Centripetal Force

General objective:

We want to show an effect of centipetal force when things are in movement. We try to answer a question who appears when the children want to know how the sun, the planets of our solar system can stay, turning around themselves and around the sun, in empty vacuum.

Special objective:

Showing centripetal force on peaces of wood or peaces of iron in movement, and the combination between gravity force and centripetal one.

Useful material

1rst: experiment

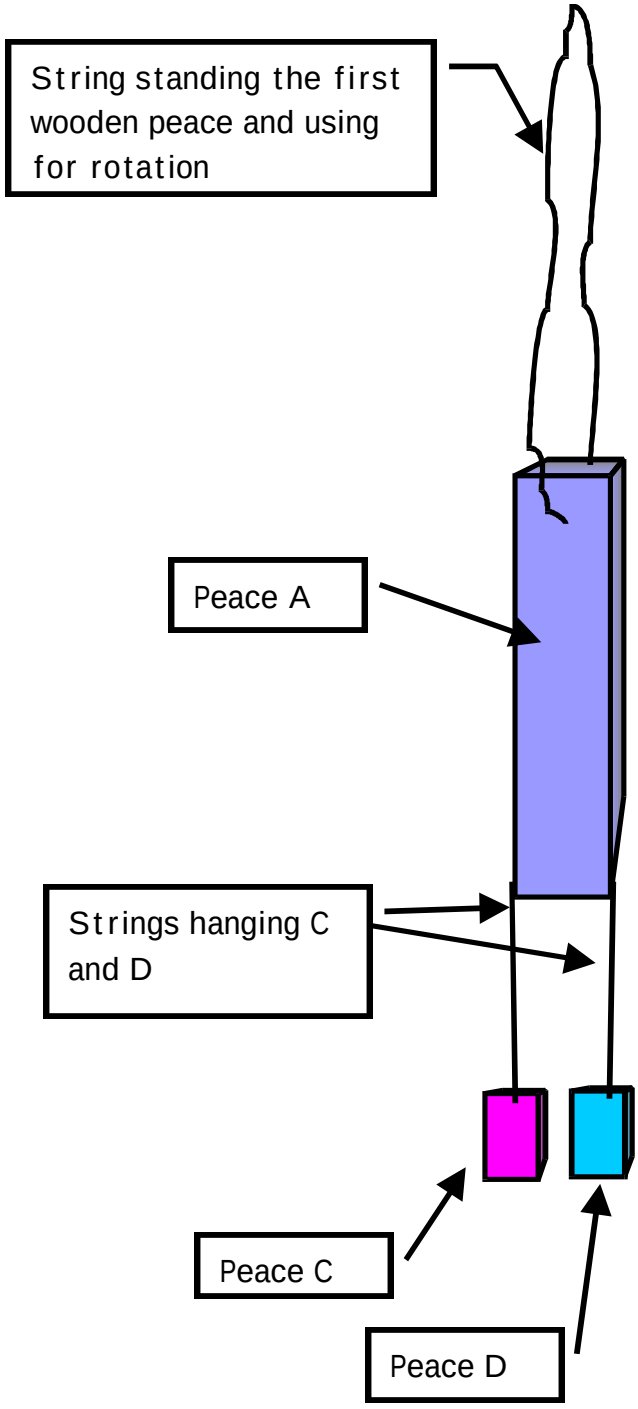
- a peace of wood for the swap-around movement
- two wood peaces with same weight
- two wood peaces with different weight
- some string

2nd: experiment

- a weight (1kg by exemple)
- an elastic string (for jumping in school sport by exemple)

Experimental protocol: 1rst experiment

1 - Diagramm unused system:



Engine of movement:

To give the rotation movement of all the system, turn string on itself:

One or two fingers hang the string and first let the system turning around alone; after to accelerate the speed, put an other finger of the other hand in the upper whole of the turning string and push down.

2- developpement of experiment:

In first, after turning the upper string on itself, hang the wood-peace A without movement.Be sure that peaces C and D are only straight by the gravity, strings who hang C and D not tangled.

Let go of wooden-peace A and let getting itself a slow rotation.

