SCHOOL OF STARS
didactic guide

GRANDMOTHER EARTH

5º y 6º de Educación Primaria

planetario de pamplona

FUNDACIÓN CAJANAVARRA

Obra Social "la Caixa"

ACTIVITY 1 *Reading about the Earth*

Read the following text, and then answer the questions

Our planet, the Earth was formed four thousand six hundred million years ago from an immense cloud of dust and gas which span around slowly and began to squeeze together. As the cloud contracted and got smaller, it began to spin faster and faster and the temperature at its centre began to increase. Finally, the centre of the cloud became so hot that it caught fire and a star was born: the Sun.

In the outer parts of the cloud, the dust and gas which was colder began to compress forming rocks. Little by little these rocks, along with the gas that was left began to come together. This is how the planets of our solar system were formed. One of these planets was the Earth.

At that time, the Earth was a very young planet.

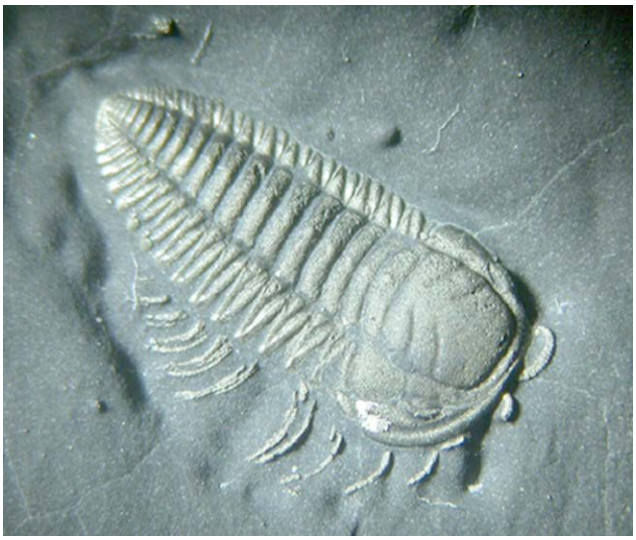
Tenía continentes y océanos situados en lugares diferentes a los de ahora. También tenía atmósfera. Pero ésta no tenía oxígeno, como la que nos rodea actualmente.

However, something was missing. It was all a desert. There was no life.

1. How old is our planet?
2. Where was the Earth formed?
3. Explain the process of its formation.
4. What other planets were formed along with the Earth, from that immense cloud?
5. How old are these seven planets? Remember that they were formed at the same time as the Earth.
6. How was the Sun born?
7. How many stars are there in the solar system?
8. How old is our star?
9. What is the difference between a planet and a star? Remember that the Sun is a star.
10. Out of all the planets in the solar system, which is your favourite?

ACTIVITY 2 *Nature in prehistoric times*

Describe these three elements of nature in prehistoric times. You could look for additional information on the Internet. Is it possible to find any of these animals nowadays?



TRILOBITE

AMMONITE

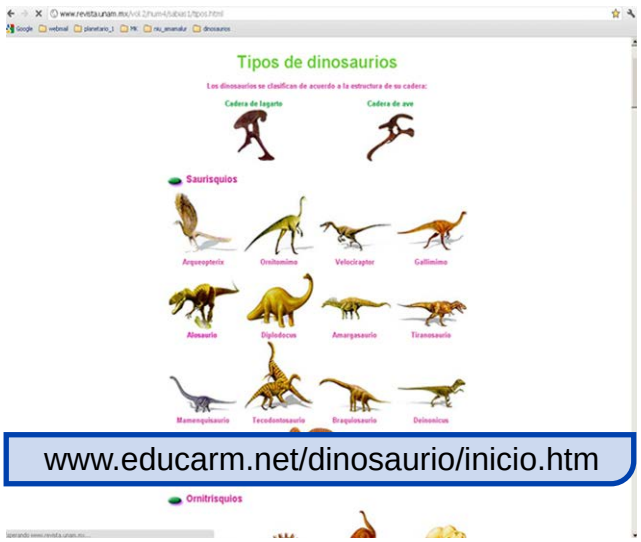
STROMATOLITE

ACTIVITY 3 *Dinosaurs*

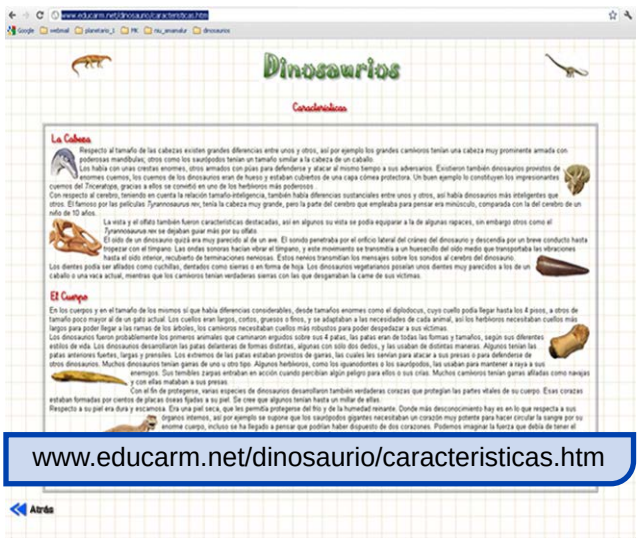
Choose from the following websites the ones that are actually useful to you for answering the questions that appear on the next page

