

## Workshop: XColony – Space Traveler Series – Space Diver

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**Space Diver Model:** from basic module to the full model

### Objectives

Learn new properties of regular hexagons and chains of hexagons, the Archimedean body „truncated octahedron” and special approximations of it.

Investigate how to represent in 3D these modules and learn how to connect them flexibly. Experiment with various transformations and kinetic properties of the ensemble of such polyhedra.

Use the KDK elements to solve various puzzles and to build the constructions described in the accompanying manual.

### Materials

Movies from the XColony channel on YouTube and KDK DVD.

Elements and documents from the KDK box

Internet resources: pictures, documents, movies

### Organization

The workshop is organized in groups of 4-6 participants.

### Activities

#### 1. Presentation of the theme and objectives (10 min)

- watch the introductory and step-by-step instructions movies
- brainstorming on the content of the movies: how many items have been identified, what kind of description could be associated with them, what other names should be given to these items in order to better designate them? Find associations with objects from reality and life, science (flowers, animals, crystals, molecules) and art (films, tilings, architecture, origami).

## 2. Distribution of materials (10 min)

- identification/designation of the elements,
- generate hypothesis on their use and foresee the final construction to be made

## 3. Playing and Learning Activities. Construction, Puzzle solving, Discovery (40 min)

- each group will inspect the materials and investigate through puzzle solving the 2D properties of the available elements (Activity 1)
- visualize the way to construct the basic modules and construct all of them (Activity 2)
- formulate the strategy to be applied to construct the final object: shedule tasks, assign tasks to members of the group equitably, proceed (Activity 3)
- investigate geometric, kinetic and combinatorial properties of the final construction; visit other groups and discuss your findings; ask questions, challenge the others to poze problems and puzzles, ask for new solutions (Activity 4)

## 4. Concluding the workshop (10 min):

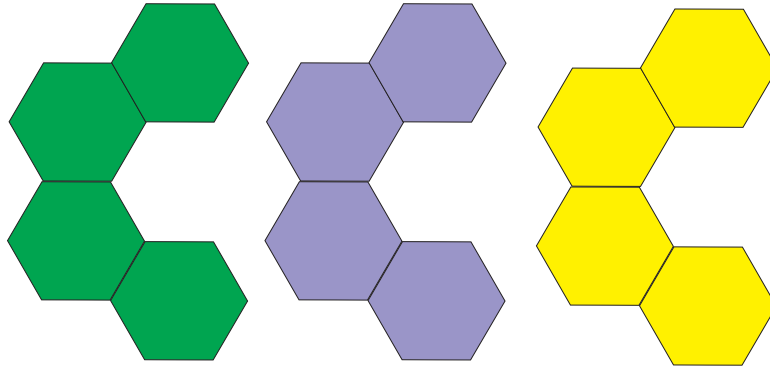
- recall the most interesting part of the workshop (each group identify one)
- pack and store or distribute the final constructions made. If the constructions are distributed there should be a fair system for that (e.g., a number of credits is assigned for every participant, each construction costs a number of credits, the student with a highest number of credits in the group will pick first and his/her number of credits is adjusted by the cost of the object). Students should be encouraged to design their own system of credits). After several sessions all students would have taken home at least one object.



## Appendix

### Activity 1

Inspect the 44 Hc4 elements having different colors.



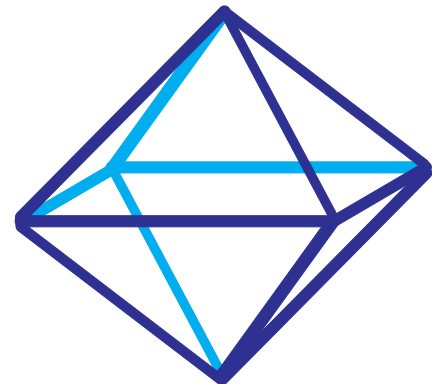
Position them in plane such that you get configurations with the following shadows:



Create 2 more problems of this type.