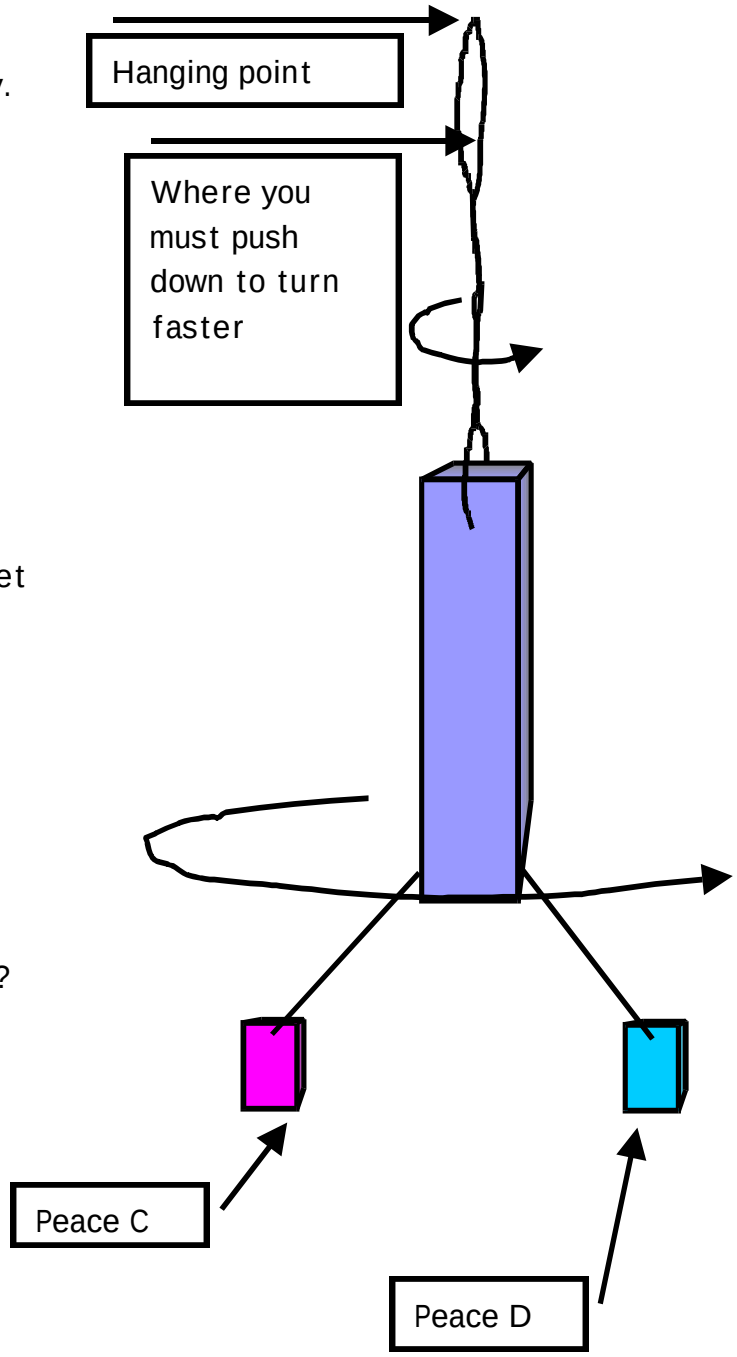
To accelerate the speed of rotation, do like upper.

May be you'll experiment again and again, because it often happens that strings who hang C and D tangle.

Take care to begin with a slow rotation and after if you want to see real centripetal force, you must be abble to make all the system truning around without tangle.

Diagram at time t of movement:

Remarks and questions



All peaces A, C and D turn in the same way.

Peace A turn on itself.

Peaces C and D turn at same speed.

C and D go far from the initial position.

C and D go up from initial position.

Questions:
When no wovement, which forces stand C et D?

What change between the two stages, no movement and rotation?

Why C and D go up?