www.dinosaurios-larioja.com

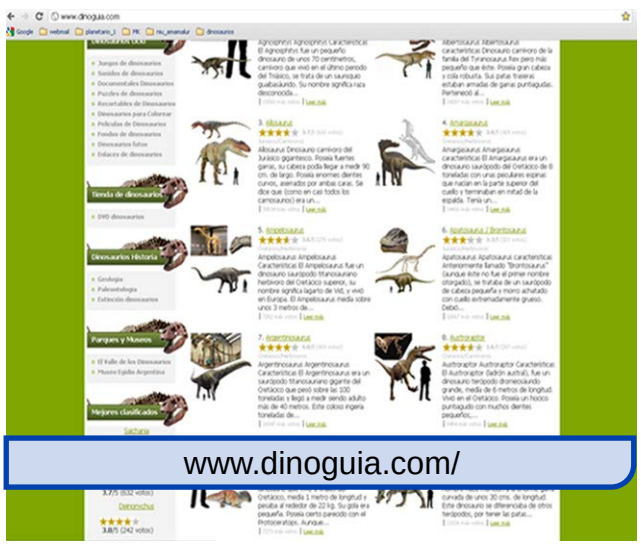
www.osasuna.es



www.educarm.net/dinosaurio/inicio.htm



www.educarm.net/dinosaurio/caracteristicas.htm

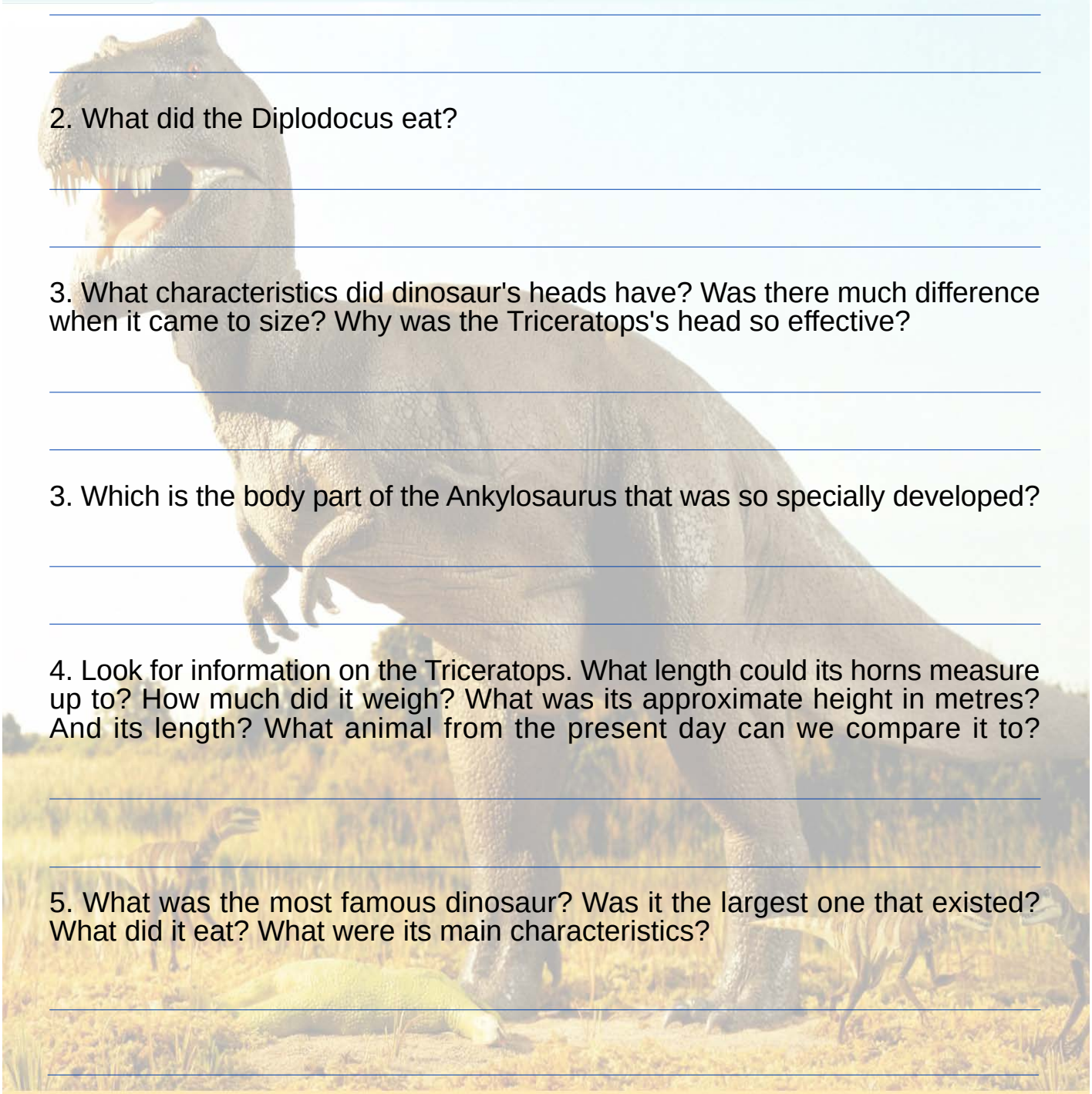


www.dinoguia.com/

www.lanasa.net

ACTIVITY 3 *Dinosaurs*

Answer these dino-questions after you have looked at the websites



1. What is the name of the dinosaur which is considered as the first ever bird? What does its name mean?

2. What did the Diplodocus eat?

3. What characteristics did dinosaur's heads have? Was there much difference when it came to size? Why was the Triceratops's head so effective?

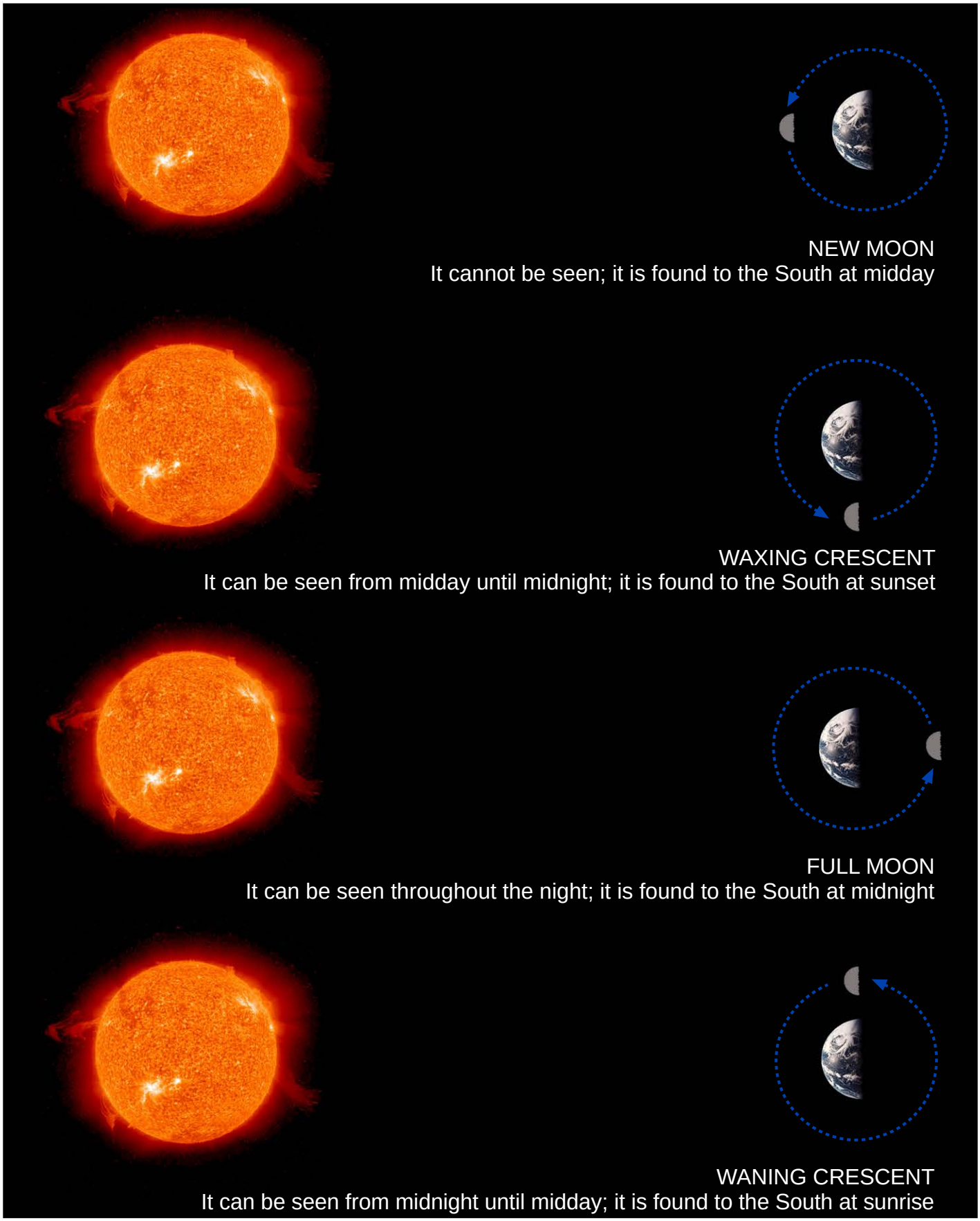
3. Which is the body part of the Ankylosaurus that was so specially developed?

