

Project

Pre-test : multiple choice question paper for the pupils

Preliminaries

Read to your students the short text here after about Eratosthenes : it should sharpen their curiosity and then motivate them to join the project fully.

"In Egypt, about 2200 years ago, a papyrus drew attention of a certain Eratosthenes, then Director of the Great Library of Alexandria (a town located on the side of the Mediterranean Sea): it was about a vertical stick which, on the first day of summer (that is to say on June the 21st) and at noon local solar time, did not cast any shadow on the ground (the Sun's rays reach the bottom of a well!). This happened very far from Alexandria, straight to the South, in a town called Syene (now Aswan). However, Eratosthenes noticed from his side that in Alexandria, on June the 21st also and at the same time, a stick vertically driven in the ground did cast a shadow, even if such a shadow was relatively short. What the hell was this mystery?

We invite you to discover it by yourselves. This will lead you pretty far since, as Eratosthenes showed, the key of this mystery will allow you to measure the circumference of the Earth, nothing less!"

You should subsequently see, in sessions 4 and 5, how to fill in this tale and which simulations to suggest your pupils. The same way, bibliographic researches will be carried out later on. But your students will of course be able to comment this true story, and start locating the two cities involved.

Then, tell them to make them feel better about the multiple choice question paper :

"During the numerous activities we will carry out about this project "Following the footsteps of Eratosthenes", we will tackle with a series of fascinating subjects about which you might already have ideas about. But keep in mind that if you can't answer some of the questions, or if you make mistakes in your answers, it is not important at all : the questionnaire will not be graded for it is rather a test game. However, don't hesitate to ask precisions about a question if you don't understand the meaning of it and to simply answer "I don't know" if it is the case."

Practical methods

Foreseen duration : according to the training of your pupils, one session of 45 minutes, or two sessions of about 30 minutes (but the slowest students will have to be able to finish later)



Equipment :

For each student :

the sheets of the multiple choice question paper
and a few blank sheets for the required
drawings in several questions ;
a black pencil, an eraser, a color pencil case or
felt-tip pens.

PROJECT : “FOLLOWING THE FOOTSTEPS OF ERATOSTHENES ”

15 questions to take stock of your knowledge on several
topics *Before answering a question, first read it to the end.*

*When you have to pick a proposed answer, **circle** the one you pick with your black pencil.*

*When you have to answer with a **drawing**, make it on a separate piece of paper and write first the number of the question on the sheet.*

1 – Let's go in the shade !

Have you ever observed shadows? Try to draw the shadow of a stick in the sun (the stick is stuck in the ground).

Then do the same thing for three sticks well spread out.

2 – Is the blackboard askew ?

Vertical, horizontal : draw a picture to illustrate these two words. First draw a line to represent the ground; then, draw a vertical object as if it was put on it, and afterwards another one next to it, but horizontal.

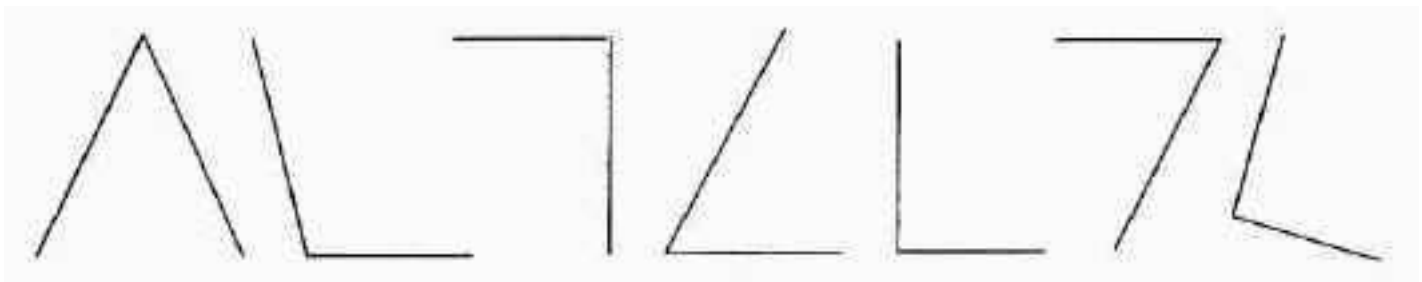
Can you name (and draw?) two instruments to check :

- the verticality of the first object : _____

- the horizontality of the second object : _____

3 – At the angle of my street

Maybe you already know what an angle is, and perhaps also a straight angle? Among the following angles circle the one you reckon to be straight ones.