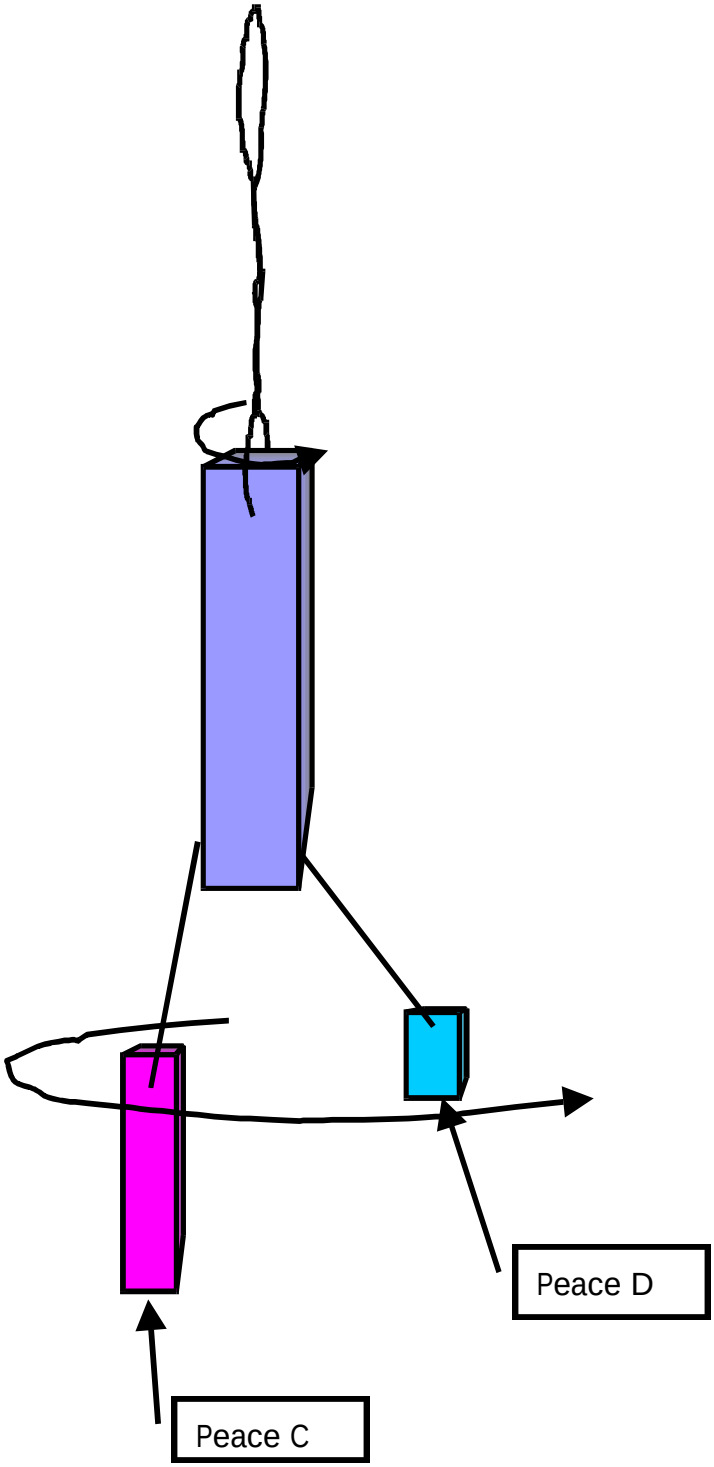
Where go the force who give the second positions of C and D (even turning around)?

3 - New experiment:

Changing the weight of wooden peaces C and D . (or with otehr material, iron, stone, ….)

Same experimental protocol, but with differnet peaces C and D:

Experimantal diagram at time t :



Remarks and questions

Peaces C and D turn in the same way than peace A.

Peaces C and D move away but peace C go up less then peace D.

The rotation speed seems to be less important than the first experiment.

Questions:
Is there also a force who push two peaces away?

Why two peaces go up in a different way even they turn in the same rotation speed?

Who create this force who can brig away the two peaces C and D?