4. Look for information on the Triceratops. What length could its horns measure up to? How much did it weigh? What was its approximate height in metres? And its length? What animal from the present day can we compare it to?

5. What was the most famous dinosaur? Was it the largest one that existed? What did it eat? What were its main characteristics?

ACTIVITY 4 *The Moon: our natural satellite*

The phases of the Moon: observation activity



ACTIVITY 4 *The Moon: our natural satellite*

The phases of the Moon: observation activity

Look for the phases of the Moon on this website: www.oan.es

Click on: información al público

Click on: agenda astronómica
Choose the year: 2012, 2013, 2014...
Save the page in astronomical favourites.

- Once you have opened the page, look for the four most important phases of the Moon of the month you are in (if it is almost the end of the month, look for next month's phases).

- Search the Internet for a website with a calendar of the month you have chosen and print it.

- Draw the four most important phases of the Moon, on the corresponding days of the month you have chosen.

- Observe the Moon every day of the month, then on the calendar draw and make a note:
  - Of its shape.
  - Of the time you made the observation.
  - Of where the Moon was in the sky.
  - If you were unable to make an observation, write down why.

- Find out what phase the Moon is in on the day of your visit to the Planetarium:
  - When can it be seen in the sky?
  - What is the next important phase it will be in? How many days are left before it reaches that phase?
  - On your visit to the Planetarium, ask in which constellation the Moon is found.

ACTIVITY 5 *The Earth's atmosphere*

Here is an interesting text on the Earth's atmosphere. Answer the questions in your exercise book. The answers are found in the text

1) Why is the atmosphere so important to life on Earth?

2) At approximately what altitude do we find outer space?

3) In which layer and at what altitude does the International Space Station orbit the Earth?

4) What gases are formed by the Earth's atmosphere? Write down their proportions.

5) How was the atmosphere formed?

6) In which layer do changes in the weather take place?

7) What is air pollution?

THE EARTH'S ATMOSPHERE

The layer of gases that surrounds the Earth is called the atmosphere. It does not only protect living beings from the radiation coming from the Sun and outer space, but it also prevents large differences in daytime and night time temperatures. It is a mixture of gases which gets thinner and thinner until reaching outer space at an altitude of around 2,000 kilometres.

IIt also allows life to exist on the Earth's surface, thanks to the atmosphere, animals and plants are able to breathe, and plants can also carry out photosynthesis.

The atmosphere is not stable and fixed, different processes and changes are constantly taking place. Its properties also change with altitude, for example the temperature, the composition and the density. The further away from the surface we go, the less and less air there is (the atmosphere becomes less dense) until it completely disappears and becomes outer space.

ACTIVITY 5 *The Earth's atmosphere*

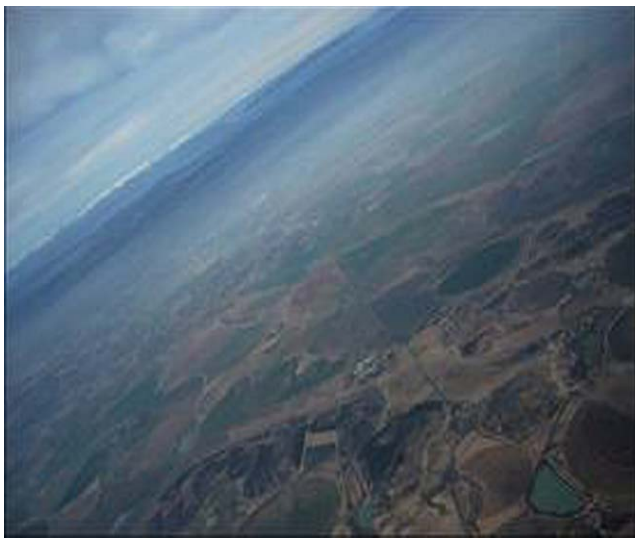
Responde a las preguntas. Las respuestas están en el texto

THE LAYERS OF THE ATMOSPHERE

The troposphere

The troposphere is the lowest layer (that which is closest to the surface) of the Earth's atmosphere. The temperature of the troposphere decreases with altitude. It reaches 12 kilometres in altitude. The major part of the atmosphere, some 85% of its mass, is contained in this layer. The phenomena which go to make up what we call the weather take place within the troposphere.

The stratosphere



This layer is around 50 kilometres thick, though above the equator it can reach up to 70 kilometres, and its temperature increases with altitude. From about 25 kilometres up into the stratosphere the major concentration of ozone is found (the ozone layer), the role of which is vital in maintaining life on our planet by filtering the ultraviolet radiation from the Sun. The absorption of this radiation is the reason for the increase in temperature with altitude in this layer.

The mesosphere

This layer surrounds the stratosphere and in it the temperature decreases with altitude, the same as in the troposphere. It can reach -90º C. It is the coldest part of the atmosphere! Above this layer the temperature again increases with altitude, but the atmosphere this far up is so thin, that there is hardly any matter to heat up anyway..

