

## Inside the atom

### 1. Preparing the Lesson Plan

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| <p><b>Brief description</b><br/><i>How would you summarize your lesson plan in a Tweet? In two or three lines briefly state the aim of the activity, the topics it covers, and the tools used.</i></p>                                                                                                                                                                                       | <p>Students "peek" into the world of atoms through a computer simulation. They explore how knowledge about how an atom "looks" from the inside has evolved. In doing so, they use online tools to publish infographics and create tests to check knowledge.</p> |
| <p><b>Age group</b><br/><i>For which age group is the activity recommended? You can either narrow it down to a concrete age, or use the following categories: Preschool, Primary Education (6 to 12 years), Lower Secondary (12 to 16 years), and Upper Secondary (16 to 18/19 years)</i></p>                                                                                                | <p style="text-align: center;">Upper Secondary – 18/19 years</p>                                                                                                                                                                                                |
| <p><b>Learning space</b><br/><i>In what type of room or space should the activity take place? The classroom, the computer room, the gym, at home, etc. Does the space have any requirements or need any preparations? For instance, closing the curtains for a projection, or moving desks to free space, creating different workstations, etc.</i></p>                                      | <p>Computer room and/or Google classroom</p>                                                                                                                                                                                                                    |
| <p><b>Learning Objectives</b><br/><i>What are the goals of your lesson plan? Please, phrase them from the point of view of the learners: the <b>knowledge</b> learners would acquire, the <b>skills</b> they would gain, and the <b>attitudes</b> they would develop. Adhere to the SMART principle as much as possible and try to keep it simple with no more than four objectives.</i></p> | <ul style="list-style-type: none"> <li>• describe atom models</li> <li>• use various online tools to acquire new knowledge Objective 2</li> <li>• collaboration</li> </ul>                                                                                      |
| <p><b>Materials</b><br/><i>Which materials are required to carry out your lesson plan? Please, keep in mind that the less materials and the more affordable they are, the easier will it be to replicate your lesson</i></p>                                                                                                                                                                 | <p>On line Phet simulations<br/>Google Forms<br/>Piktochart</p>                                                                                                                                                                                                 |



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| <p><i>plan. You can also list optional materials that are not required to successfully complete the lesson plan, but that would add value to the lesson.</i></p> |  |
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### Other

*Are there any comments or details you would like to add regarding this section, which would facilitate the replicability of the lesson plan? Write them below this text!*

## 2. Developing the Lesson Plan

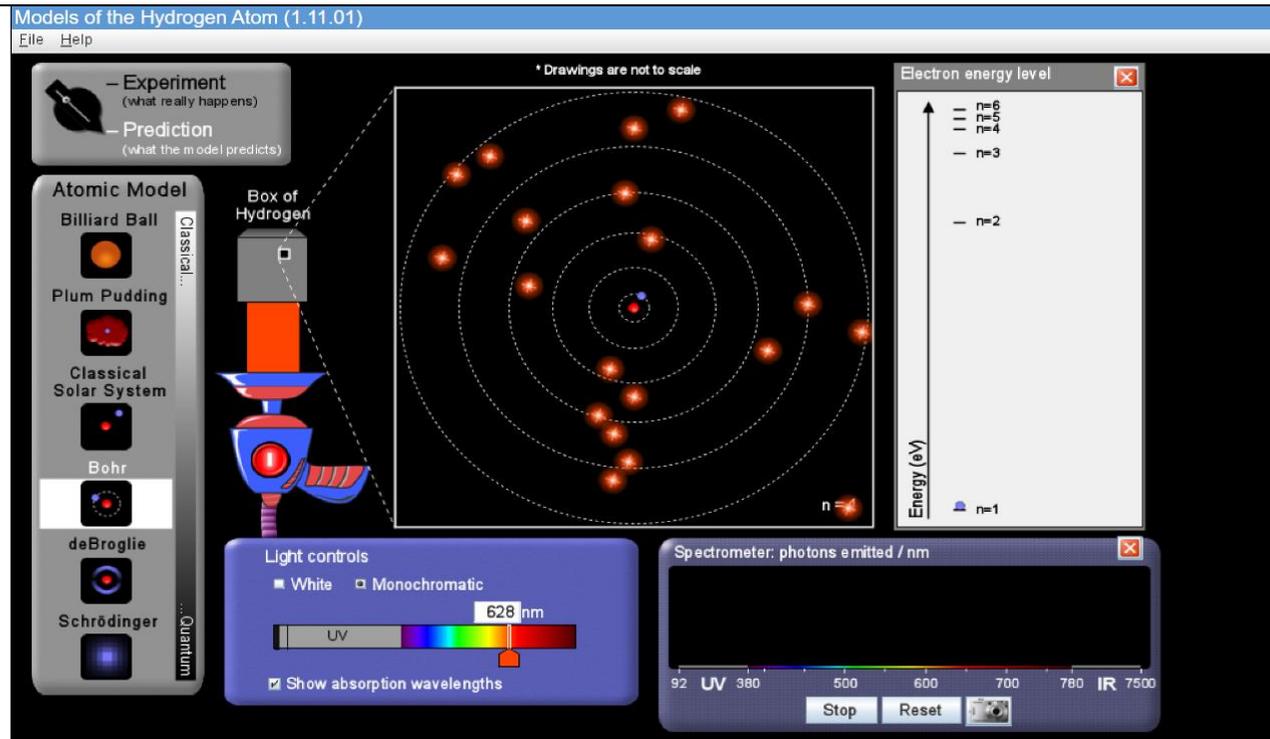
In order to replicate your lesson plan, other educators need to understand clearly each step of the process. Please, use clear language, add the necessary details, and ensure that a person who is not familiar with your teaching context and methods is able to replicate the lesson plan. We recommend dividing the lesson plan into steps, and to detail each step in one row of the table below. For instance, a simple lesson plan can be divided into an introduction, a game, and a debriefing discussion.

