THE MAGICAL WORLD OF CHE-MIST**𝔈**RY.I



Fig.1

video1 [Chameleon](https://youtu.be/fEZD1k4SL_I?t=50)

**Initial activity**

Discuss in pairs using the following expressions and complete the sentences.

1. What happens in that video? Which color had the liquid substance?

I believe..................................................................................................................

1. Is this a magical trick?

Yes, I think so.

Non, I do not think so. It has probably been...........................................................

1. Or, is this the logical chemistry?

Non, I do not think so.

Yes, I think so, but I do not know how to explain it.

Yes, I think so. Perhaps it is something related to...................................................



TO DISCOVER IF THAT WAS REAL CHEMISTRY OR PURE MAGIC CHANGES, KEEP GOING INTO THIS CHAPTER.

1. **INTRODUCTION: ALCHEMY ORIGINS**

*Read the following text and explain to your partners. Work in groups.*

*Write on the blackboard the words you do not know the meaning. The teacher will translate them.*

In Rome, from 37 to 41 dC, it was said that Caligula emperor would have carried out experiments to produce gold starting from orpiment (apparently arsenium sulphide), and that Diocletian emperor (c.III dC) would have given the order to burn all the Egyptian works concerning the chemistry of gold and silver, in order to stop such kind of experiments.  
A school of alchemy flourished in Arabia from 750 to 1258. The first known work resulting from this school is the “*Summa Perfectionis*” (maximum perfection), attributed to the alchemist and philosopher Abu 'Abd Allah Jâbir Ibn Hayyân al-Sufi (latinized as Geber, c.VIII), nicknamed by his contemporaries "king of the Arabs and The Philosophers Prince". This is the oldest book on chemistry properly said**1**. Arab alchemists were fascinated by the concept of metal transmutation and attempted to carry out the process**2**. Arab alchemists also worked with gold and mercury, arsenic and sulfur, salts and acids, and became acquainted with a wide range of what we now call chemical reagents**3**.

“Magic chemistry”, as happened with the rest of Arab science, was communicated to Europe through Spain, thanks to the impressive flourishing that science and arts experienced in Al-Andalus throughout the middle Ages. The first existing works of European magic chemistry are those of the English **Roger Bacon** and the germanic philosopher Alberto Magno; both believed in the possibility to transmute lower metals into gold. The idea stimulated the imagination of many people throughout the middle Ages. They thought that silver and mainly gold were the most “perfect” metals compared to the rest, which were considered “imperfects” metals. Therefore, they believed in the famous philosopher's stone, a substance much more perfect than gold, which could be used to bring the most common metals to the perfection of gold. Roger Bacon believed that gold dissolved in *aqua regia* was the “elixir of life”, also known as the elixir of immortality**3**, which is a legendary potion or drink that guaranteed eternal life. We will focus later on in this *legendary potion (*point 6 of Che-Mist€ry.II*)*.

In the thirteenth century the Italian scholastic philosopher Saint Thomas Aquino, the Majorcan polymath **Ramon Llull** also contributed much, by the way of magic chemistry, to the progress of chemistry, with their findings of the uses of antimony , the manufacture of amalgams and the isolation of the spirit of wine, or ethyl alcohol. Significant compilations of formulas and techniques of this period include Pyrotechnics (1540), by the Italian metallurgist **Vannoccio Biringuccio**; about metals (1556), by the Germanic mineralogist Georgius Agricola, and Alquimia (1597), by **Andreas Libavius**, a naturalist and Germanic chemist. The most famous of all the alchemists was the Swiss Paracelsus, who lived in the 16th century. He maintained that the elements of the composite bodies were salt, sulfur and mercury, which represented earth, air and water respectively. The 16th-century Swiss alchemist [Paracelsus](https://en.wikipedia.org/wiki/Paracelsus) believed in the existence of [alkahest](https://en.wikipedia.org/wiki/Alkahest), which he thought to be an undiscovered element from which all other elements (earth, fire, water, air) were simply derivative forms. Paracelsus believed that this element was, in fact, the philosopher' Stone, the universal medicine and the irresistible solvent.

After Paracelsus, the alchemists of Europe were divided into two sets. The first was composed of those who permanently work on scientific discoveries with compound and reactions. These scientists were the legitimate predecessors of modern chemistry, as announced by the work of French chemist **Antoine Lavoisier**. The second set accepted the visionary and metaphysical part of the ancient magic chemistry and developed a practice, inspired by imposture, black magic and fraud, from which the current notion of magic chemistry originates4.