ACTIVITY 5 *The Earth's atmosphere*

Answer the questions. The answers are found in the text

The thermosphere

From about 85 kilometres and up to 400 kilometres up we find the thermosphere (also known as the ionosphere) and here the temperature increases again with altitude. The increase in temperature is notable between 120 and 150 kilometres altitude (300ºC) and then from 150 kilometres upwards the increase is more gradual. The International Space Station rotates around the Earth within the thermosphere at over 250 kilometres altitude. This is the layer where the natural light displays known as the aurora borealis in the North and the australis in the South are produced.

The exosphere

The outermost layer of the Earth's atmosphere is the exosphere. This layer is a blurry frontier where the atoms from the Earth escape into outer space. It is located between 400 and 2,000 kilometres above the Earth's surface and beyond it is outer space.

COMPOSITION OF THE ATMOSPHERE.

The atmosphere is made up of a mixture of gases in the following proportions: 78% Nitrogen, 21% Oxygen, 0.93% Argon, 0.033% Carbon Dioxide and tiny amounts of other gases. But the composition of the air has not always been the same. It has varied over the course of time.

ACTIVITY 5 *The Earth's atmosphere*

Answer the questions. The answers are found in the text

FORMATION OF THE ATMOSPHERE

When the Earth was formed, around 4,600 million years ago, it was heavily bombarded by meteorites which eventually melted the rocks on its surface. This gave rise to an ocean of magma, from which the gases escaped which formed the first of the Earth's atmospheres, the proto-atmosphere. When the meteorites stopped falling, or disintegrated before reaching the surface due to the friction with the proto-atmosphere, the Earth began to cool down.

When the Earth cooled to below 100ºC, the water in the proto-atmosphere condensed and fell to the surface forming the first oceans. This happened 3,800 million years ago. Clouds and rain appeared and the seas and the primitive atmosphere were formed.

POLLUTION

Many gases are released into the atmosphere due to human activity, gases which alter the composition of the air and its properties and cause air pollution.

Pollution is said to be the accumulation of substances that alter the composition and properties of the natural atmosphere. The fumes that come from the combustion of carbon and oil release large amounts of CO2 and other gases into the atmosphere.

ACTIVITY 6 *The cardinal points*

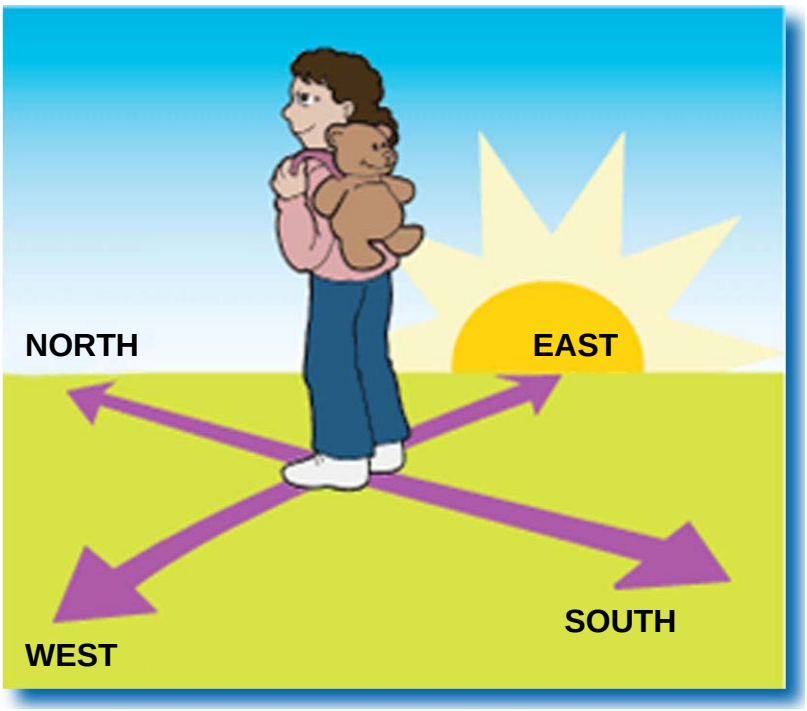
What are the cardinal points? What are they used for? In this activity we will explain it to you and encourage you to put them into practice

INTRODUCTION

To help somebody locate where a certain object is, we can tell them that t is to their right or left. For larger areas these indications do not help us orientate ourselves with enough precision. For this we draw plans and maps which use universal reference points called cardinal points: North, South, East and West.

How do we define them?
The cardinal points, are imaginary reference points, meaning that they are not shown on the ground.

If we place ourselves (if we are in the northern hemisphere) with our right arm towards where the Sun rises, we know that North is in front of us, West is to our left and South is behind us.



Did you know?

In Latin speaking countries people use the terms "Oriente" and "Occidente" to refer to the cardinal points of East and West. This is because "Oriente" means the place where the Sun rises, which comes from the word "orire" which means birth and which corresponds to the East.

On the other hand "Occidente" means the place where the Sun sets, which comes from the word "occedere" which means death and corresponds to the West. In Spanish the East is also referred to as "Levante" and the West "Poniente".

ACTIVITY 6 *The cardinal points*

What are the cardinal points? What are they used for? In this activity we will explain it to you and encourage you to put them into practice

Orientation procedures

Compass:

This is the quickest form of orientation. It can be applied in any kind of circumstances, during the day or during the night. It functions by using a magnetised needle, which always points to magnetic North.

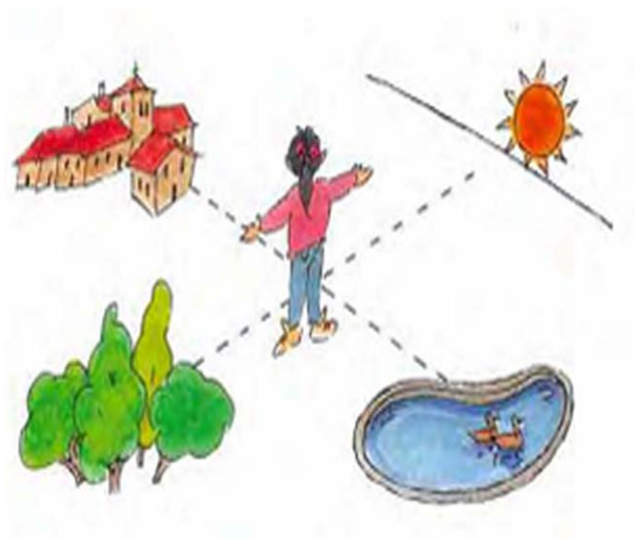
Orientation using the Sun:

The Sun can be used directly as an orientation tool. There are only two days in the year when the Sun rises exactly at the cardinal point of East and sets exactly at the West. These two days are the Spring Equinox and Autumnal Equinox. We are able to orientate ourselves using the Sun if we remember that:

- The Sun rises approximately in the East; the hour and exact point depends on the season and time of year we are in.
- The Sun sets approximately in the West; the hour and exact point depends on the season and time of year we are in.
- At midday the Sun is above the cardinal point of South.

