body are:

- **Sweat.** It regulates body temperature by evaporating upon contact with the air, which decreases our sensation of heat, but also contains a specific substance that coats our skin and acts as a natural sunscreen.

- **Tanning.** Tanning is a defense mechanism caused by an aggression, in this case produced by the sun. The skin tries to defend itself from ultraviolet radiation by synthesising melanin. Melanin is a pigment that is placed on the cells of the epidermis to absorb the ultraviolet radiation and to prevent these cells from being damaged. Melanin is responsible for tanning..

- **Thickening of the skin.** Epidermis cells multiply much faster when exposed to solar radiation continuously. This causes the skin to thicken over the next 4 to 7 days and this deviates up to 5% of the ultraviolet radiation that reaches the skin.

➔ **Hair.** Hair is a great photoprotector. Its level of photoprotection depends on the density and the colour. Black hair offers greater photoprotection than blonde hair, which is in turn more photoprotective than white or grey hair.

On the other hand, there are external measures. These are the actions that we can use to protect the skin from the sun externally.

There are environmental measures aimed at avoiding exposure to radiation and physical measures or photoprotective substances that reduce the effects of the exposure.

The environmental measures are strategies that attempt to reduce or prevent our exposure to ultraviolet radiation. The main goal for these is the conservation of the ozone layer, since ozone in the atmosphere plays an important barrier function absorbing much of the solar radiation.

Other strategies are:

➔ **The creation of shaded areas and spaces**, since this reduces the transmission of direct radiation up to 50-90%, depending on the material that is used.

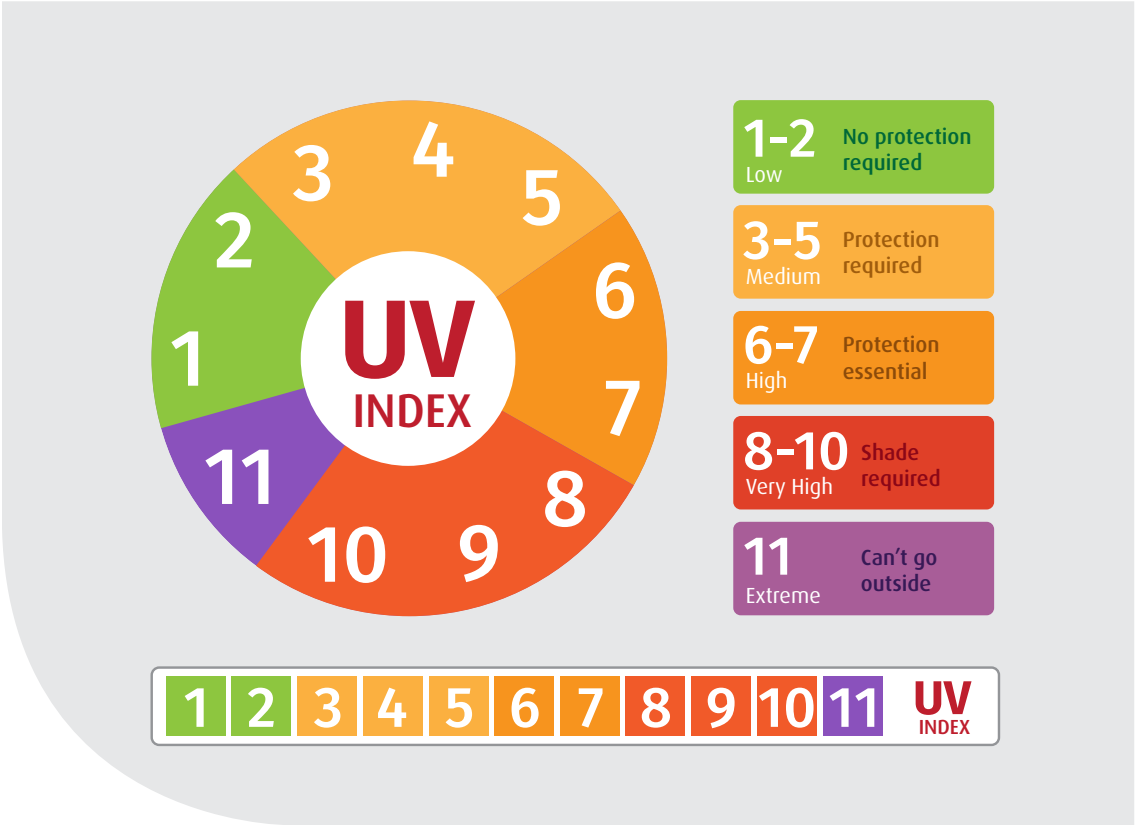
➔ **Leafy vegetation** provides shade of a better quality, since in addition to diminishing radiation and temperature levels, it increases humidity; although the artificial shadows provided by tall buildings are also another valid alternative.

