Name ______________________________

Instructions for a Stellated Octahedron

Materials

12 square pieces of paper of the same color, or 4 square pieces of three colors each. All types of paper will work, including origami, foil, or even scrapbook paper.

Folding Directions

1. Fold a piece of square paper in half. Unfold.

2. With the crease vertical, fold the left edge to the middle crease. Do the same to the right edge. Be careful not to go past the crease.

3. Rotate the paper 90 degrees and unfold, so that the creases are now horizontal.

4. Fold the top-left corner down to the top crease, creating an isosceles right triangle. Do not go past the crease. Do the same thing to the bottom-right corner.

5. Airplane fold the hypotenuse of the top-left triangle down to the existing top crease (the bottom angle should measure 22.5 degrees). Do the same to the bottom-right triangle. Do not unfold.

6. Holding the airplane fold down, flip the top panel on the existing crease down toward the middle. Flip the bottom panel on the existing crease up toward the middle. Do not unfold.

7. Fold the bottom-left corner up to meet the midpoint of the top (creased) edge. Do the same thing to the top right corner. Fold it down to meet the bottom (creased) edge. The result should be a parallelogram that should flop open if you let it go.

8. Secure the parallelogram so that each triangle gets tucked into the panels underneath. Flip it and rotate it 90 degrees counterclockwise.

9. Take the bottom-left vertex of the parallelogram and fold it up to meet the vertex of the obtuse angle on the same side. Do the same thing with the top right vertex. You now have a square that should flop open if you let it go.

10. Bend the square down along the existing diagonal, creating a mountain fold.

11. Repeat steps 1–10 eleven more times.

(*See the next page for assembly instructions*.)

Name ______________________________

Assembling the Model

1. Hold a piece, or a module, in one hand. You should be looking at the side with pockets.

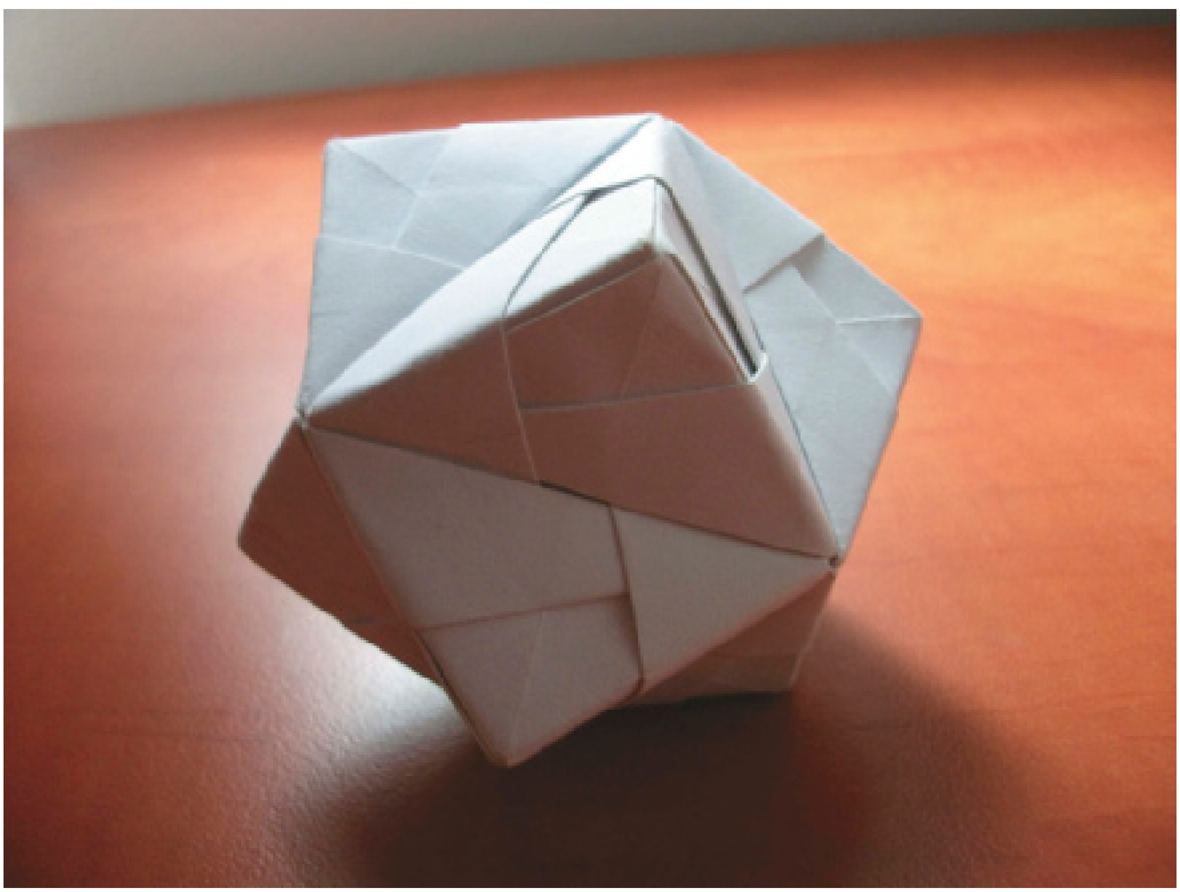
2. Hold a second piece perpendicularly to the first piece. Slide the tab of the second piece into a pocket of the first piece.

3. Each stellated point, or triangular pyramid, should have three faces. Look for the beginning of a pyramid. Insert a tab from a third piece into the remaining pocket of the pyramid. By doing so, a tab will need to be lifted up and inserted into a pocket, securing the pyramid.

4. Continue building new pieces onto the growing model. Be sure to tuck all tabs into the appropriate pockets. Any random valley vertex will be surrounded by four pyramids.

Creasing Tip

- Running the edge of a ruler or other rigid object along the paper's folds will help you make sharp creases.



activity sheet 2

Name ______________________________

Investigate Properties of the Stellated Octahedron

1. Does Euler's formula apply for this stellated polyhedron? $V + F - E = 2$

a. Determine the number of vertices (V).

b. Determine the number of faces (F).

c. Determine the number of edges (E).

2. If the square paper used in this model had side length x, what is the area of 1 square? Show your work or explain your answer.

3. If the square paper used in this model had side length x, what is the area of all the squares used to construct the model? Show your work or explain your answer.

4. Use a ruler and measure the surface area of your model in either square inches or square centimeters. Show your work or explain your answer.

5. Find the surface area of a model constructed with squares of side length x. Show your work or explain your answer. (Hint: Your answer should be in terms of x.)

6. What percent of the materials used is visible in a completed model? Show your work or explain your answer.

7. What percent of the materials used is hidden in a completed model? Show your work or explain your answer.

8. If you used 4-inch squares to create the model, what will be the surface area of a completed model?

9. If you used 8-inch squares to create the model, what will be the surface area of a completed model?