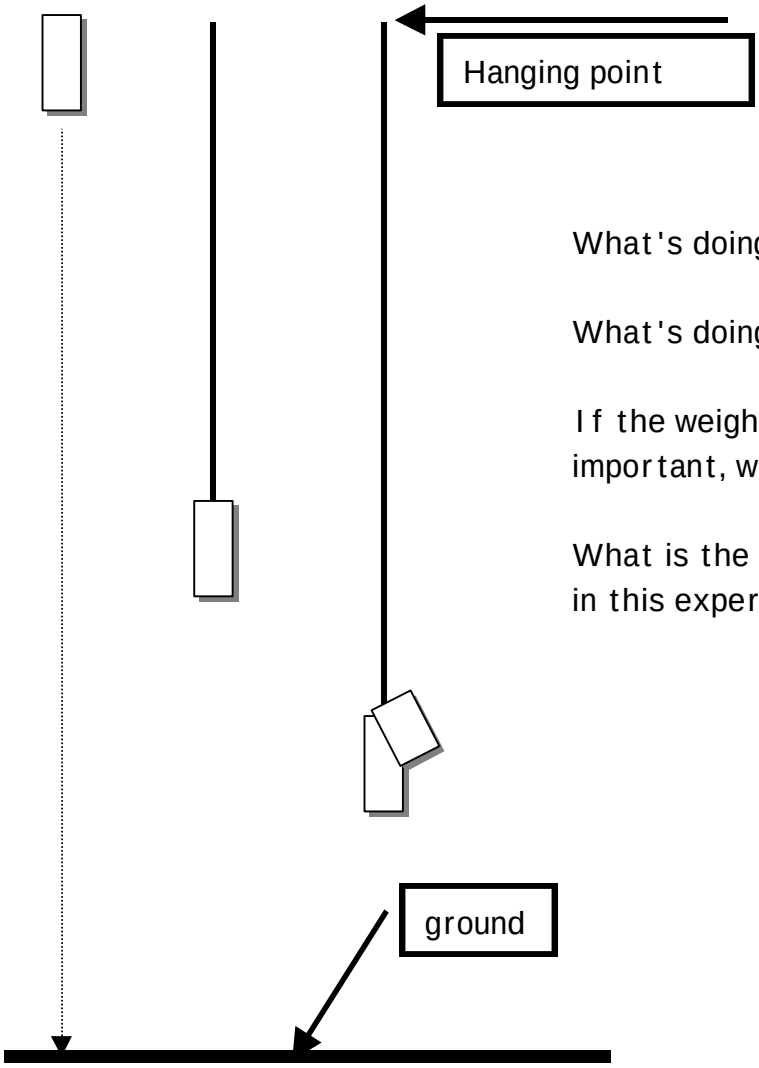
Wher go this particular force?

Experimental protocol: 2nd experiment

First part of experiement:

Take a mas and let it fall down. Why it falls?
Take this mass and hang it with an elastic string
Let the mass falling down by gravity. What happens after few minutes?
Take an other mass and put it with the first (attach to elastic string)

Diagram:



What's doing the mass that we let falling down?

What's doing this mass hanging by elastic string?

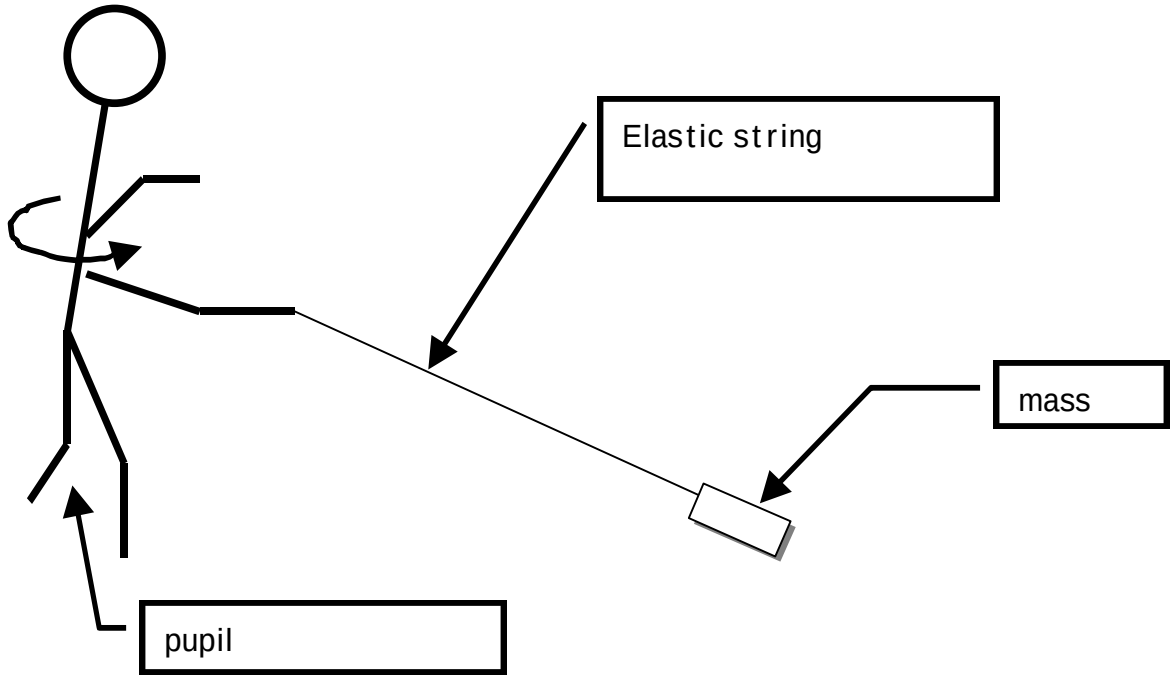
If the weight attach to the elastic string is more important, what happen?