➔ **Glass windows** do not allow UVB radiation to go through, but UVA radiation and visible light still do. That's why they are not able to give adequate photoprotection. On the other hand, cars' tinted windows can filter out most of the UVA radiation as well as visible light.

➔ **On an individual level**, it is more than advisable to avoid the sun at noon, since between 12:00 and 16:00 solar radiation reaches the Earth more perpendicularly and the highest UVI levels of the day are reached.

The UVI will be a good point of reference to know the degree of photoprotection measures to be used in solar exposures.

The UVDerma App from the Piel Sana Foundation informs you of the current UVI and gives you photoprotection advice according to type of skin.



It is also important to avoid exposure to artificial radiation sources, such as sun beds, the ultraviolet radiation emission of which is much higher than solar radiation at noon. Their frequent use before the age of 30 increases the risk of skin melanoma by up to 75%.

Physical photoprotection is composed of all the elements that block the radiation and become a barrier between a person and the sun. These measures are:

- **Clothes**. They are an excellent measure of sun protection. Fabrics protect us mainly from UVB radiation. The different kinds have different ultraviolet protection factors (FPU/UPF) that can be equivalent to the protection of sunscreen lotions. The amount of protection depends on two factors: the design of the garment and the characteristics of the fabric. Thus, garments with loose-fitting designs, in dark colors, using thick fabrics with low stretch and porosity (such as nylon, wool, silk, or polyester) offer greater photoprotection capabilities. Recent studies point out that the photoprotection provided by clothing has more to do with the skin surface covered than with the characteristics of the fabric with which it is made.

The characteristics stated above regarding fabrics and the FPU they provide must also be considered for **parasols**.

➔ **Hats and caps** are a good measure of photoprotection for the head and neck, although it depends on the material and the size of the wing. The proper way to use the caps, with the visor forwards, will ensure optimal sun protection.

➔ **Glasses** form a screen capable of blocking up to 90% of UV radiation. Transparent glass mainly absorbs UVB radiation, but most UVA radiation remains. Darker glass blocks UVA radiation and visible light. The photoprotective efficiency of sunglasses depends on their size, shape and the material with which the lenses are made. It is important that they protect all sides and have a design that covers lower and lateral spaces. It is recommended that the glasses abide by EU regulations. These classify the level of protection of the glasses between 0 and 4. Levels 2 and 3 are suitable for everyday use. Category 4 sunglasses are the most suitable for extreme cases, such as snow or water sports, but are not suitable for driving.

Finally, we will talk about solar filters, which are all those **substances that absorb, reflect or disperse ultraviolet radiation, thus avoiding its penetration of the skin**.

Depending on their form of administration, photoprotectors may be topical or oral.

➔ **Topical photoprotectors are** the most used. They may contain chemical (or organic) filters, physical (or inorganic) filters and biological photoprotectors.

- **Chemical** (organic) filters are substances that penetrate the skin. Once there, they absorb ultraviolet radiation and deactivate it, thus preventing skin damage. They are colourless and the most accepted for their good cosmetics, but they are more likely to cause skin intolerance.

- **Physical** (inorganic) filters are inert powders of mineral origin that act as physical barriers, reflecting and dispersing radiation. Their main disadvantage is their bad cosmetic results, as they tend to give the skin a white-ish look and can stain clothes. At present, they are used in micronised form or combined with absorbent pigments, which give them a more transparent appearance.

- **Biological** photoprotectors are antioxidant compounds that counteract the damage caused by sun radiation in skin cells.

At present, most commercialized sunscreen lotions include a combination of physical, chemical and biological photoprotectors, to provide a greater security and efficiency of the product.

All sunscreens have a number that represents their Solar Protection Factor or SPF. This indicates the amount of protection they offer against UVB radiation. At present it is recommended to use SPF of at least 30. In addition, the photoprotectors must be protected against UVA radiation, which is usually portrayed as the word 'UVA' with a circle around it.

