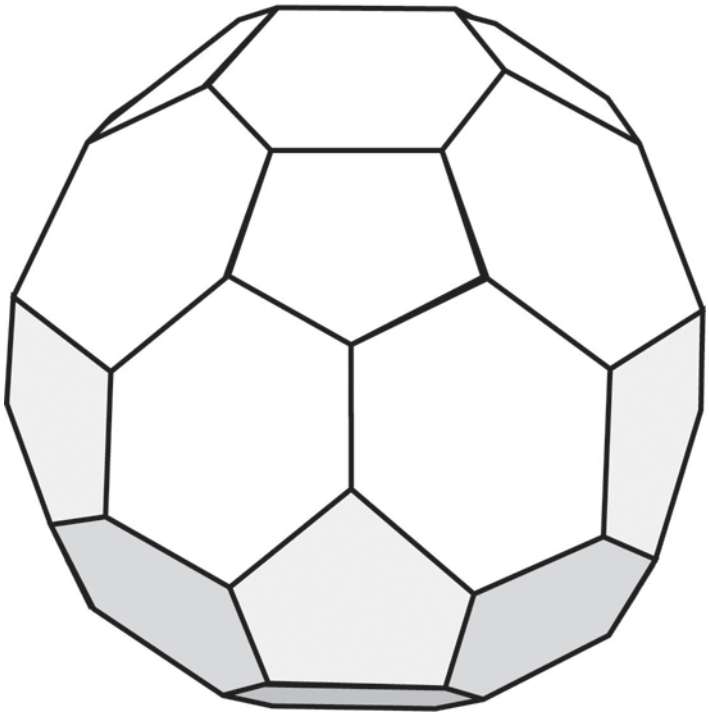
Build a Buckyball Model



This activity was developed by the
Hands On Science Center at the
National Museum of American History,
Behring Center

An educator's introduction for building a Buckyball Model

This is a versatile method for building a buckyball structure that gives the crafter the opportunity to experiment. Here are some things to try:

- Resize the polygons on a photocopier to make smaller and larger buckyballs. Patterns for the pentagon, hexagon, and connectors must be resized by the same percentage to maintain proportion.
- Use different colors for hexagons and pentagons.
- Paint or use glitter to decorate the polygons.
- Try different media. Flex-foam works well for this project.

Any sturdy medium that can be easily cut with scissors, paper cutter, or razor knife should work well for this activity.

Once you are familiar with the buckyball structure, try putting one together with small Styrofoam balls and toothpicks or the ball and stick components from a molecule modeling kit. This would be a more accurate representation of the buckyball structure. Sixty balls and ninety sticks are needed.

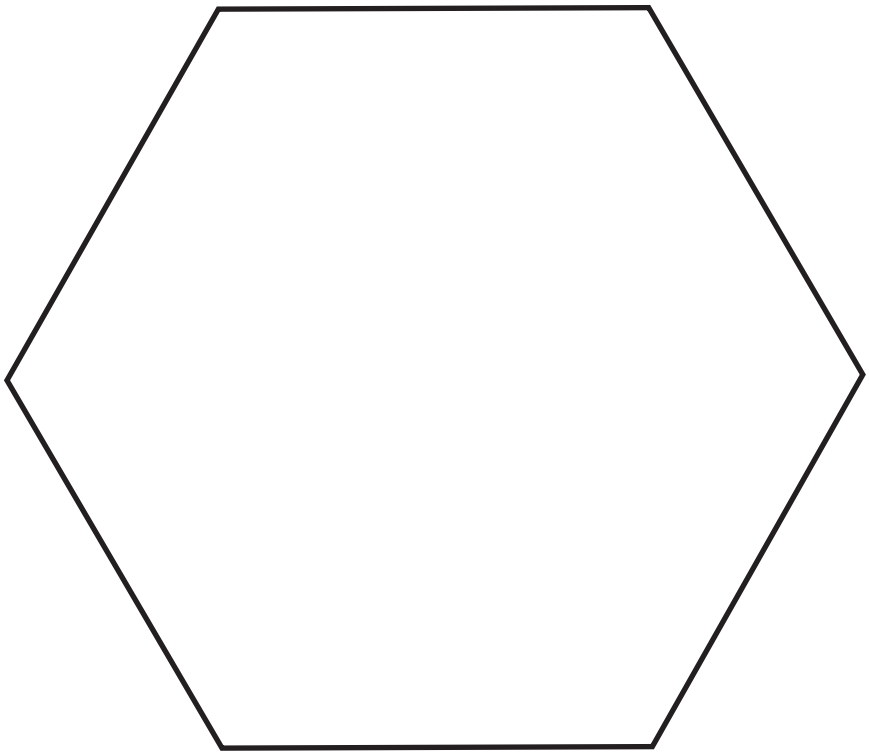
The resulting structure of this activity is a called a truncated icosahedron. The buckminsterfullerene (buckyball) has this structure, however, buckyballs are not solid. They are hollow cages with a carbon atom at each vertex. Each vertex, or carbon atom, is connected to three others. There are 60 vertices and 90 edges in the truncated icosahedron. Likewise, there are 60 atoms and 90 bonds in the buckyball molecule.

