## Cube Tessellation

The Cube tessellation is a repetitive work based on the molecule described here.

The single molecule is a Cube sitting on a frame of paper. The cube dimension is a unit, and the frame is 3 by 3 units. In the center, there is a cube. If you turn the model over, the cube is open on the bottom.

The model has a rotational symmetry. All four edges are the same.

The molecule has a unique property - the edges of the original square paper are still on the edges of the molecule. This allows the folder to make many molecules from a single sheet of paper.

(I can add more explanation as to why this works later)

Once you know how to make one molecule, you can make 2 by 2 molecules. I will explain that once you will approve this version.

## Single Molecule

### Part 1 - Precreases

1. Start with a grid of 8.
2. Cut three rows and columns.
3. You have a grid of 5 now.
4. We are going to add four pre-creases on units number 8, 12, 14, and 18. Unit 13 is in the center, and those four all have adjacent edges with it.
5. 8 and 18 will each get a top-left to bottom-right diagonal crease, as a mountain.
6. 12 and 14 will each get a top-right to bottom-left diagonal crease, as a mountain.
7. Unit 8 - find horizontal grid line number 2 I will call it H2) and vertical grid line number 3 (V3).
8. Pinch H2 from the right and V3 from the bottom until they meet. Move your finger inward slowly, and make sure you feel the crease lines.
9. Once you find the common intersection of the lines, bring them gently together. Do not force the paper below the creases to bend too much. This will form a crease line in unit 8, along the diagonal, in the right direction. Force this crease until you reach grid lines H1 and V2.
10. You can also try and orient H1 and V2 into valleys. This will make sure your diagonal mountain will not exceed its limit. H1 and V2 create the top left corner of unit 8.
11. Rotate the paper 90 degrees clockwise and repeat this process. When done, repeat it two more times.
12. Your precreases are done! Please make sure that the grid orientation is the opposite of the pre-creases.

### Part 2 - Collapse

1. Turn the paper over. The precreases should be valleys now. All the grid lines are mountains.
2. Reinforce the four grid lines around the center unit (13) as mountains.
3. Hold the paper with your right hand, so the center unit (13) is between the thumb and finger of the right hand. Make sure unit 13 is popping up above the frame level at all times.
4. With your left hand pinch grid line H3 from the left so units 11 and 16 will touch each other completely.
5. Rotate 90 degrees clockwise and pinch again H3 (H3 in reference to the new position of the paper, and NOT the H3 we already pinched.)
6. Rotate again and repeat. It may take more than 4 repeats to make it work.
7. Once you feel H3 all around is a mountain, you can squeeze all of the edges inward. A cube will form in the center. The center pops up on the side where the precreases are valleys.
8. Your first molecule is done! It should feel as if the cube has risen up and is sitting atop the square, at the center, with a flat frame all around it. Unit 13 is facing the ceiling, so that would be the top face of the cube. The bottom is open. One can feel the diagonal folds on the inside of the cube, all 4 folded in the same direction. Taking the top side of the cube as a reference point, there will be 4 two-layered 'spokes' or wall-like structures that radiate from the sides of the cube to the edges of the frame. They will resemble 4 walls since, if one were to walk on the outside of the cube, along the frame, you wouldn't be able to pass since these walls would stop you on all 4 sides. Your frame will consist of 8 units in total, so you will encounter a wall after every second unit if you imagine walking around your raised cube.

## 2 by 2 molecules

### Part 1 - Precreases

1. Start with a grid of 8.
2. Repeat the process of the single molecule in the top left corner. Your center square is on unit 19. Diagonals on units 11 and 27 (above and below the center unit) should be top left to bottom right.
3. Once you have the four diagonals set, rotate the paper 90 degrees clockwise, and repeat the process, but reverse each diagonal. Now the units above and below the center should be top right to bottom left.
4. Continue until you get all four molecules pre-creased.

### Part 2 - Collapse

1. Hold the paper in a way the precreases should be valleys now. All the grid lines are mountains.
2. Collapse the top left molecule first. Follow the exact instructions of the single molecule. The top and left walls will be exactly like the single molecule. The wall to the right to the bottom should go all the way to the equivalent edges and will be much longer (4 units long).
3. Once the first molecule is done, find the wall that connects it to the top right molecule. After one unit it aligns with the center of the second molecule.
4. Reorient the four mountains around the center unit of the second molecule. One of them continues the wall we mentioned in the previous step.
5. Make sure the first molecule is released and not tightly folded.
6. Make sure the center unit of the second molecule is popped up. Now find the three missing walls around it. One should go to the bottom (from the right side of the square unit). One goes to the left (from the top mountain line of the center unit), and the last goes to the top edge.
7. To finish the two bottom molecules, you have to construct both halfway, and then collapse them together. It's impossible to fully collapse three molecules and then try to arrange the last. The molecules should be slightly open to collapse.
8. Once you get used to the pattern, you can orient all the creases without collapse, and then hold everything and squash it all inside. If all the creases are at the right orientation, there is only one way for it to fold.

|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **A** |  |  |  |  |  |  |  |  |
| **B** |  |  | B3  top left |  |  | B6  Top right |  |  |
| **C** |  | C2  Top right | C3  center | C4  Top right | C5  top left | C6  center | C7  top left |  |
| **D** |  |  | D3  top left |  |  | D6  Top right |  |  |
| **E** |  |  | E3  Top right |  |  | E6  top left |  |  |
| **F** |  | F2  top left | F3  center | F4  top left | F5  Top right | F6  center | F7  Top right |  |
| **G** |  |  | G3  Top right |  |  | G6  top left |  |  |
| **H** |  |  |  |  |  |  |  |  |