Do you know how to call an angle that is less open than a straight angle?

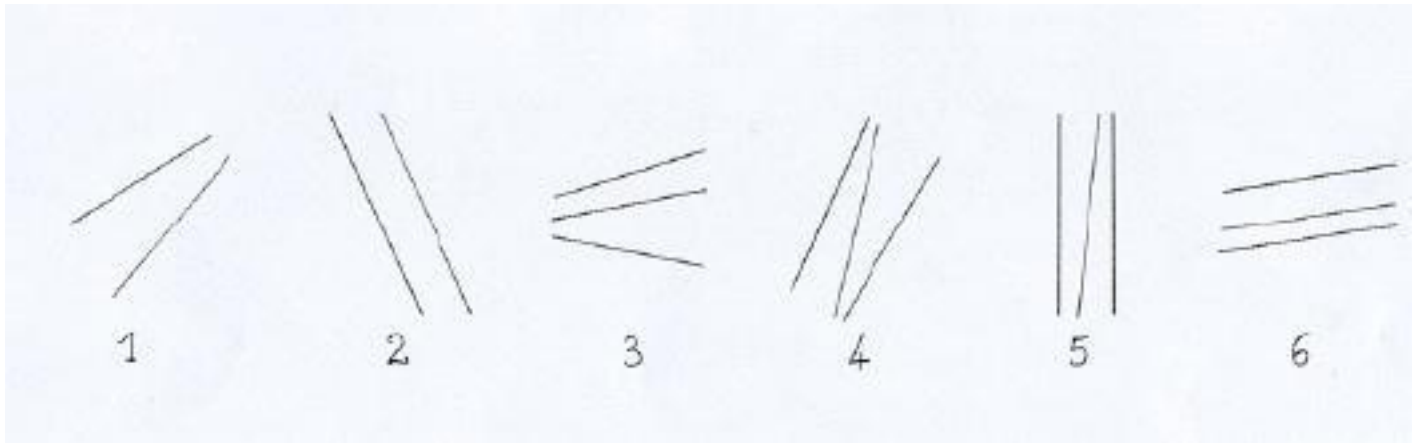
It is called a(n) _____ angle

Do you know the instruments used to measure the "spread" of an angle?

It is called a _____

4 – Let's take a street parallel to yours...

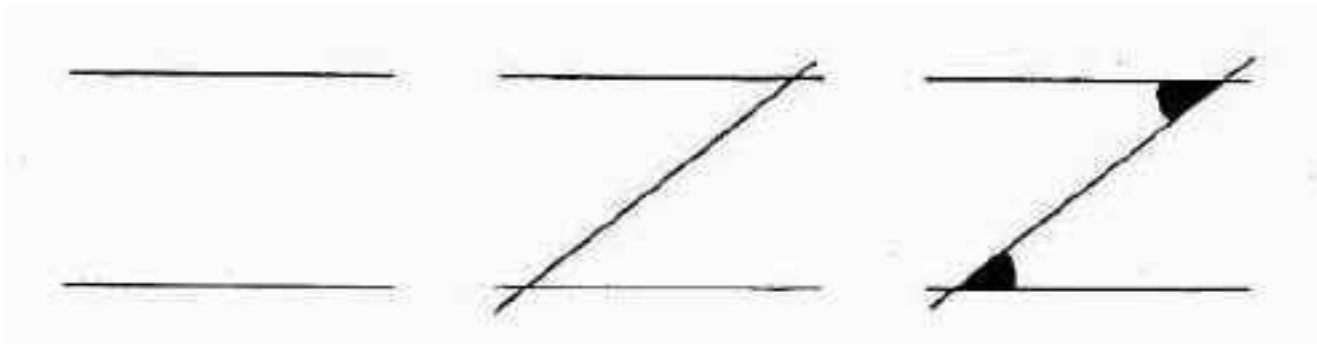
Have you ever heard of "parallel straight lines"? Even if you haven't, you might be able to find what it's about giving a look at the following group of straight lines :



If you think you have found some, circle the group of parallel straight lines on the picture.

