Background information

Title: *Let's become "Atomic Architects"*

Brief Description: Through this Inquiry-based activity students will understand the basic structure of an atom. They will be introduced to the basic elements of matter 'protons, neutrons and electrons which form an atom. Moreover, they will represent the atomic structure of hydrogen through an AR/VR activity.

Keywords: structure, atom, electrons, neutrons, protons, AR/VR, hydrogen

Target audience: teacher with students

Age range: 10-12 years old

Context(s): school

Time required: 90 minutes.
Technological tools required:

- Playing with Protons goes digital Authoring Tool
- MetAclass App for Android

Author(s)'s background: *science teacher*

Connection with the curriculum: Physics, 5th grade in primary school, structure of matter.
Learning objectives:

- Understanding of the basic structure of an atom: Students will understand that an atom consists of a nucleus (composed of protons and neutrons) surrounded by energy levels or electron shells (rotating electrons)
- Engaging in scientific inquiry: Students will actively participate in the inquiry process by generating questions, making observations, constructing models and reflecting on their findings.
- Encouraging collaboration and communication

Guidance for preparation:
Gather all the materials you will need:
Smarties, Candies, Playdough, small balls, toothpicks

TEMPLATE:

1. Setting the scene

- Begin by asking students if they know what makes up everything around us.
- Spark their curiosity by explaining that they will become “Atomic Architects” and explore how atoms are structured!

Introduce the atomic theory (planetary model) through the video:
https://www.youtube.com/watch?v=pNroKeV2fgk

2. Look around

- Engage the students in a Brainstorming session to elicit their prior knowledge about atoms and atomic structure.
- Encourage them to generate questions they have about atoms and their structure.
  Write down their questions on a shared chart or whiteboard.
- Set up inquiry stations around the classroom, each focusing on a different aspect of atomic structure.
- At each station provide materials and instructions for students to explore and construct atomic models

At this scenario we will introduce the atomic structure of Hydrogen, but with the same way, this scenario could be made for other atoms.

3. Investigation – Part 1

Make a maquette model showing the structure of an atom (in general)

They will need:

- Playdough, pom-poms, ping pong balls, marbles, or candies in different colors
- Toothpicks, wires, or string

What they do:

1. Core and nucleus

Students use Playdough or candies in different colors to create the core or nucleus of an atom using a different color from the rest of the atom.

2. Energy levels

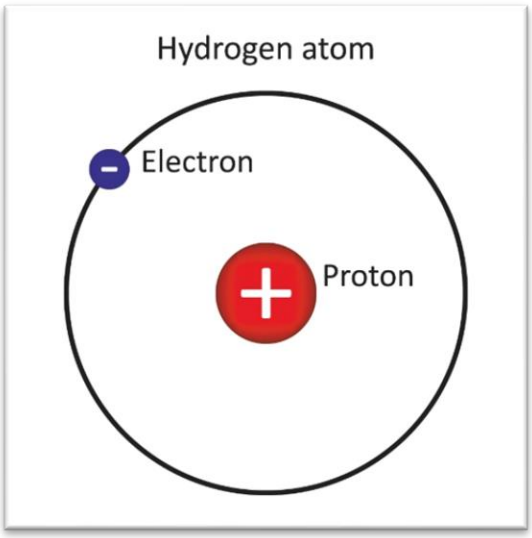
Students use small balls, pom pom or marbles to represent electrons and toothpicks to construct energy levels around the nucleus.

3. Elements and symbols

Students write the symbol of different elements on index cards or small pieces of paper and attach them to their constructed atomic models

For the atom of Hydrogen:

1. Provide students the basic atomic structure of the atom of Hydrogen



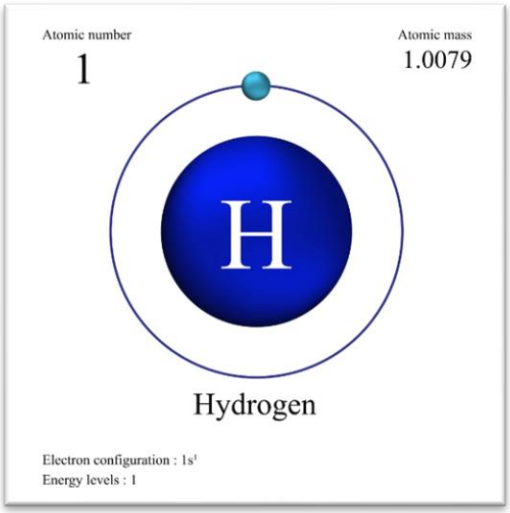
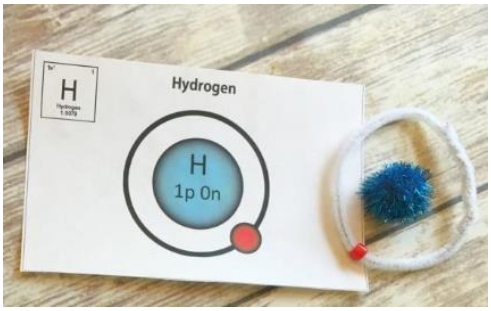