Observation of regular patterns reveals the nature of such structures and helps to avoid errors in construction. In the buckyball, a single ring of hexagons surrounds each pentagon. Also notice that by building the structure one layer at a time, the following formula arises:

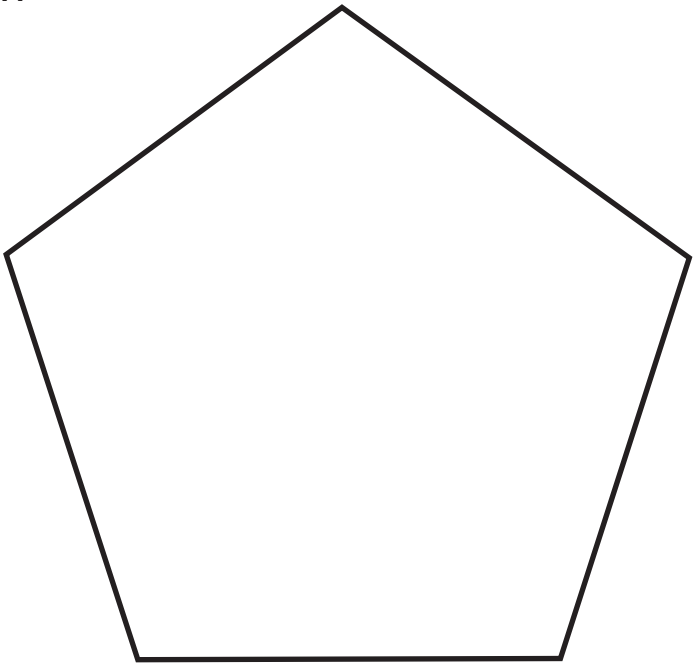
1 pentagon
5 hexagons
5 pentagons
5 hexagons
5 hexagons
5 pentagons
5 hexagons
1 pentagon

