Practical Session n°11: Propulsion

1- PROBLEM

How can the rocket Ariane take off and fly away from the Earth?
Suggest an explanation.

2- EXPERIMENTS TO UNDERSTAND HOW PROPULSION WORKS

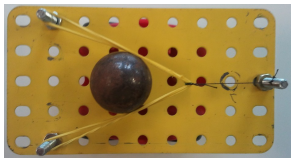
2.1- Situation 1

Available equipment

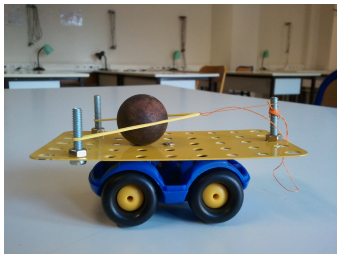
a wagon, a rubber band, a string, overloads, matches, a steel ball.

Carry out an experiment with the set up shown on pictures 1 and 1' (wagon without overload).

Record your observations.
Explain the experiment the most rigorously as you can on your report.



Picture 1



Picture 1'

Help card: How to structure a reasoning

Before the burning of the string

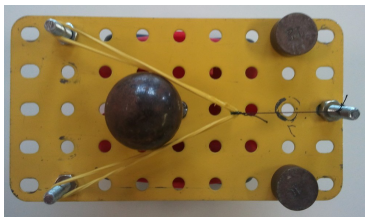
- *What can be said about the vector addition of the external forces acting on the system { wagon + steel ball }? Justify your answer.*
- *What can be said about the momentum vector of this system?*

After the burning of the string

- *Draw a diagram of the experiment.*
- *Represent the momentum vector of the wagon $\overrightarrow{p_1}$ and the momentum vector of the steel ball $\overrightarrow{p_2}$ on your diagram.*
- *What can be said about the vector addition of the external forces acting on the system { wagon + steel ball } knowing that the friction forces exerted by the air can be neglected? Justify your answer.*
- *What can be said about the vector momentum of the system { wagon + steel ball }?*

If a system is composed of 2 different parts, its momentum is the sum of the momentums of each part: $\vec{p} = \overrightarrow{p_1} + \overrightarrow{p_2}$

Anticipation: *If overloads are added to the wagon, does the wagon go:*
☐ *slower?* ☐ *at the same speed?* ☐ *faster?*
Justify your answer.



Picture 2

How to check your anticipation

- *Place two overloads on the wagon (see picture 2).*
- *Carry out the experiment.*
- *Conclude.*
- *Change your arguments if necessary.*

2.2- Situation 2

- *Inflate the balloon.*
- *Place the balloon on the tube fixed onto the wagon (see picture 3) and keep your finger on the tube's extremity so that it doesn't deflate.*
- *Remove your finger.*
- *Record your observations.*
- *Interpret this experiment.*

Picture 3

3- CONCLUSION

Explain how the propulsion of Ariane works using the conclusions of your experiments and the following video.
http://tinyurl.com/rocketPS11
Find out other examples for which this phenomenon is involved.