LET’S WATCH [HERE](https://www.youtube.com/watch?v=gxiLuz9kHi0) (video2) THE ALCHEMY HISTORY FROM THE VERY BEGINNING

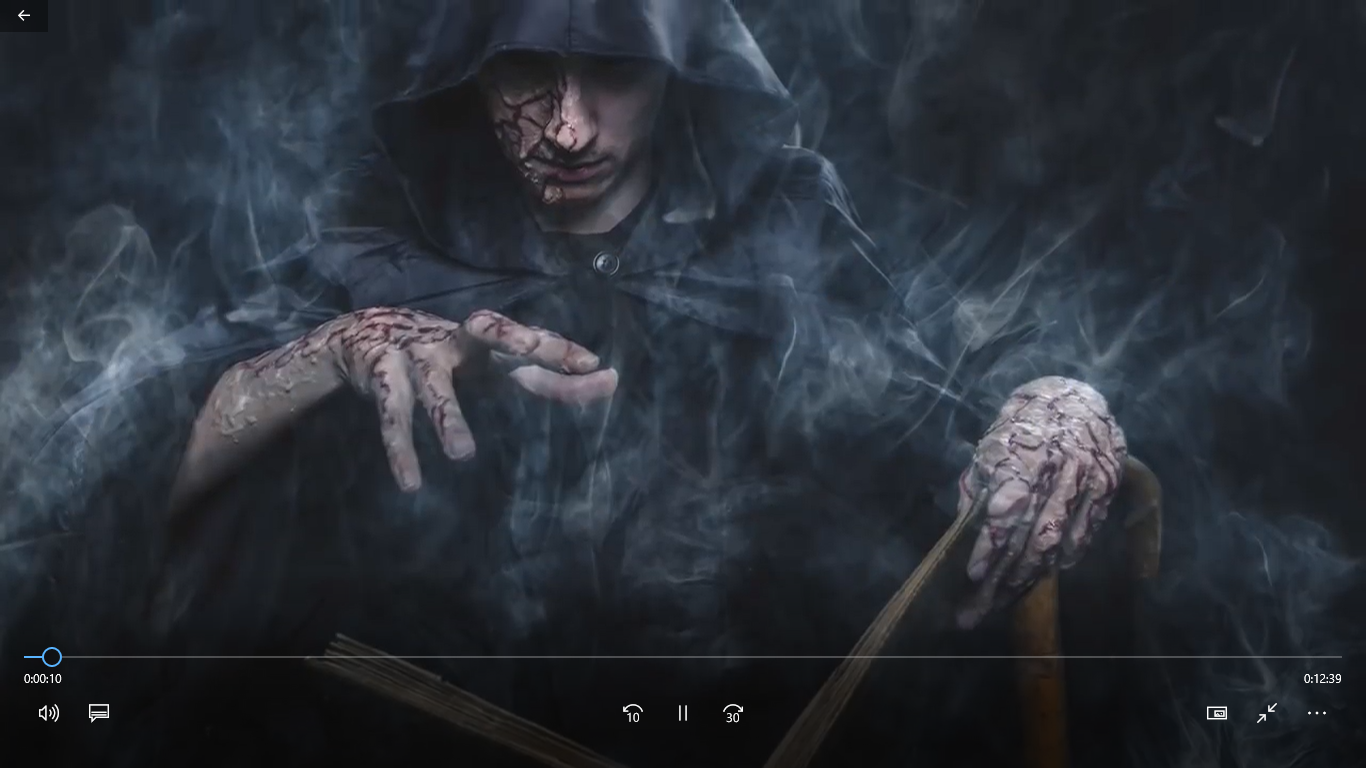
[](https://www.youtube.com/watch?v=gxiLuz9kHi0)

Fig. 2

**Activity 1.** Answer the following questions:

1. Is Alchemy related to Magic? If yes, how or why?

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1. Is Alchemy related to Chemistry? If yes, How or why?

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1. From the previous text and video, could you complete the following table? (You will probably need a more exhaustive research).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Century  or years | Country | Language of written articles/books | Why were they known for? |
| Roger Bacon |  |  |  |  |
| Ramon Llul |  |  |  |  |
| Vannoccio Biringuccio |  |  |  |  |
| Andreas Libavius |  |  |  |  |
| Antoine Lavoisier |  |  |  |  |

1. After reading the life of Roger Bacon and Ramon Llul, how many things had them in common? Search in Internet if need it.