5 – Z as in Zorro (this question is reserved to junior high school students)

Look at the three steps of the construction of this funny "Z" :



The two angles colored in black

have a particularity : which one ? _____

We could check it, how? _____

6 – Welcome to the Earth !

What is the shape of the Earth? (Draw it on a piece of paper)

How do you know ? _____

What object does it make you think of? _____

7 – Sticks again !

Take the picture of the Earth you just drew, and add, around it, three little sticks stuck in the ground like posts but very spread out.

8 – The Earth under the sun

Draw the Earth as you imagine it can be seen from space, with continents for instance, but also with the Sun illuminated it. If you want to show that it is the night somewhere on your planet, carefully color it in black.

9 – Day and night

Among the following 4 sentences, circle the one(s) that express(es) in a correct way, according to you, why it is alternately daytime and nighttime for the inhabitants of the Earth : (you can circle several answers)

- 1) The Earth revolves around the Sun
- 2) The Sun revolves around the Earth
- 3) The Earth revolves around itself
- 4) The Earth revolves around itself and around the Sun

10 – A little wind from the West

Here is a map of France with, on its side, what is called a compass card : it indicates the direction of the four cardinal points that are the following :

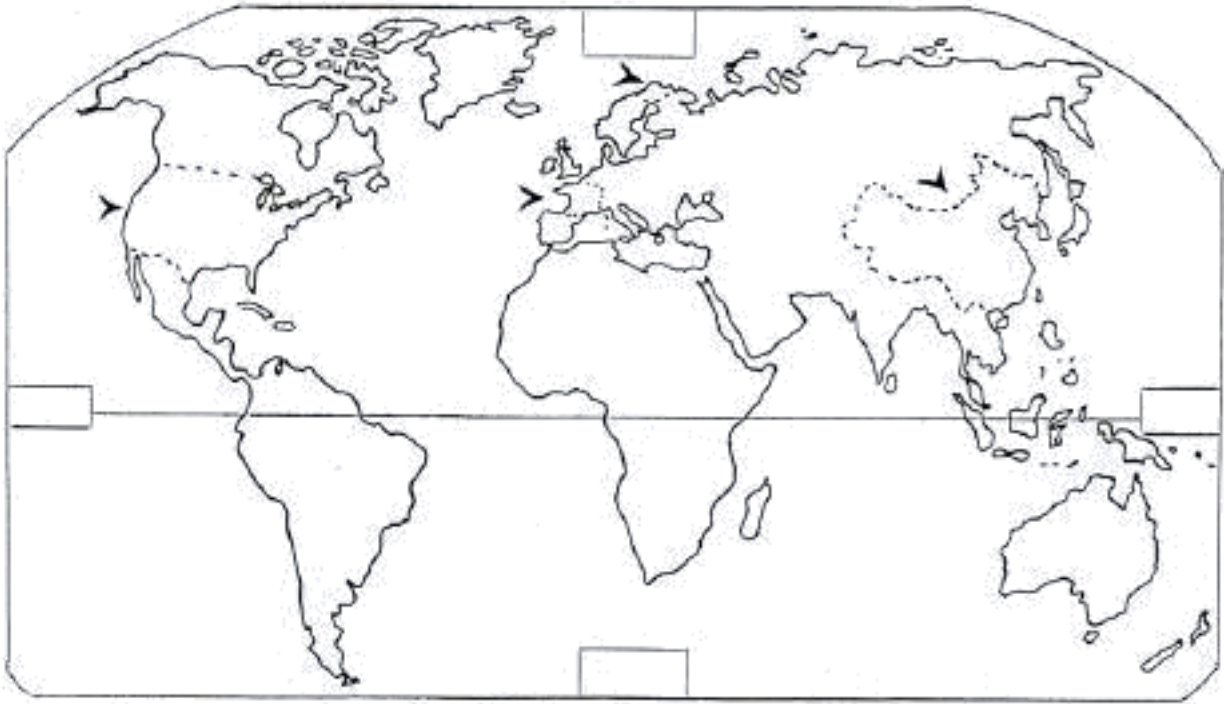
North (N) Sud (S) East (E) West (W)