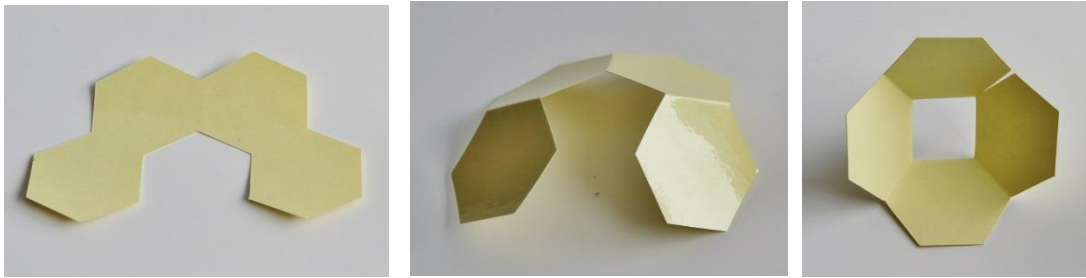
### Activity 2

Imagine a regular octahedron and cut its corners such that all faces become regular hexagons. Is it possible?

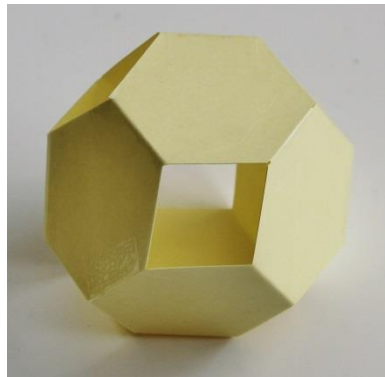


Pick 2 elements Hc4 of the same color. Fold each one of them such that you form a ring of 4 hexagons in 3D. Tape the first and last of the edges to fix the ring shape. Use the 2 rings and

connect them on the 4 exterior edges. You should obtain the octahedron with cut corners body, which is the basic element of the final construction.



Hc4 element: **flat, folded** and **connected**

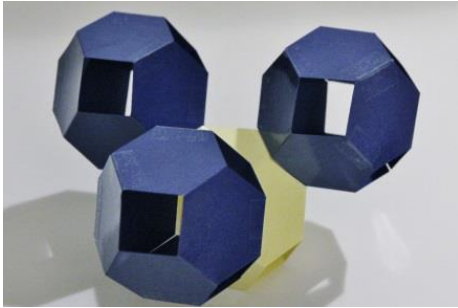


Two connected Hc4 elements linked on the exterior edges = **The O module**

### Activity 3

Repeat what you have learned and connect the base, the top, and the middle flexible modules:

- The base module is obtained by connected only one edge between the yellow and each of the blue O modules: the connection is on the upper face of the yellow module
- The top module is obtained by connected only one edge between the yellow and each of the red O modules: the connection is on the upper face of the red modules
- The middle module is obtained by connected the yellow module with the red and the blue modules as described before



**Base Module**



**Top Module**

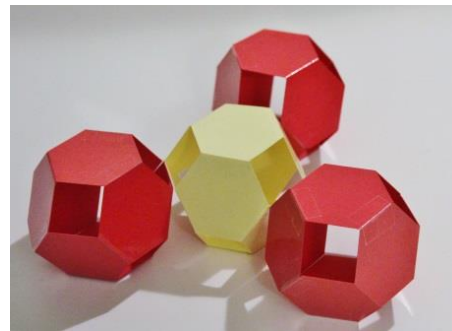
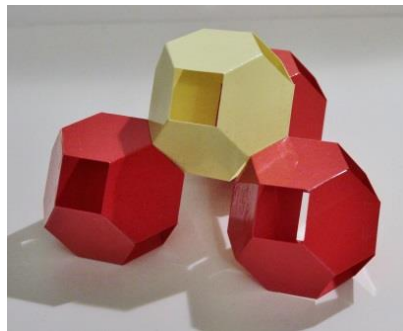


**Middle Module**

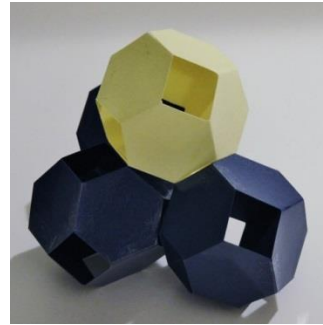
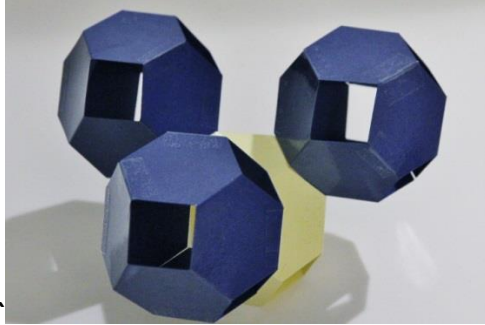
#### **Activity 4**

Play with the complex modules (base, top, middle).