LET'S DO AN EXERCISE

Maria is attempting to orientate herself using the Sun. If it has just risen, meaning it is dawn, point to the following cardinal points:



The town is towards

the _____ .

The forest is towards

the l _____ .

The swimming pool is towards

the _____ .

ACTIVITY 6 *The cardinal points*

Here are several exercises to practise using the cardinal points. Use the program Google Earth whenever necessary.

Search for a map of your town or city on Google Earth (North is usually shown at the top of Google Earth maps). Locate where your school is, mark the cardinal points on the map and placing yourself at your school, answer these questions:

In which direction is the town hall of your town or city found? _____.
In which direction is the nearest swimming pool? _____.
In which direction would you go to get to the health centre? _____.
Where is the most emblematic monument of your town or city found? _____.

Work in pairs. One of you be the guide and one the visitor: Leaving from the same school, the guide has to direct the visitor towards the location of their choice. Did they manage to get to the place chosen by the guide? Now change over and repeat the exercise.

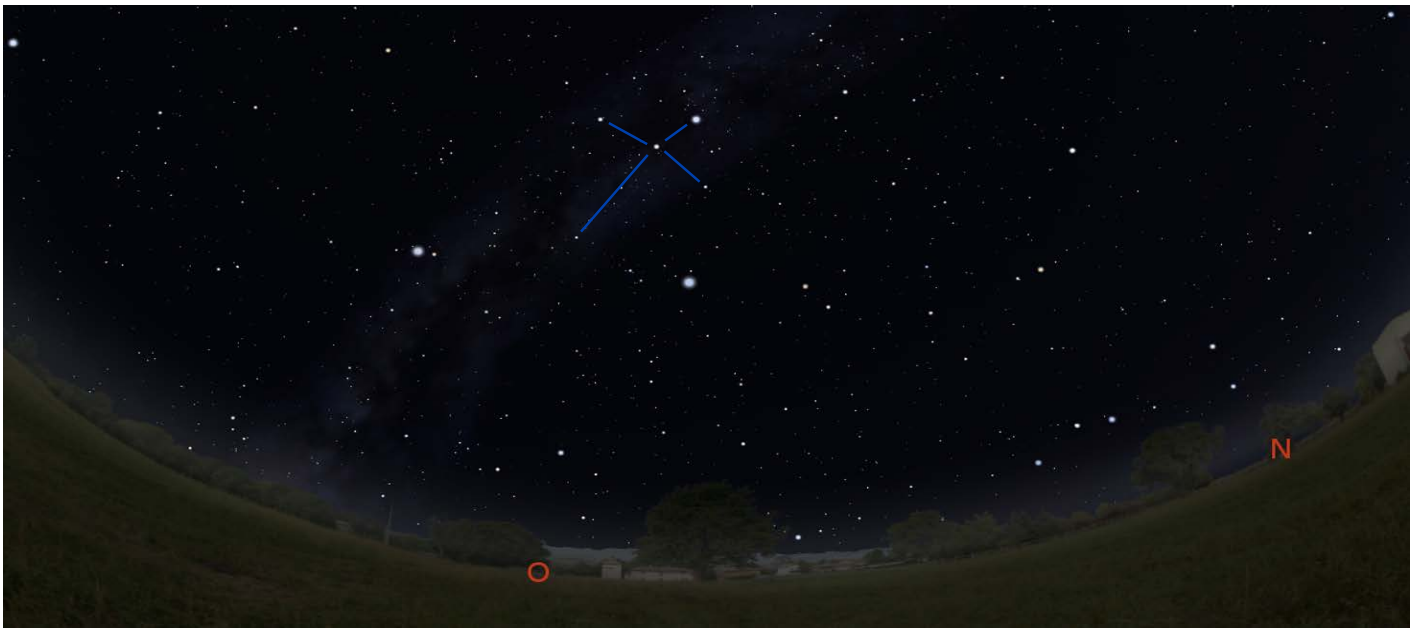
Study the world map and complete the sentences with the appropriate words.

The _____ Ocean is to the East of the continent of Africa.
Oceania is located to the _____ of South America.
The _____ Ocean is found to the East of Asia.
The Atlantic Ocean is located to the _____ of America.
The _____ Ocean is found to the North of Europe.
Antarctica is found to the _____.

Work in pairs. Imagine you and your partner are going on a journey around the world. Tell them what route you will be taking by using the cardinal points.

ACTIVITY 6 *The cardinal points*

In the old days, pilgrims who were walking the St James's Way, knew that if it was summer and they got up before sunrise, the Milky Way marked the direction in which they had to travel to get to Santiago de Compostela. Within the Milky Way we can also distinguish the constellation of Cygnus (the Swan) also known as St James's cross (see illustration)

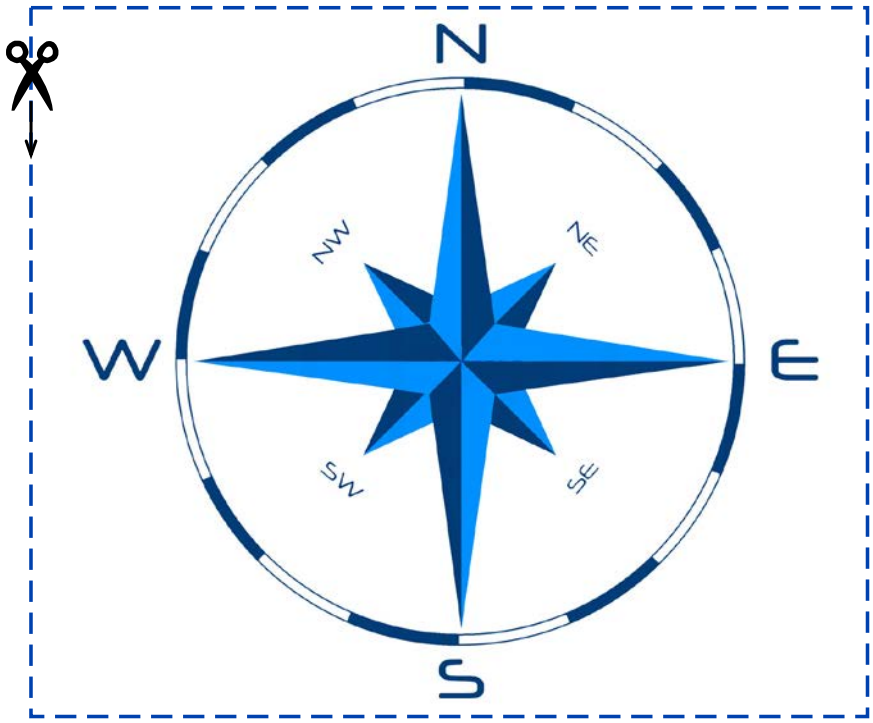


The following illustration shows five of the stages of the St James's Way in Navarra.