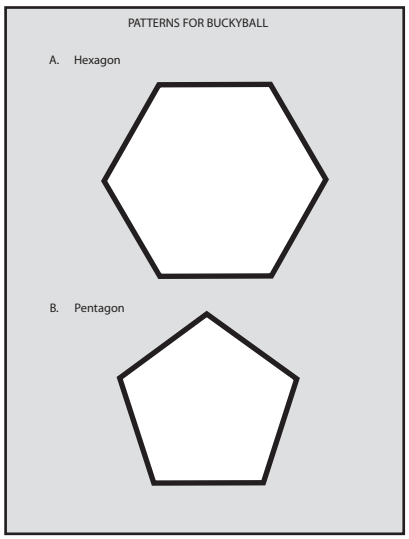
PATTERNS FOR BUCKYBALL

A. Hexagon

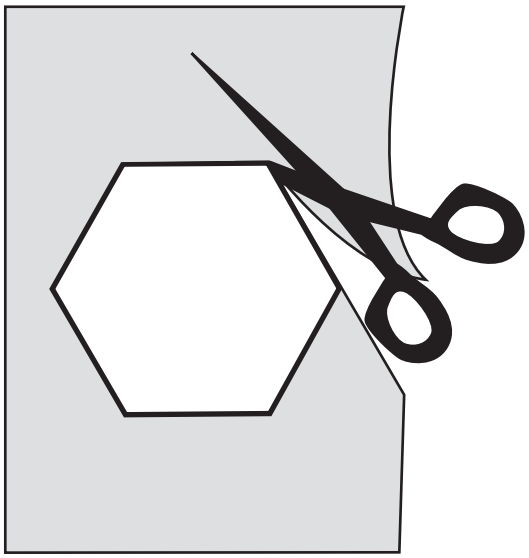


B. Pentagon

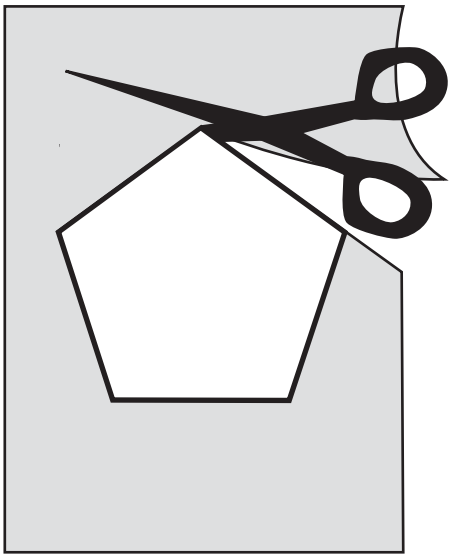




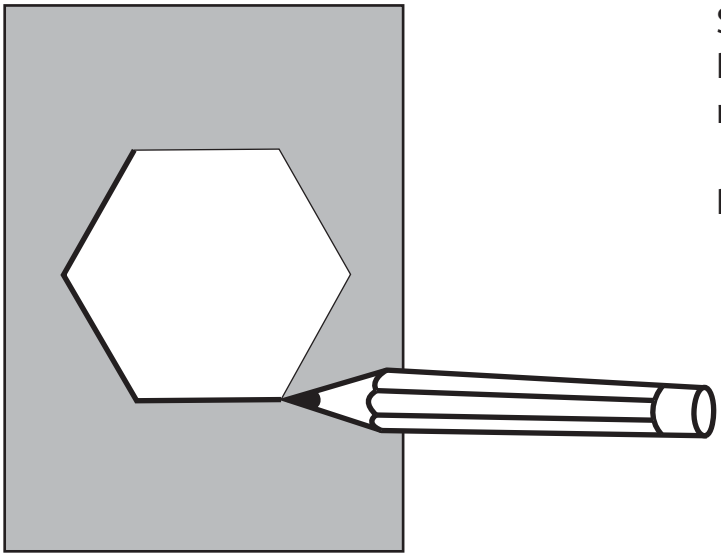
STEP 1
Print or copy the hexagon and pentagon pattern on to heavy paper.



STEP 2
Cut out the hexagon pattern.

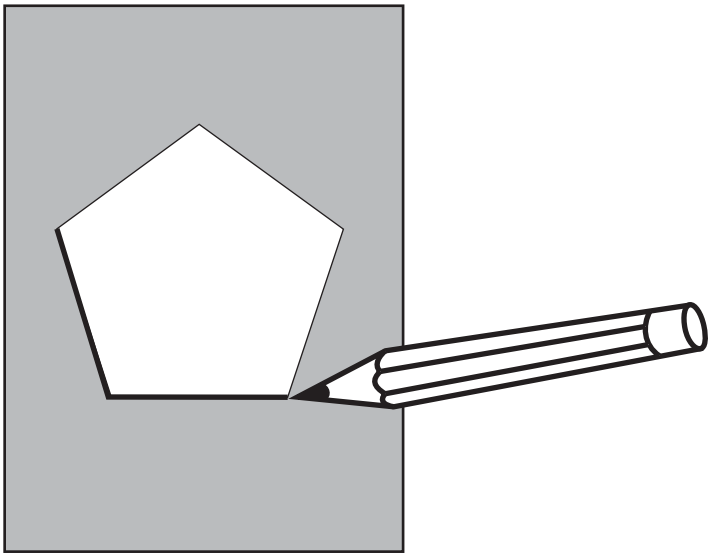


STEP 3
Cut out the pentagon pattern.