Figure 1: Models of atomic structure of Hydrogen

2. Set them free to make the representation of the atomic model own their own, with whichever materials they prefer.
   Here are some examples of the crafting:



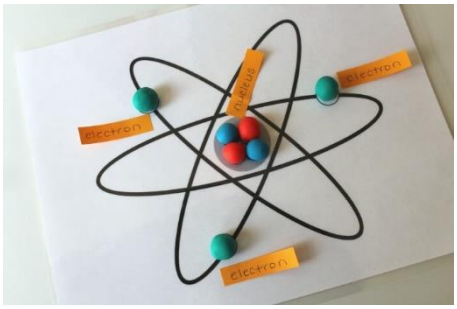


Figure 2: Examples of craft activities of atomic structure of Hydrogen

4. Investigation – Part 2

- Allow students to rotate through the inquiry stations in small groups, encouraging them to explore, construct and record their observations.
- Provide guiding questions at each station to stimulate their thinking and guide their investigations.
- Summarize the collective findings and explanations generated by students.
- Use the constructed atomic models to illustrate the basic structure of atoms, emphasizing the nucleus, energy levels and electrons. They may use a worksheet like this:

Name of atom	Symbol	Number of protons (Atomic number,Z)	Number of neutrons	Number of electrons	Number of neutrons & protons (Mass number,A)
Hydrogen	H	1	0	1	1

Figure 3: Worksheet table

- Make general conclusions about the atomic number and mass number of an atom and their connection.

Reminder:

1. The atomic number (symbol Z) of a chemical element is the charge number of an atomic nucleus. For ordinary nuclei, this is equal to the proton number, or the number of protons found in the nucleus of every atom of that element
2. The mass number (symbol A) is the total number of protons and neutrons in an atomic nucleus.

5. Creation of the AR project

1. Print the QR code of the AR project:

Figure 4: QR code of Hydrogen AR project

2. Print the markers of Hydrogen:

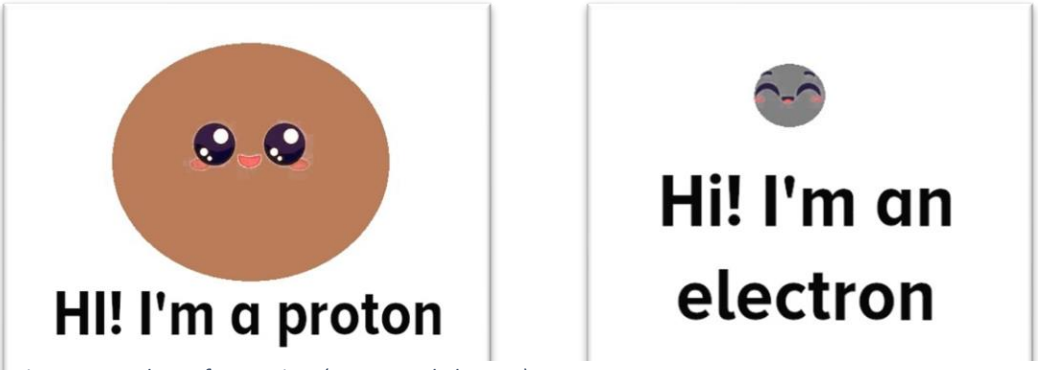


Figure 5: Markers of AR project (Proton and Electron)