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1. In your opinion, was alchemy related to religion? Justify your answer.

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1. Do you think that European scientists play an important role in chemistry? Justify your answer.

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Now, we will share our conclusions with the rest of the classmates.

1. **ANTOINE LAVOISIER**

You are going to discover who Antoine was by your own resources (Internet), answering these questions:

**Activity 2.**

Who was Antoine Lavoisier?

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Why he became famous?

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Which universal law did he settled?

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Is he related to Alchemy or to actual Chemistry?

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1. **CHEMICAL REACTION OR CHEMICAL EQUATION?**

Previously to well understand Lavoisier’s Law, we need to know a few concepts.

Watch this video3

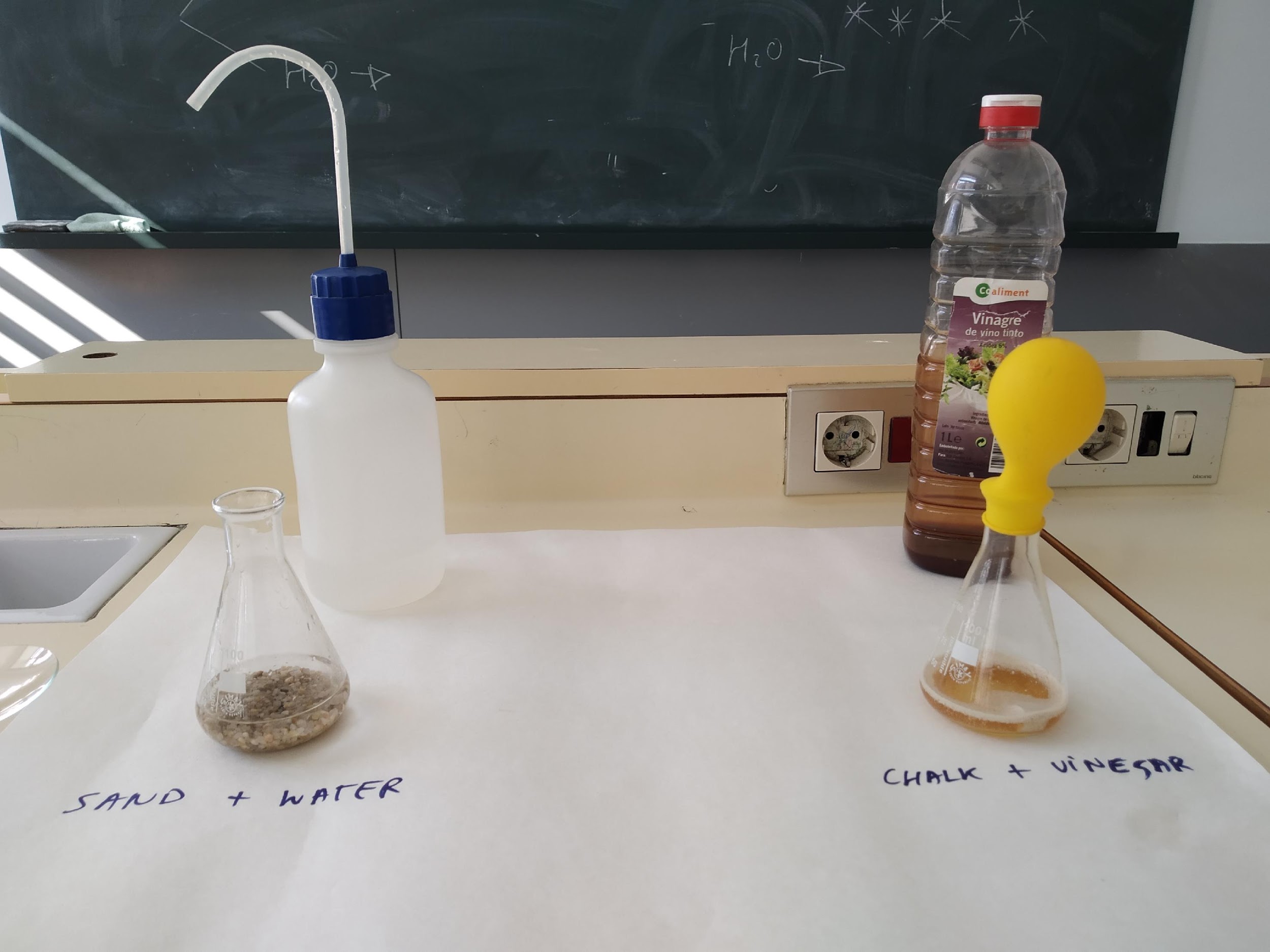


Fig. 3

Sand + Water = NOTHING HAPPENS = NONE CHEMICAL REACTION

Chalk + Vinegar = SOMETHING HAPPENS = CHEMICAL REACTION

After watching the following [video4](https://www.youtube.com/watch?v=TStjgUmL1RQ), you should be able to answer the following questions:

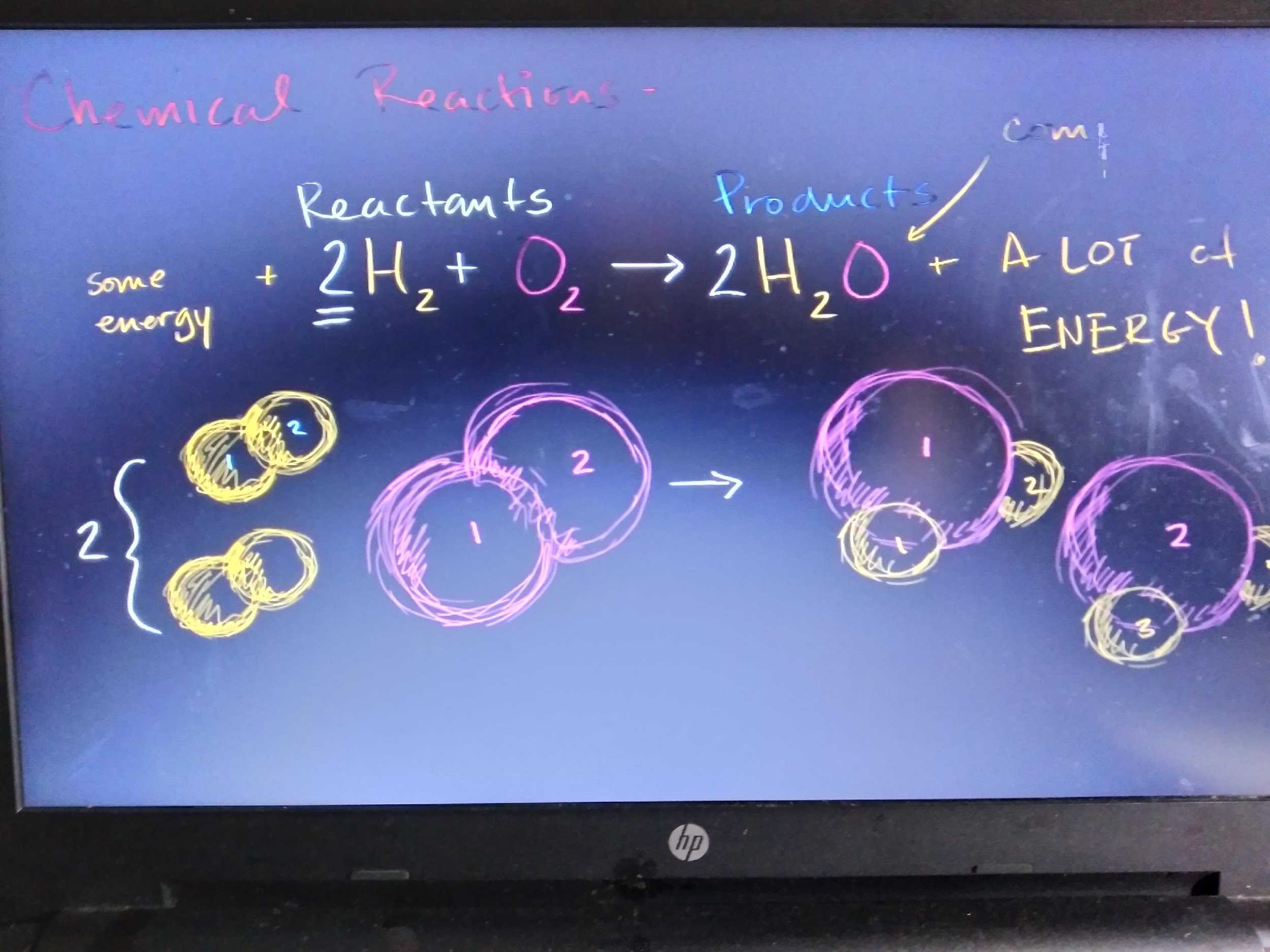
[](https://www.youtube.com/watch?v=TStjgUmL1RQ)

Fig. 4

**Activity 3.** Work in groups

In general, which are the reactants in a chemical reaction?

