

MUL+IPLIERS

ACTIVITY 3:

Building the idea of pollution caused by PM



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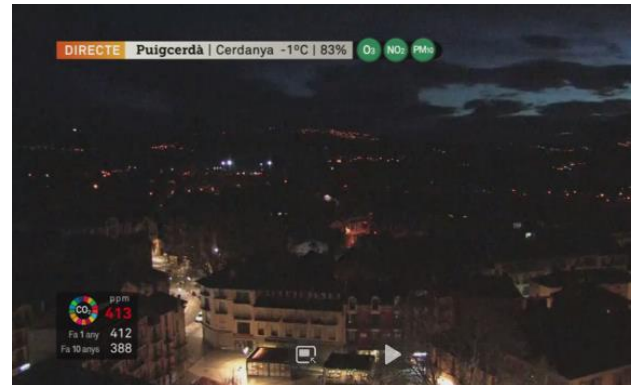


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HOW IS POLLUTED AIR LIKE?

2. The weather forecast section of the Catalan Television provides information on air quality indicators (O₃, NO₂ and PM₁₀) in different cities. Which are the main similarities and differences between the TV indicators and those indicators that you identified in the first activity? Which are the main similarities and differences between the TV indicators and the indicators that you have identified in the first activity to explore your initial ideas? Complete the table below.



At the beginning, I mentioned as pollutants...

“Extra” pollutants:
Which pollutants did you consider that do not appear on the indicators?

“Forgotten” pollutants:
Which pollutants did you not consider that do appear on the indicators?

Now we will explore each one of these air pollutants.



WHAT IS THE AIM OF THIS ACTIVITY?

Starting with the students' ideas expressed in the previous activity, the aim of this activity is to reflect about the different kinds of pollutants that could be in the air.

This activity will be used to introduce the existence of two main different types of pollutants: 1) the PMs; and 2) gas pollutants.



HOW WILL WE DO IT?

This activity starts using the initial ideas expressed by the students' individually in the previous activity. Specifically, based on their initial ideas, we ask them that, in small groups, compare and discuss similarities and differences between their drawings and explanations.

At first, we will let the students freely to identify those similarities and differences that they consider relevant. Later, the teacher will ask some open questions to help them to focus their attention on those relevant aspects. Some examples of questions are:

What differences do you think there are between the pollutants that appear on the weather forecast section?

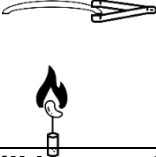
Is there any pollutant that no one had identified before?

These questions will be dealt on in further activities.



WHAT DO WE REFER TO WHEN WE TALK ABOUT PM?

3. In small groups, we will do an experiment reproducing the smoke emitted by cars or factories by burning a peanut or a piece of paper.

What do I want to investigate? How if the smoke that is released when we burn a piece of paper?	What do I need? <ul style="list-style-type: none">• Watch glass• Wooden clamp• Peanut / piece of paper• Lighter• Wire• Cork• Electronic magnifying glass
What do I do? While burning a peanut, I place a watch glass held by a wooden clamp over the column of smoke. 	
What do I think that will happen? (What do you think you will observe when you do the experiment? What will happen to the watch glass?)	Why do I think it will happen? (What makes you think that you will observe such results?)
LET'S DO THE EXPERIMENT	

<p>What happened? (What did you observe? What happened to the watch glass? Can you identify any of the things you observed?)</p>	<p>Why do I think it happened? (How do you explain the results obtained? What do these results make you think about?)</p>
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4. Similarly to what we have done, science teams study the air quality of cities. Look at this [video](#) to learn about it. From the video, comment on big group the similarities and differences between what we have done and what science teams do.



Figure 1. Example of 3 different pollution filters used in professional stations for monitoring the air quality. Photo from the EPA Ireland video ([link](#))



WHAT IS THE AIM OF THIS ACTIVITY?

The aims of this activity are, on the one hand, to build the idea that can be small particles in the air, although we do not feel them by senses (e.g. we cannot observe, smell... them). And, on the other hand, to visualize that air contains some particles that should be understood as small pieces of matter in solid state in suspension bigger than those particles that are part of them (such as: O₂, N₂...



HOW WILL WE DO IT?

This activity is proposed to be done in cooperative groups of 3-4 students.

It is essential that before doing the experiment, the students ask themselves what they think will happen (e.g., the glass will get black, the glass will stay clean and will only get hotter, etc.), **and why they think this will happen** (e.g., because smoke is a gas and they will be deviated with the glass, because there are small parts of matter in the solid state that will remain collected in the glass, etc.). If the students are not aware of what they think initially, they will not be able to be aware of their own learning process and develop new explanations based on their own ideas.



5. With everything you have seen about PM, what conclusions can you draw?
Please refer to its size.





HOW WILL WE DO IT?

CLOSURE OF THE EXPERIMENT

After the experiment, the students must answer “*what happened?*” and “*why do I think it happened?*” in small groups. After that, they can share their ideas to agree the key idea of this little experiment.

Special attention must be paid to the fact that, despite the experiment, there will be students who will keep thinking that smoke is a gas. We need to share what we have seen in the experiment and make them reflect on this.

This activity will also allow the students to become familiar with the digital electronic magnifier that is going to use in further activities, so you need to give time to be able to do this process.

VIDEO

Watching the video of activity 7 can help us in closing the activity talking about the fact that those particles that professional scientist capture using filters in the air quality stations, and particles that we have captured on the watch glass during the experiment are the same.

It is important that at the end of these activities the large group agrees on what the PMs are and how big they are.