3. Open metAclass app and scan the QR code

Figure 6: Scan QR code

4. The AR project is starting to download

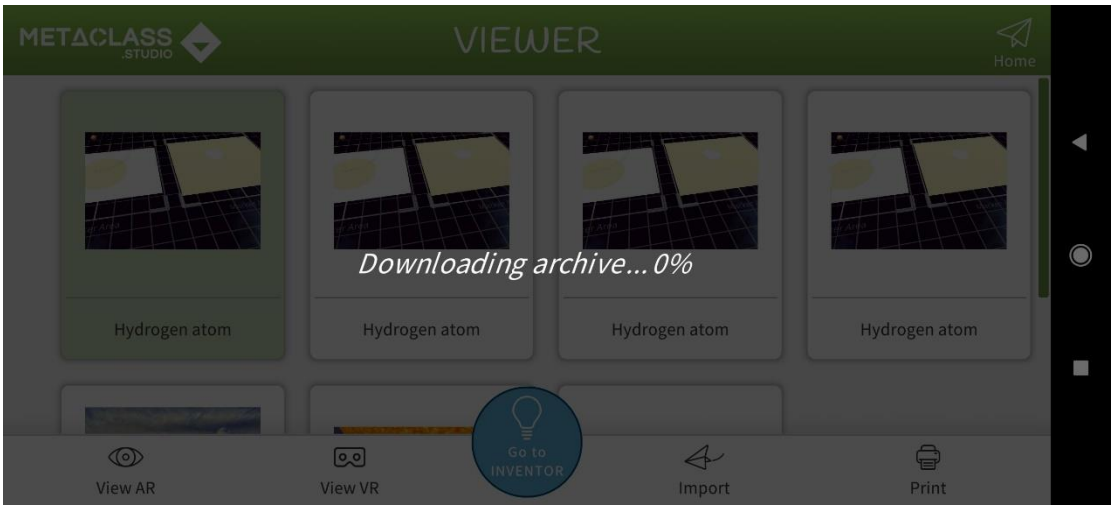
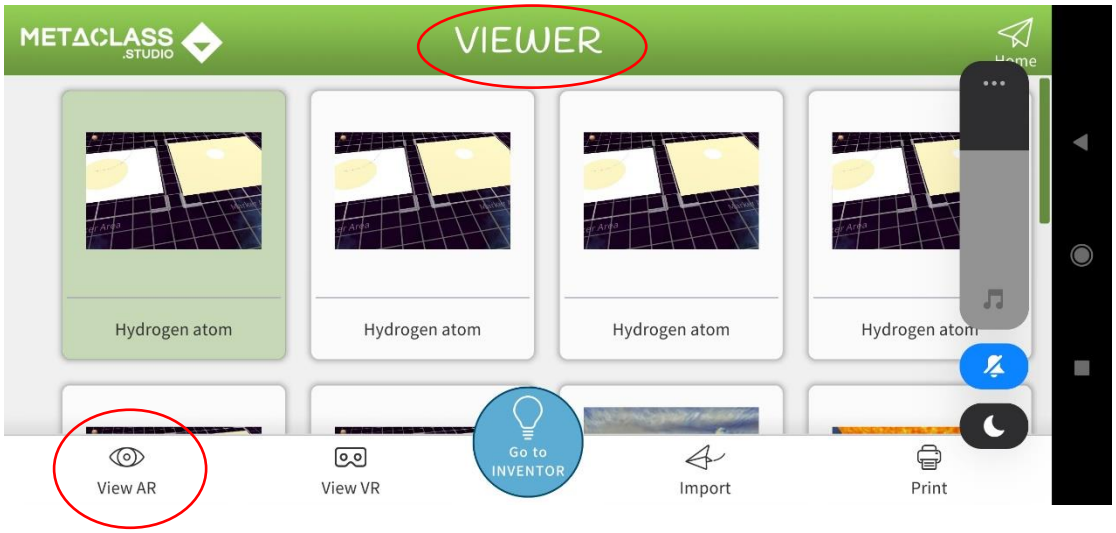