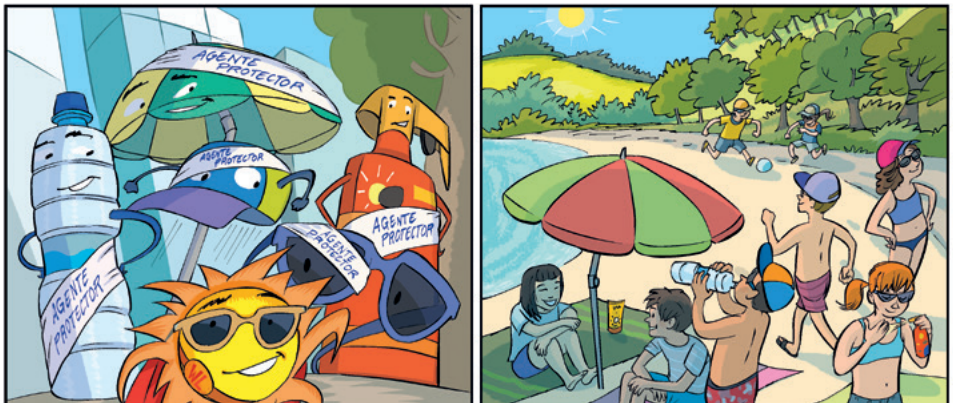
➔ **Oral photoprotectors** are the **natural substances** that act by **neutralising the damage of ultraviolet radiation** in different ways. **They complement topical protectors, but cannot replace them.**

In general, the Mediterranean diet contains foods with a high content of antioxidant substances. Foods rich in lycopene, beta-carotene and vitamin C are excellent antioxidants and skin protectors. Here are some examples of antioxidant foods:

- Tomatoes
- Grapes
- Berries
- Apricots
- Carrots
- Pumpkins
- Citrus fruits
- Spinach
- Watermelon
- Black chocolate

Activities

Activity 1. **Comic**



Discuss with the students

- What are photoprotectors and why are they important?
- Which ones do you know?
- What are they used for?
- How are they used?
- Which ones do you think are the most important? Why?
- Does your whole family use them?

In the workbook, ask students to draw some situations in which photoprotectors are usually used and another common situation in which they are outdoors without using them. Comment on the situations that have been drawn and whether it is correct to have used them or not in these situations.

Resources: Comic 4 in digital format. Workbook.

Activity 2. **Video: "Photoprotectors"**

Play the video "Photoprotectors" to the students. In this video, Lux talks about photoprotectors and then bids us farewell.

Workbook: fill out the activity sheet.

Resources: video Unit 4: "Photoprotectors" and workbook.(https://youtu.be/v9mGD9NEuas)

Activity 3. **Cooking with antioxidants**

Students can cook the following recipe in the classroom or look for recipes with foods that contain antioxidants, and present them in class.

Ingredients:

- A glass of milk.
- 20 strawberries.
- 10 cherries.
- A natural or strawberry yogurt.
- Two teaspoons of sugar or sweeteners.
- Ice

Preparation:

1. Wash the strawberries and cut them into small pieces. Put them in a blender.
2. Wash the cherries, cut them open and discard the bone. Add them to the blender.
3. Add the natural or strawberry yogurt and the glass of milk.

4. Add two teaspoons of sugar and two ice cubes or a little crushed ice.

5. Blend well until you achieve a homogeneous mixture of soft, creamy texture.

6. Pour into a glass and decorate it with a strawberry slice or a mint leaf.

Activity 4. **Sunscreen application workshop**

Start the activity explaining the meaning of the information that appears in sunscreen bottles. Students will be asked to bring sunscreen from home and they will be taught to apply it properly: spreading a thin layer (no need for the skin to be completely covered in white), not forgetting the ears, neck or feet (if they are exposed to the sun) and repeat its application every 2 hours.

Resources: Illustration of places where you need to apply sunscreen, proper application. Illustration with explanation of directions and information on sunscreen bottles (illustration similar to www.labrix.mex and elblogdepills.com).

Activity 5. **Video: UVTATOO**

Students will draw pictures using sunscreen on different parts of the body. With an ultraviolet lamp in a dark room, the drawings will be revealed as if they were tattoos.

Visualize different videos about revealing the effects of sunscreen with ultraviolet light. For example: https://youtu.be/pn7eZtaI8Fg.

Resources: sunscreen and ultraviolet lamp (black light).