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In general, which are the products in a chemical reaction?

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Which symbols do we need to represent a chemical reaction?

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Why a chemical reaction is also named chemical “EQUATION”? Is that something related to Lavoisier’s Law? What does mean “to balance” a reaction?

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When representing a chemical reaction we use an arrow 🡪. Which mathematical operation is related with this arrow?

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Now you are going to verify Lavoisier’s Law with your practice.

We are going to run our first reaction!! 

**P1. LABPRACTICE 1: “Lavoisier’s Law or Law of mass conservation”** 

**Work in pairs**

**Goal**

Classify different reactions, get used to their inorganic names and formula and verify Lavoisier law.

Could you predict if the reaction of vinegar with baking soda (sodium bicarbonate) will occur? (You will learn more at point 4)

Look for the formulas and names (either English than your mother tongue).

**Material** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Procedure**

* Weight 4g sodium bicarbonate in a watch-glass. Pour 20 ml of vinegar, with a pipette and pro-pipette, in an Erlenmeyer. Introduce the sodium bicarbonate in a balloon. Weight all together. Record the value (W1).
* Mix the sodium bicarbonate with vinegar and close the Erlenmeyer with the balloon (just like at video3). Observe. After 5 min, record the weight again (W2).

**Results**

Your observations and weights.

Write down the chemical equation: with reagents –look for their formulas- and try to predict the products.

**Conclusions**

Answer the initial goals.

Is W1 equal or really close to W2? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Is that related to Lavoisier’s law? Explain why yes or why not\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Finally try to balance the chemical equation, what means, to accomplish Lavoisier’s law.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

WEBGRAPHY

1 – <http://www.science-et-magie.com/ALCHIMIE/alchimie01.htm> (15/05/2020)

2 - <https://en.wikipedia.org/wiki/Philosopher%27s_stone#cite_note-Strohmaier-6> (15/05/2020)

3 - <https://ca.wikipedia.org/wiki/Usuari:Mcapdevila/Elixir_de_la_vida> (15/05/2020)

4 - <http://www.escuelapedia.com/academia/alquimia-en-europa> (15/05/2020)

Fig.1. <https://pixabay.com/es/images/search/alchemy/> (<https://pixabay.com/es/photos/poci%C3%B3n-magic-alquimia-botella-3539394/>)

Fig. 2. <https://www.youtube.com/watch?v=gxiLuz9kHi0>, from [CrashCourse](https://www.youtube.com/channel/UCX6b17PVsYBQ0ip5gyeme-Q)

Fig. 3. Instituto Bisbe Berenguer, Hospitalet del Llobregat, Catalunya.

Fig. 4. <https://www.youtube.com/watch?v=TStjgUmL1RQ>, from [Khan Academy](https://www.youtube.com/channel/UC4a-Gbdw7vOaccHmFo40b9g)

Video 1: It was suppose to be a homemade video from Instituto Bisbe Berenguer, Hospitalet del Llobregat, Catalunya. Because of Covid-19, I had to use this other video, <https://youtu.be/fEZD1k4SL_I?t=50>, from <https://www.youtube.com/user/spitfire979/>

Video 2: <https://www.youtube.com/watch?v=gxiLuz9kHi0>, from [CrashCourse](https://www.youtube.com/channel/UCX6b17PVsYBQ0ip5gyeme-Q)

Video 3: Instituto Bisbe Berenguer, Hospitalet del Llobregat, Catalunya. Març 2020

Video 4: <https://www.youtube.com/watch?v=TStjgUmL1RQ>, from [KhanAcademy](https://www.youtube.com/channel/UC4a-Gbdw7vOaccHmFo40b9g)

Icons and symbols:

<https://www.flaticon.es/icono-gratis/busqueda_1150645>

<https://www.flaticon.es/icono-gratis/aplausos_305488?term=aplausos&page=1&position=34>, by Z. Najdenovski