Figure 7: Download the AR project

5. Select the View AR and Hydrogen Atom AR project:



6. Scan the electron’s marker:

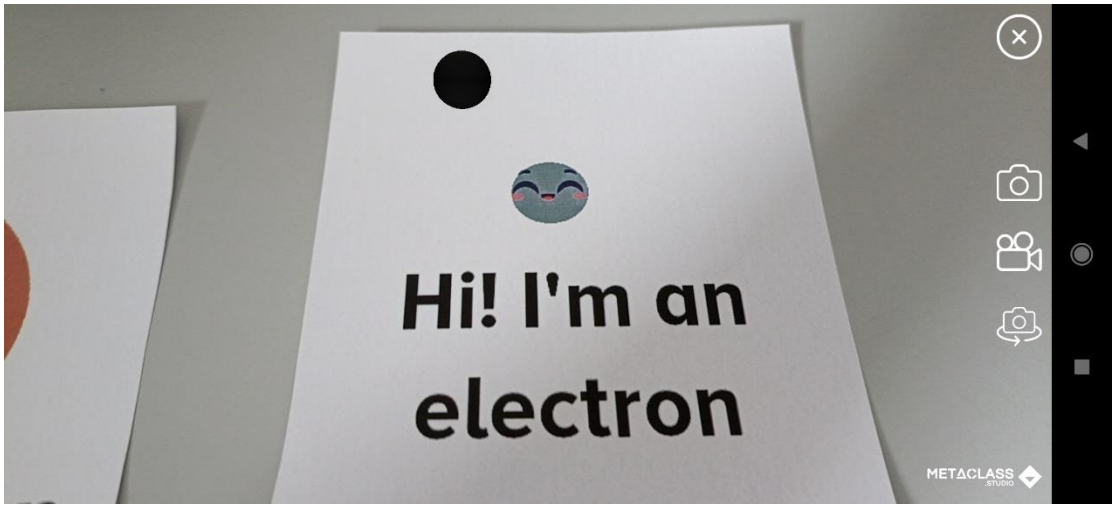


Figure 8: Scan the marker of electron

7. Scan the proton’s marker:

Figure 9: Scan the marker of proton

8. Scan the Hydrogen atom.
   Put together the two markers and the animation of the rotating electron around the proton, it will appear:

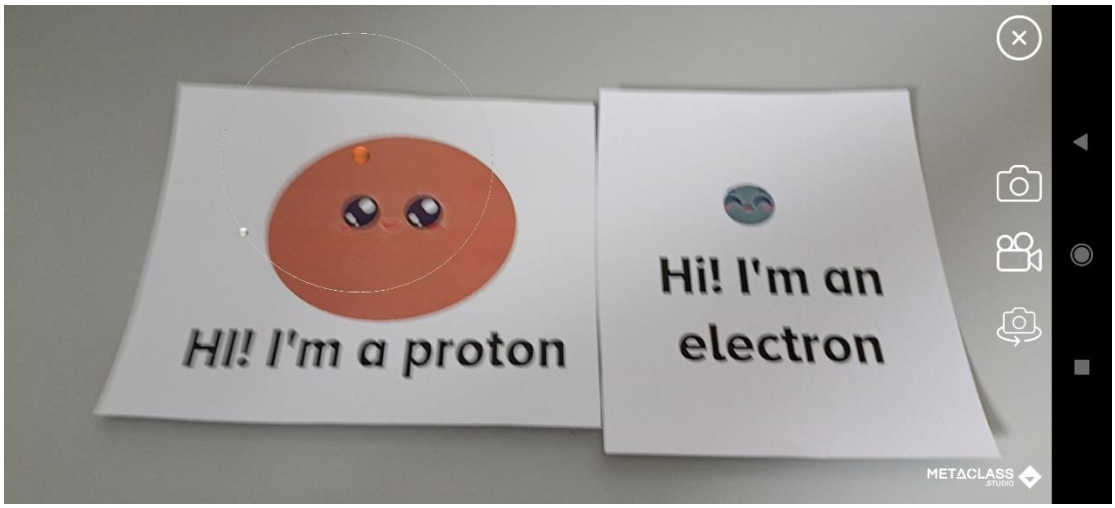


Figure 10: Scan the markers together and the animation of Hydrogen atom will appear

6. Communication and discussion

1. Recap of Key Concepts:

Summarize the key concepts discussed during the activity, such as the structure of atoms, the role of the nucleus and the arrangement of energy levels

2. Shared Reflections:

Allow students to share their reflections on what they learned about atomic structure.

Encourage them to discuss the similarities and differences they observed in their constructed atomic models and how they relate to the real-world behavior of atoms.

3. Answering Key Questions:

Revisit the questions generated at the beginning of the activity and encourage students to provide answers or explanations based on their observations and understanding.

Discuss how their perspectives may have changed or expanded as a result of the inquiry process.

4. Connecting to Everyday Life:

Facilitate a discussion on the relevance of atomic structure to our everyday lives.

Help students recognize how the behavior of atoms and their interactions contribute to various phenomena, such as the properties of materials, chemical reactions, or the functioning of electronic devices.

Help students recognize the similarity between the bohr model of atoms and the planetary model.

5. Expressing Understanding:

Give students an opportunity to showcase their understanding of atomic structure through a brief written reflection, a diagram, or a presentation.

Encourage them to explain the key components of an atom, their relationships, and the significance of electron arrangement.

6. Next Steps:

Discuss possibilities for further exploration or extension activities related to atomic structure, such as investigating the periodic table, exploring different elements, or learning about the contributions of scientists in understanding atomic structure.

A good idea could be students to add the QR code and markers in their craft, so they have an AR perception in their craft models!

7. Closing Remarks:

Conclude the activity by highlighting the importance of atomic structure as a fundamental concept in understanding the world around us.

Encourage students to continue their scientific inquiry and exploration, fostering their curiosity and interest in the field of chemistry.

The conclusion of the activity should reinforce the main ideas, provide students with a sense of accomplishment, and inspire them to continue their scientific exploration beyond the activity itself.