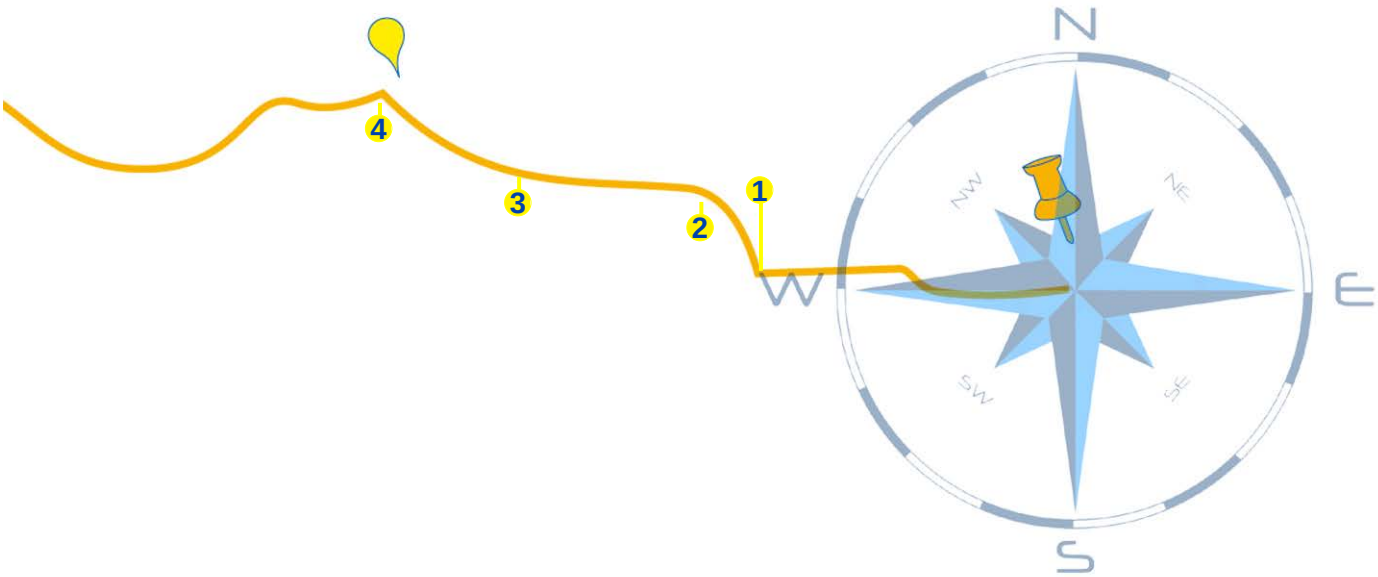
Stage 1: *from Roncesvalles(1) to Zubiri (2).* Passing through Burguete and Viscarret.
Stage 2: *from Zubiri (2) to Pamplona (3).* Passing through Larrasoaña and Zabaldika.
Stage 3: *from Pamplona (3) to Puente la Reina (4).* Passing through Zariquiegui and Obanos.
Stage 4: **f***rom Puente la Reina (4) to Estella (5).* Passing through Cirauqui and Villatuerta.
Stage 5: *from Estella (5) to Los Arcos (6).* Passing through Ayegui and Azqueta.

ACTIVITY 6 *The cardinal points*

Print this compass rose onto tracing paper, then placing it over the map on the next page, write the different directions you would have to take to complete the 4th stage of the St James's Way: from Puente la Reina to Estella