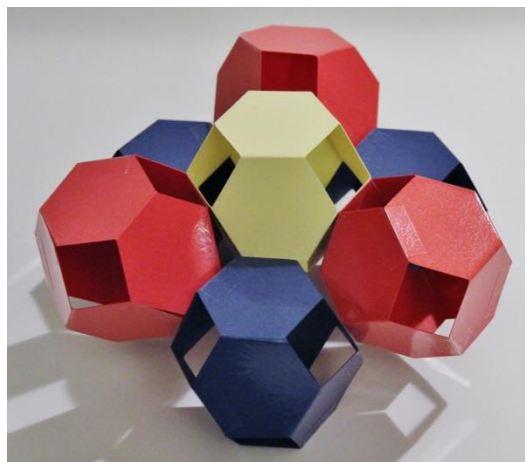
Analyze the flexibility of each of them. Assemble them to obtain the Space Diver model. First connect temporarily the top and the base. Could you assemble and disassemble the model with one hand? Would it be possible to assemble more than one middle module in the model? Work with the colleagues from other groups to investigate this. Is it possible to fill the entire space with only O modules? Assume that you have as many as you want. Great, you just discovered a tessellation of the space.



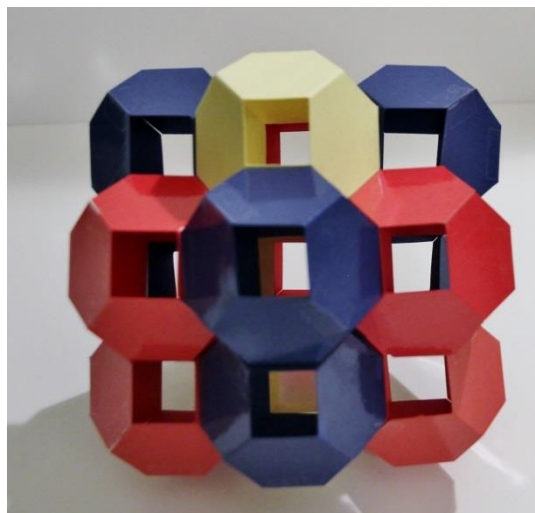
**Top module – various instances**



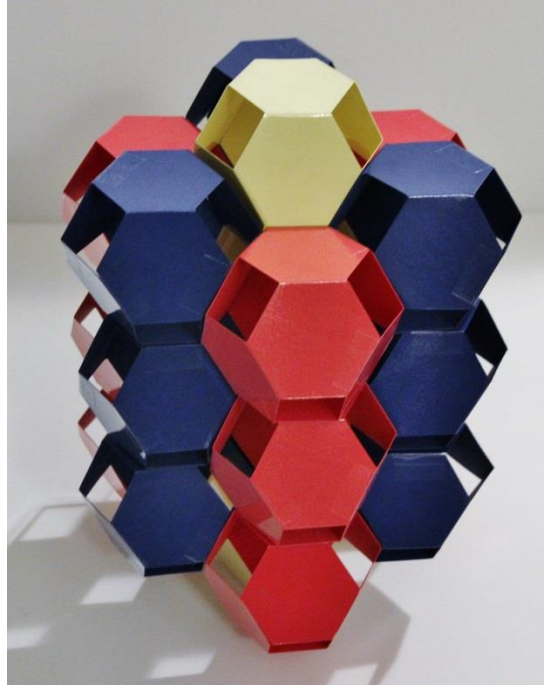
**Base module – various instances**



**Base and Top modules connected temporarily**



**The Space Diver model (base, middle and top modules connected temporarily)**



**Interaction with 2 middle modules** (there is a green O inside one of the middle modules)