



# Low-cost and easy experiments about the water in the atmosphere

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## Introduction

- Atmospheric water and the changes it suffers are essential in the water cycle.
- The concepts related to water are present in the educational curricula of many levels.
- There are many misconceptions from the students related with atmospheric water.
- We present some easy experiments which can help in the learning of these concepts.

## Why low-cost?

- Cheap and simple to do: promotes students autonomy.
- It only requires part of the time of a class session.
- It can be adapted to many different levels.
- It can be carried out either in the laboratory or in the classroom.

## Ocean of misconceptions

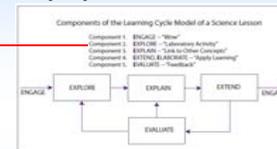
Some examples:

- Clouds are made of water vapor.
- Air humidity and temperature are independent parameters.
- In cloud formation, only the water vapor is needed.



## Didactics

With the aim of a meaningful learning of students we propose:



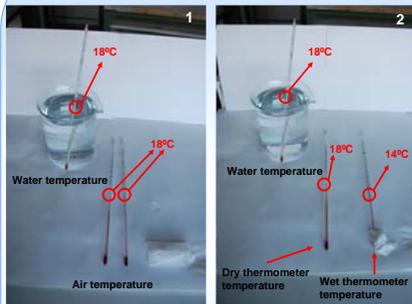
Phase	Activity
Before the experiment: <b>PREDICT</b>	What will happen? Why will it happen?
During the experiment: <b>OBSERVE</b>	Do the experiment
After the experiment: <b>EXPLAIN</b>	What really happened? Why did it happen?

## Experiment descriptions

We show 5 examples of this kind of low-cost experiments. We detail:

- **Key concepts:** main scientific concepts of the educational curricula which could be approached with each activity.
- **Key questions:** strategic questions which teachers can propose to students in order to stimulate reflection and understanding about the concepts.

## A crazy thermometer?

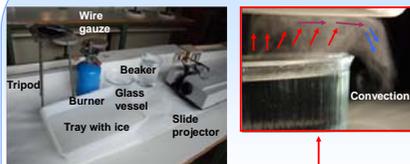


**Key concepts:** evaporation, vaporization heat, air humidity.

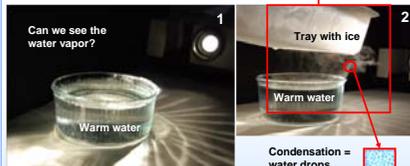
**Key questions:** What's the initial temperature of all thermometers?

Which thermometer is cooler? Why?

## What are clouds made of?



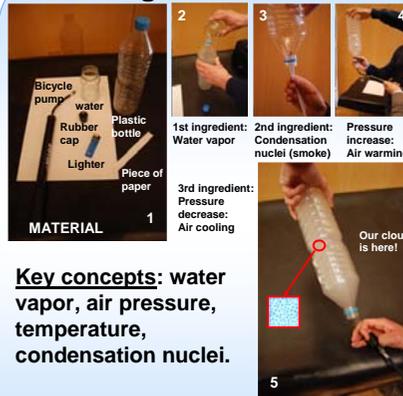
**MATERIAL**



**Key concepts:** evaporation, air humidity and cooling, condensation

**Key questions:** Is water vapor visible? What happens when air cools?

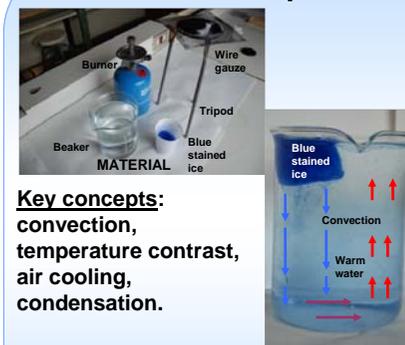
## Let's generate a cloud



**Key concepts:** water vapor, air pressure, temperature, condensation nuclei.

**Key questions:** What happens when the pressure of moist air decreases?

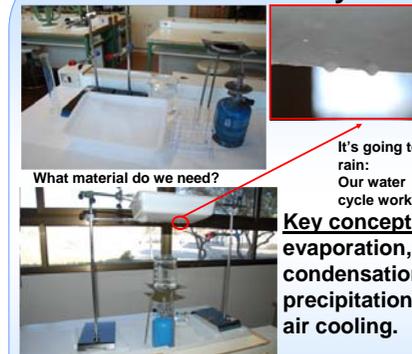
## The cold drop



**Key concepts:** convection, temperature contrast, air cooling, condensation.

**Key questions:** How are the particles in the water moving? What atmospheric phenomena could originate a movement like this?

## Does water follow a cycle?



What material do we need?

It's going to rain: Our water cycle works!

**Key concepts:** evaporation, condensation, precipitation, air cooling.

**Key questions:** Why does water evaporate? Why do appear drops in the tray? Why do drops grow and fall?

## References

(1) Nelson J., Nelson J., 2006. Learning cycle model of a science lesson. *The Physics Teacher*. 44: 396-397. (2) White, R. Crustone, R. 1992. Proving understanding. *The Palmer Press*.