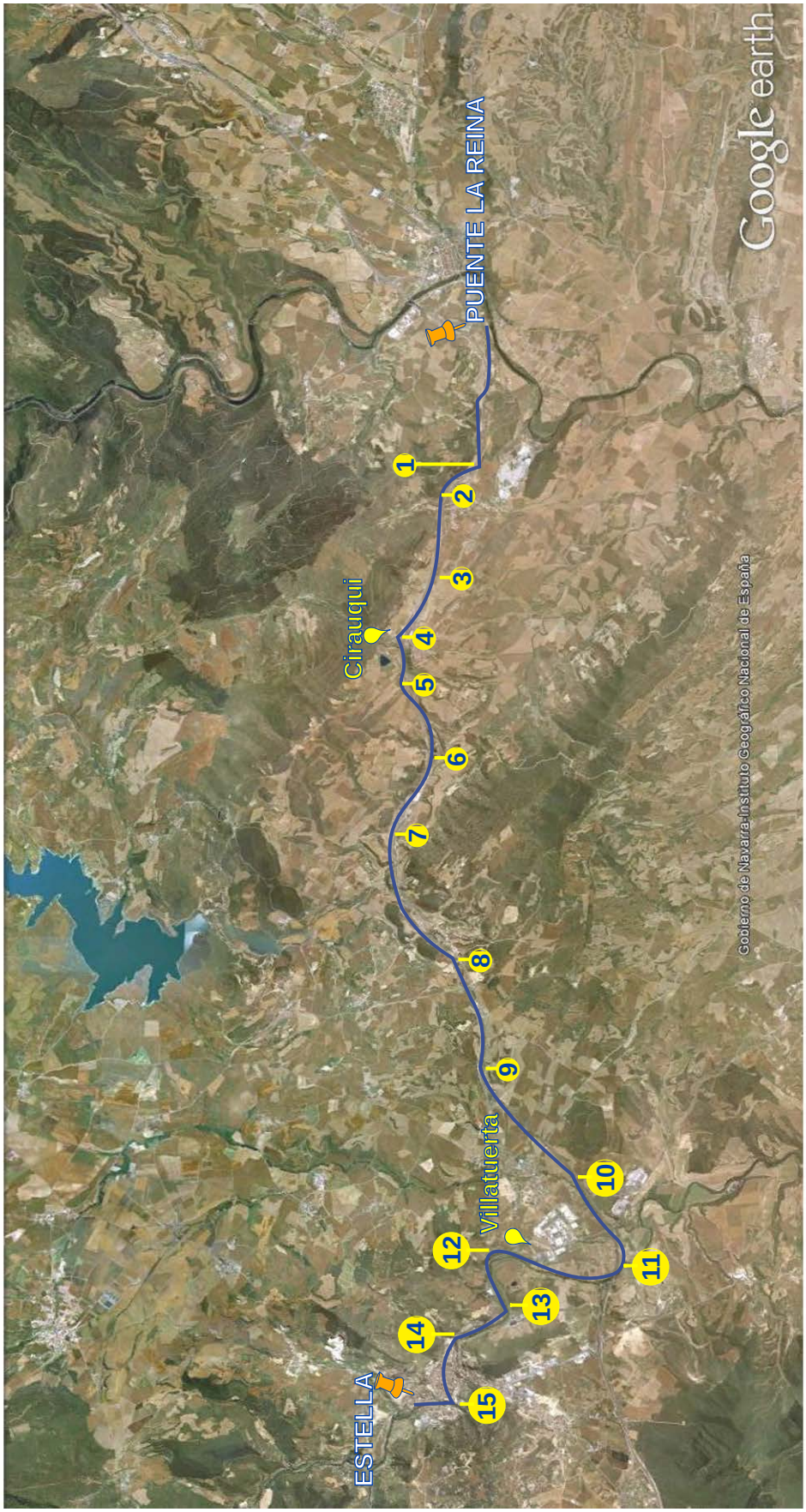


EXAMPLE.
- In order to reach point 1: We leave Puente la Reina heading West.
- In order to reach point 2: We turn and head NW.
- In order to reach point 3: We continue heading West.
- In order to reach point 4: We turn and head NW.



ACTIVITY 6 *The cardinal points*

4th stage of the St James's Way: from Puente la Reina to Estella



ACTIVITY 7 *The planets to scale*

Hanging from the ceiling of the corridor that leads to the Tornamira hall of the Planetarium we find the planets of the solar system (including the dwarf planet Pluto). The diameter of the largest Planet, Jupiter is 71 cm. The Sun that would correspond to "our hanging Jupiter" would be a sphere of almost 7 metres in diameter. The following table shows information on the planets and the distance at which they orbit the Sun at the same scale ratio.

Scale: 1 metre = 201.387.830,99

Diameter of Jupiter = 71 centímetros (142.985,36 km)

Diameter of the Sun = 6,912 metros (1.392.000,00 km)

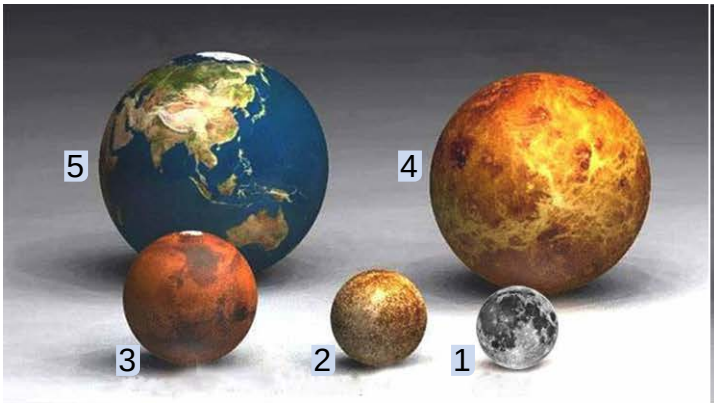
NAME	Mercury	Venus	Earth	Moon	Mars
Diameter in km's	4.879	12.103	12.756	3.475	6.794
Scale diameter (m)	**0,024**	**0,060**	**0,063**	**0,017**	**0,034**
Distance from the Sun (AU)	0,387	0,723	1,00	0,003*	1,524
Scale distance (m)	**288**	**537**	**743**	**1,91***	**1.132**

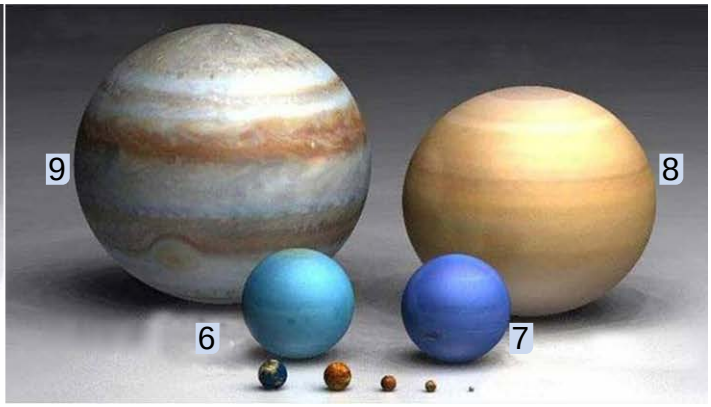
NAME	Jupiter	Saturn	Uranus	Neptune	Pluto
Diameter in km's	142.985	120.534	51.115	49.533	2.296
Scale diameter (m)	**0,710**	**0,599**	**0,254**	**0,246**	**0,011**
Distance from the Sun (AU)	5,203	9,537	19,191	30,069	39,482
Scale distance (m)	**3.865**	**7.084**	**14.256**	**22.336**	**29.328**

** Moon distances are referenced to Earth*

The image below will help you to get an idea of the size of each of the planets. And the image on the following page compares them to the size of the Sun.