| <b>Method</b><br><i>Which type of facilitation method or activity do you use for this part? For instance, a discussion, a presentation, a role-play game, a collaboration game, a discussion, assessment such as quizzes etc.</i> | <b>Details and description</b><br><i>Provide details of the content of this activity. Ensure that the lesson plan can be replicated by other educators by being detailed and using clear language. For instance, describe which materials are being used, whether students work individually or in groups (and the size of those groups), what is the teacher doing, which instructions are the students given, what contents are being covered, etc.</i> | <b>Time</b><br><i>Approximately, how long does this part of the lesson plan take?</i> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| <p>Discussion</p>                                                                                                                                                                                                                 | <p>The teacher in the computer lab divides the students into groups of three or four students. Let the number of groups be even - each group will analyse the results of another group). The teacher distributes the worksheets to each group and gives brief instructions</p>                                                                                                                                                                            | <p>5 ‘</p>                                                                            |

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| <p>Collaboration<br/>(work in groups)</p> | <div style="text-align: right; margin-bottom: 10px;">  </div> <p><b>Activity 1: Explore the "Plum pudding" model and Rutherford's "Solar" model of the atom</b></p> <p>Run the computer simulation "<b>Rutherford scattering</b>"</p> <p><a href="https://phet.colorado.edu/sims/html/rutherford-scattering/latest/rutherford-scattering_en.html">https://phet.colorado.edu/sims/html/rutherford-scattering/latest/rutherford-scattering_en.html</a></p> <p>Students complete Worksheet 1</p> <div style="border: 1px solid black; padding: 10px; margin: 10px auto; width: 80%; text-align: center;"> <p>Worksheet 1</p> <p><b>Launch simulation "Plum Pudding Atom"</b></p> <p>Observe what happens when the selected atom is bombarded with Alpha particles - write a conclusion</p> <hr/> <hr/> <hr/> <hr/> </div> <p><b>Launch "Rutherford Atom" simulation</b></p> | <p>10'</p> |
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|                                           |                                                                                                                                                                                                                                                                                                                          |            |
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|                                           | <p>Carefully observe what happens when an atom is bombarded with Alpha particles - write a conclusion</p> <hr/> <hr/> <hr/> <hr/> <p>Compare the results of these two "experiments"</p> <hr/> <hr/> <hr/> <hr/>                                                                                                          |            |
| <p>Collaboration<br/>(work in groups)</p> | <p><b>Activity 2: Run the computer simulation "Models of the Hydrogen Atom"</b></p> <p><a href="https://phet.colorado.edu/sims/cheerpi/hydrogen-atom/latest/hydrogen-atom.html?simulation=hydrogen-atom">https://phet.colorado.edu/sims/cheerpi/hydrogen-atom/latest/hydrogen-atom.html?simulation=hydrogen-atom</a></p> | <p>15'</p> |