Write down the initial letter (Capital letter) on the right spot at the tip of the arrows of the compass card. On the map, locate your school : pick a region more to the North of the location and write North, a region more to the South and write South, and so on...

11 – Travelling all over the vast world

Here is a map representing the five continents : it is called a planisphere. Write down the names of the four cardinal points in the small rectangles. Locate France, the United States, China, Lapland coloring them with a different color for each one of them.



According to you, the United States are :

- West of France
- East of France

According to you, France is :

- West of China
- East of China

12- Look, the Sun is rising!

Do you know in which direction we see the Sun rise?

North South East West

Do you know in which direction we see the Sun set?

North South East West

13- The Sun is shining in my eyes !

Picture yourself standing, facing the sea or a vast plain, with the Sun in front of you, high in the sky.
At what moment of the day can you see it like that? _____

In which direction can it be at that moment? _____

Draw a line representing the horizon, and then in the middle and high up, the Sun in the sky.

Draw the course of the Sun From dawn, when it rises, to dusk, when it sets.

On account of your answers at questions 12 and 13, try to locate the cardinal points.

Last, draw arrows on the course of the sun.

14– As the days, the nights and the seasons go by...

Do you know why, in France, the nights are longer in the winter than in the summer? _____

Do you know why it is cold in the winter and hot in the summer? _____

COMMENTARIES FOR THE TEACHER

Concerning the answer to question n°1, it is possible to meet different types of mistakes :

- No Sun
- Bad positions of the Sun, the stick and the shadow.
- A shadow that is not linked to the bottom of the stick
- Details in the shadow.
- A shadow that is as big as the stick. It is not a mistake because this situation can take place but it shows a tendency to consider that the shadow is like an image, a reflection.

Concerning the answer to question n°9, we can consider that, according to theoretic physics, that the choice of sentence 2 is also correct since the Earth and the Sun have a movement that is relative to each other's. Therefore, it all depends on the reference you choose : if it is the Earth, then it is correct to say that the Sun revolves around it !

The pupils are often sure that the only correct hypothesis is the fourth sentence. It is very instructive, but very difficult to make them admit that several hypotheses explain the alternation of days and nights. To look at it in a different point of view, it is difficult to make them admit that there is no familiar phenomenon that would help them determine which hypothesis is right.

As well, about question n°13, if a student lead the course of his sun from right to left after having written that the East is on the right for the sunrise and the West on the left for sunset, and that therefor the North is where the Sun is the highest in the sky, we should keep in mind that the drawing is not wrong out of context since that is the way it is in the southern hemisphere.

About the "mistakes" or "imprecisions" you will heighten in several answer drawings, you might prefer to be rather circumspect : the pupil may have a rather correct conception but may not know how to put it correctly on paper, for numerous reasons : foolish mistake, clumsiness, inability to draw in three dimensions on a piece of paper... Therefore, don't hesitate to ask the pupil to check.

It would be better, on our account, to make a rather "transversal" evaluation, counting the number of students that answered right at a question, and then making out the nature and the frequency of the mistakes found in the answers to that same question. That work seems much more interesting to us for the following sessions.

Nevertheless, for each pupil, why not establish some sort of qualitative "profile" finding his strong and weak points in each of the fields involved? The profile will of course be confronted to the one of the post-test at the end of the project, which could well be... the same questionnaire!