What is the particular way of the elastic string, show in this experiement?

2nd part of experiment:

Take the mass with the elastic string and make turning the two with the rotation of a pupil, hanging with hands the other end of the elastic string. The pupil turn on him or herself.

Diagram:



Remarks and questions:

Mass go up when turning. Elastic string is straight.

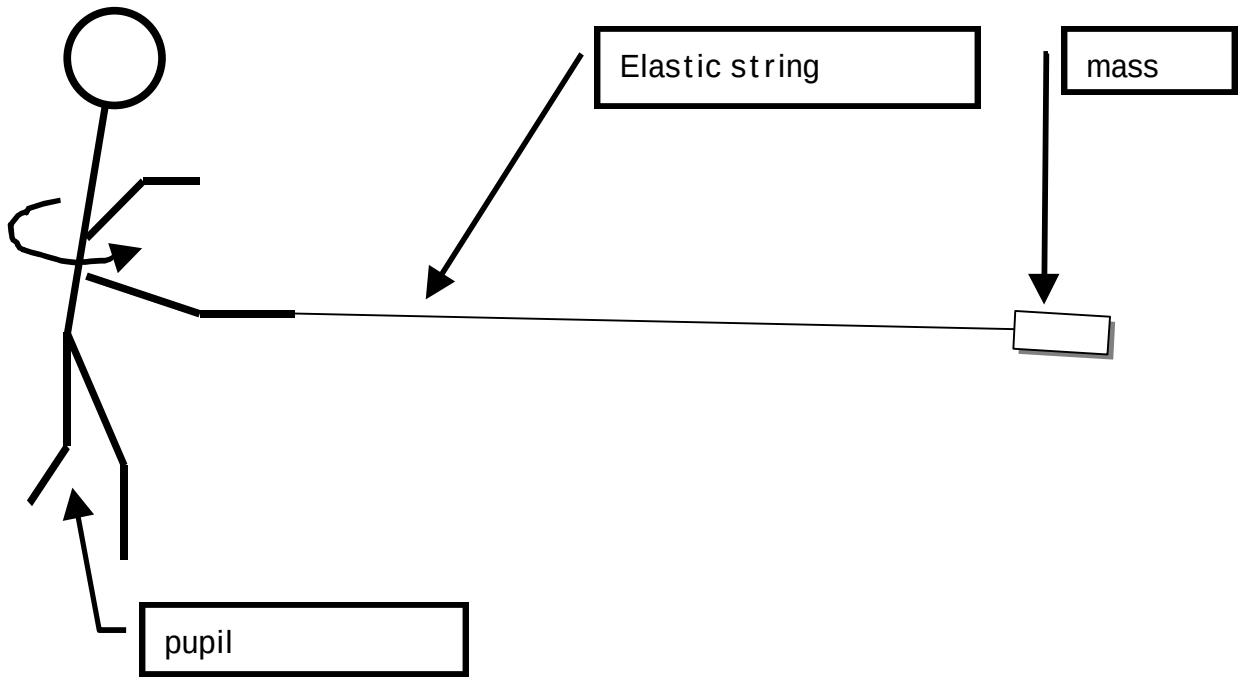
Why the mass go up?

Which force the pupils can feel in his or her arms when he or she turn?

What's possible to change, if whe don't change mass, elastic string and pupil?

Answer: rotation speed of all, pupil, elastic string and mass

Diagram:



What's doing mass when the rotation speed grow up?

What's doing the elastic string?

Why is it changing?

Conclusions:

In the first experiment, if the peaces C or D have the same weight or not, it's evident that the cause of going up is the rotation movement.

In the second experiement, this force going outside of the circle of rotation depends on rotation and rotation speed, because elastic string is longer when spped is higher.

This force is called centripetal force.

With the experiement with different weight, pupils ask other questions and give answers: The centripetal froce is stronger on peace D, because it goes up higher then the peace C. But, how can be sure of that.

To proceed an other experiment, with precise measurements.

We develop this experiment in an other writing-paper, with diagrams and pictures.