Select the Predictions option: - what the model predicts  
(enable Options: Electron energy level)

For each model of the hydrogen atom (Billiard Ball, Plum Pudding, Classical Solar Sytem, Bohr, de Broglie, Schrodinger), observe what happens when exposed to monochromatic and white light:  
write down observations

Select the Experiment Options (What Are really happens) –

Enable options “Show spectrometer” - observe carefully what the spectrometer shows



Students complete Worksheet 2

### Worksheet 2 – Models of Hydrogen atom

**Prediction:** - what the model predicts

Billiard Ball: \_\_\_\_\_

\_\_\_\_\_

Plum Pudding:

\_\_\_\_\_

\_\_\_\_\_

Classical Solar System:

\_\_\_\_\_

\_\_\_\_\_

Bohr: \_\_\_\_\_

\_\_\_\_\_

DeBroglie: \_\_\_\_\_

\_\_\_\_\_



|                    |                                                                                                                                                                                                                                                            |     |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
|                    | <p>Schrodinger: _____<br/>_____</p> <p><b>Experiment - (What Are really happens)</b></p> <hr/> <hr/> <hr/> <hr/> <hr/>                                                                                                                                     |     |
| Peer assessment    | <p>Each group reviews the worksheets of one of the other groups and compares the results in the discussion that follows. The teacher leads the discussion and guides the students towards common conclusions.</p>                                          | 15' |
| Making infographic | <p>Each group is given the task to create an infographic using Piktochart tool with a summary of what they have learned about the development of the atom model.</p>  | 20' |
| Quiz               | <p>Each group is given the task to make a short quiz of 5 questions in the online tool (<b>Google Forms</b>) that will be solved by other groups.</p>                                                                                                      | 15' |

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| Assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <p>Students solve a quiz (<b>Google Forms</b>) compiled by the teacher and which test the knowledge of the subject (atom models)</p> <p><a href="https://docs.google.com/forms/d/1Cx7PU8NusnhcDrIDSub-QuR0ZA_d7YZa3aOOkKX1eRQ/edit">https://docs.google.com/forms/d/1Cx7PU8NusnhcDrIDSub-QuR0ZA_d7YZa3aOOkKX1eRQ/edit</a></p> | 5' |
| Discussion and self-evaluation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Students complete a self-assessment list                                                                                                                                                                                                                                                                                      | 5' |
| <p><b>Blended and remote learning environments</b></p> <p><i>Can the activity be replicated in a blended learning environment (online and offline teaching combined) or in a remote learning scenario (fully online teaching)? If so, for which of these two learning environments can it be adapted, or both? Which tools and what preparations are necessary?</i></p> <p>The activity can be assigned to students in the <b>Google classroom</b>. In this case, each student is given a task with the specified activities (filling out worksheets, creating a knowledge quiz and completing the quiz) with a certain deadline. Google classroom can be used in the case of online classes for the whole class or only for students who are absent from real classes at school.</p> |                                                                                                                                                                                                                                                                                                                               |    |

### Other

*Are there any comments or details you would like to add regarding this section, which would facilitate the replicability of the lesson plan? Write them below this text!*

## 3. Follow up of the Lesson Plan

This section is optional, as not every topic or activity has materials available to complete this. However, we encourage you to try to find materials for follow up and to suggest an evaluation method of the lesson plan!



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| <p><b>Follow material and/or homework</b><br/><i>Help learners complete their learning process by suggestion materials the educator can suggest them to read or work on. This can be readings, exercises, websites, a more challenging level of the activity carried out in the lesson plan, etc. If you share any external resources, ensure you have the rights to share those resources.</i></p> |  |
| <p><b>Evaluation</b><br/><i>You can suggest an activity or an exercise that the educator can propose to their students to evaluate the lesson plan. This does not refer to your evaluation of the lesson plan.</i></p>                                                                                                                                                                              |  |

### Other

*Are there any comments or details you would like to add regarding this section, which would facilitate the replicability of the lesson plan? Write them below this text!*

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