

1. **Name:** Atomic passion

2. **The project consists of the following STEAM areas:** Chemistry (chemical bonds), mathematics (geometry, proportion and symmetry), art (dyeing with natural pigments), engineering (3D modeling), Technology (3D printing), physics (attractive and repulsive forces between ). molecules), sustainable development

3. **Students aged 13-16, whole class**

4. **Two workshops in the school** (one to get acquainted with the necessary knowledge for the project, theoretical knowledge of chemical bonds, and the other for application of science from each phase of the process).

The first activity lasts **90 minutes** and the second **120 minutes**.

5. **Keywords:** chemical bonds, interaction, geometry, particles

6. Through these activities, students will use their geometric knowledge to make models of molecules. We will use 3D modeling as well as 3D printing to make spheres that represent the atom of metal and nonmetal using knowledge of their characteristics. We put students in a position to solve a problem (real molecules) by using previously acquired knowledge and creativity. To achieve the project goal, we use knowledge from the field of chemistry (characteristics of chemical bonds) and the field of mathematics - the angles of atoms in the construction of bonds, symmetry of molecules as well as attractive and repulsive interactions between particles. Students are expected to solve problems by concluding whether each interaction leads to a chemical bond.

Our project encourages learning to create models of molecules through trial and error and use practical acquired knowledge to help students better understand the relationships of particles in the micro world. By developing our project, in addition to gaining knowledge about chemical bonds, students experience teamwork, they expand cooperation and communication, creativity and imagination. We want to encourage students to apply knowledge about chemical bonds in real life.

7. Activities are performed in school, in the classroom, where students practice their knowledge of chemistry, physics, geometry and modeling.

- Computer with internet and 3D modeling program (Solid Works...)
- 3D printer
- Filament for printing
- Colors based on natural pigments
- VR glasses
- Magnets
- 3D animation

8. In communication with the professor and mutual communication, students combine previously learned knowledge from mathematics, physics, chemistry and technology and form the basis of knowledge for future activities.

- Students additionally process units in the field of geometry
- Students draw sketches of molecule models

- Students create 3D models of balls using software
- Students print ball models on a 3D printer
- Students paint the balls with natural pigments
- Students connect balls and form molecules
- Students make 3D animations that realistically simulate the construction of chemical bonds in molecules
- Students use VR glasses to watch previously created animations
- Students make suggestions for improving the project, after the survey.

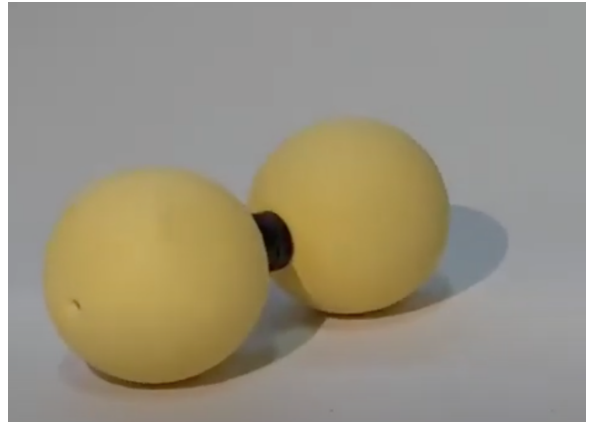
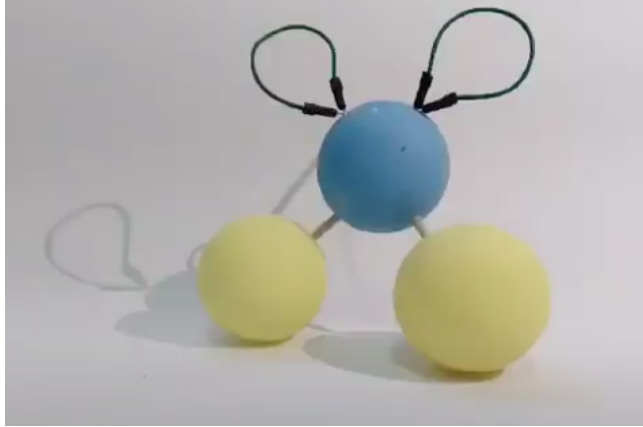
Through the work, students will explore:

- Chemical bonds and relationships between particles (strength of chemical bonds)
- Design of 3D models (ball radius, volume, dimensions)
- Forms of molecules (angular shape, tetrahedral shape, trigonal-pyramidal, linear)
- Geometry of molecules (angles between bonds, symmetry of molecules as a whole)
- Aesthetics (model coloring)

9. This activity describes how modeling molecules can be connected with practical activities. Our activities connect the fields of chemistry, mathematics and technology. Our activity can be implemented in regular school classes as a project.

- Chemical bonds
- Molecule models (2D and 3D)
- Molecule geometry
- Symmetry of molecules
- Interactions between particles
- Proportion
- Sustainability
- Applicability \* Reuse
- Gender equality





10. Evaluation is done through informal student feedback and assessment made by teachers.

11. Chemical bonds

[https://youtu.be/DFzbx0MO\\_Kk](https://youtu.be/DFzbx0MO_Kk)

12. [aleksandragosnjic@gmail.com](mailto:aleksandragosnjic@gmail.com)

Team:

Mila Projovic

Jovan Kostic

Dimitrije Mirkovic

Jovan Lazarevic

Aleksandra Gosnjic