1.Moon 2.Mercury 3.Mars 4.Venus 5.Earth 6.Uranus 7.Neptune 8.Saturn 9.Jupiter



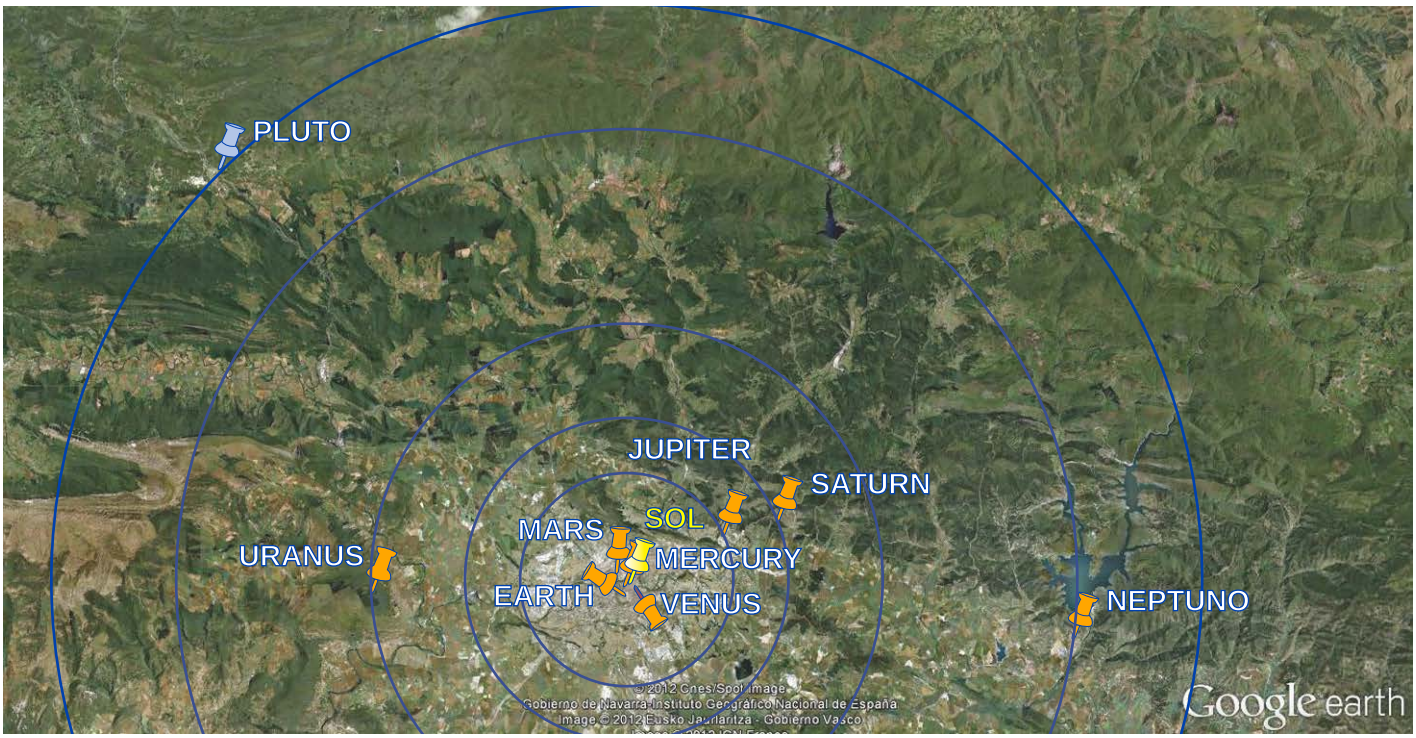


5 4 3 2 1

ACTIVITY 7 *The planets to scale*

In order to represent the distances, we have used Google Earth and we have located the Sun in the bandstand in Pamplona's Plaza del Castillo:

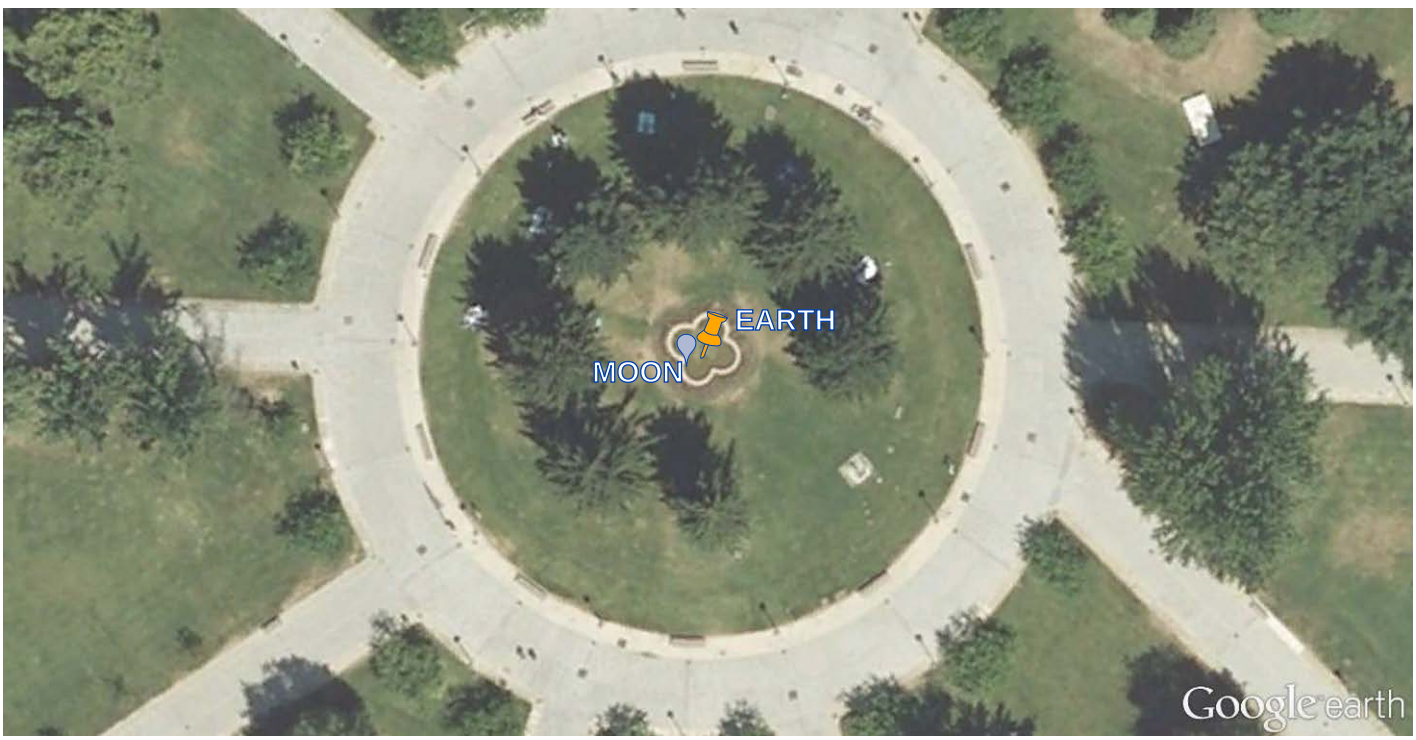
Mercury: Escuelas de San Francisco
Venus: Plaza Merindades
Earth: The centre of la Ciudadela
Mars: The Oblatas bridge
Jupiter: Arre
Saturn: Alzuza
Uranus: Peñas de Etxauri
Neptune: Aoiz
Pluto: Lekunberri



ACTIVITY 7 *The planets to scale*

This more detailed image shows the Sun and the terrestrial planets.

This more detailed image shows the Earth and the Moon within the Ciudadela park in Pamplona.



Let's repeat the "geo-reference" which we used on page 17, but this time place the **Sun in the school playground**, that way you can get an idea of how the solar system would be on your local scale. (Use Google Earth).

planetario de pamplona

www.escuela.pamplonetario.org
www.pamplonetario.org

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