Activity 6. **Hat-making workshop**

This activity consists in making newspaper hats.



2º With care, we will place the sheets on the head ensuring that they remain centered around it.

3º Mould the paper sheets to the head by lowering the ends and sticking them with adhesive tape around its outline, from the forehead to the nape of the neck.

4º Once we have created a basic shape, we can remove the hat from the head and give it the appearance we want (cowboy, pamela, etc.). It can be painted and decorated with different accessories (flowers, feathers...).

Families may be invited to the workshop or even, once primary students have become well acquainted with the technique, they can carry out the workshop themselves with younger elementary students.

Materials: newspaper, adhesive tape, scissors and paint (optional).

Activity 7. **The school's shadows**

Students can measure the shadows cast by different elements of the playground. This can be done at different times of the day to identify the hours when the sun is most dangerous. Chalk can be used to mark the measurements on the ground.

It is worth remembering that the smaller the shadow, the stronger the sun will be.

Place signs around the areas where the sun shines longest and indicate the most dangerous hours of the day.

Materials: measuring tape, chalk and signs.

Activity 8. **Team of photoprotection agents**

We become photoprotection experts. Volunteer students can form a team of photoprotection agents for the school.

The functions of this team can be:

- Monitor the students that are in the sun at the least appropriate hours and advise them to stay in the shade.
- Reminding other classmates that they should wear a cap and sunscreen, as well as stay hydrated and in the shade.
- Check the danger signs placed in any outdoor areas and maintain them as needed.
- Inform students of different stages/years of the positive and negative effects of the sun.
- Inform students of different stages/years of the different photoprotective measures available.
- Encourage classmates and reward them with badges or stickers if they have "sun-healthy" behaviours.

Activity 9. **Balloon experiment**

We inflate a balloon and tie a knot on its end. Then we take another balloon, introduce a small amount of tap water (approximately 33cc) into it, inflate it with some air and tie a knot once again the same way.

We light a candle and choose two volunteers, one will take the air balloon and the other will do the same with the water balloon.

We ask the class what they think will happen with either balloon. Once the different theories have been discussed, the volunteer with the air balloon will bring it close to the flame, making it explode. Next, the student with the water balloon will do the same with his, but this time everyone will realise that the balloon, though blackening when in contact with the flame, is not exploding.

The water-filled balloon does not explode because water absorbs a lot of the fire's energy, keeping the balloon cool and causing it to not increase in temperature too much. Water needs this energy to be able to change forms from its liquid state to its gas state.

Discuss and compare this experiment with the importance of staying hydrated in hot weather and when exposed to the sun.

Activity 10. **True and false**

This activity will expose different myths and false information related to sunscreens and photoprotection measures. Students will need to identify which ones are "true" and which ones are "false".

Myths:

➔ The most economical and effective protection against the sun is the shade.

TRUE. The shade protects us from direct sunlight, although we must not forget about diffused radiation.

➔ Tanning protects you from sunburn.

FALSE. Tanning is a skin reaction to UV radiation and only protects us partially from further damage.

➔ We must avoid the sun in summer between 12 and 17h.

TRUE. Due to the higher solar elevation, UV radiation is very high in the central hours of the day

➔ Applying sunscreen before leaving home is enough.

FALSE. Sunscreen must be re-applied every 2-3 hours, depending on the skin type and the intensity of the sun.

➔ Clothes protect me completely from the sun.

FALSE. Clothing protects only whatever body parts are covered; it's also worth remembering that darker clothes are more photoprotective and allow less sunlight to go through them than lighter-coloured clothes do.

➔ A high-factor sunscreen will prevent me from getting tanned.

FALSE. Sunscreen will prevent us from getting burned and will stop damaging sun rays from affecting us. It may take longer for us to tan, but that's because it will happen more progressively.

➔ It is advisable to stay hydrated while exposed to the sun.

TRUE. It is important to combat dehydration not only from the outside, but also from the inside.

Resources: workbook.

Learning assessment

At the end of the unit, you will find a rubric in the workbook where the students can record the level of knowledge acquired.

Some ideas for the rubric:

- ➔ I know the definition of photoprotection.
- ➔ I know about the photoprotectors that our body provides naturally.
- ➔ I know about the external and environmental measures designed to avoid exposure to radiation.
- ➔ I know about the measures we can adopt on an individual level to avoid excess exposure to radiation.
- ➔ I know some sources of artificial radiation.

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