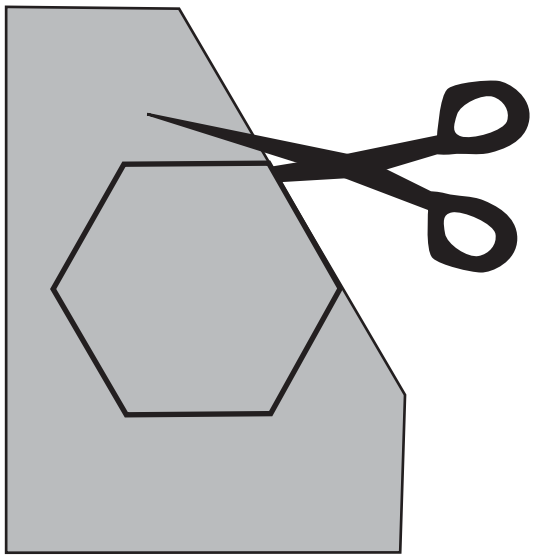
STEP 4
Place the hexagon onto your choice of media and carefully trace the pattern.

Repeat this step 20 times.



STEP 5
Place the pentagon onto your choice of media and carefully trace the pattern.

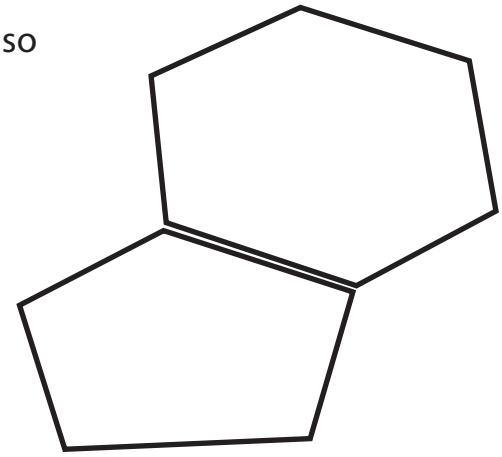
Repeat this step 12 times.



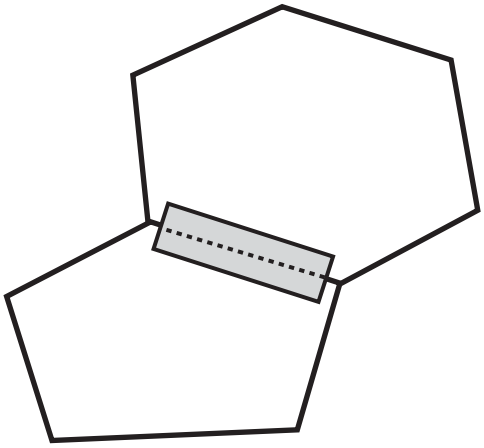
STEP 6
Cut out all 20 hexagons and all 12 pentagons.

STEP 7

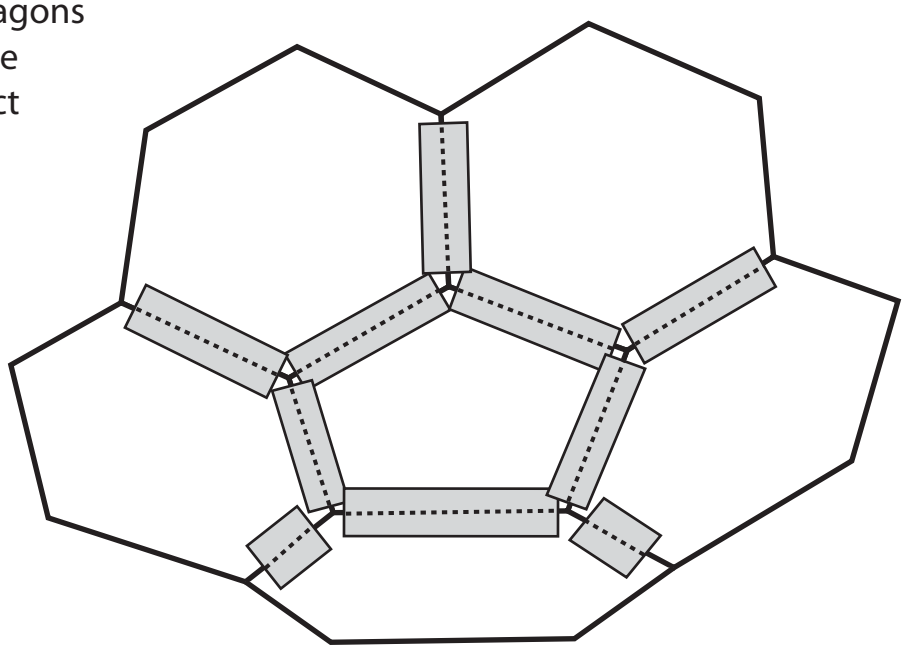
A Place a pentagon and a hexagon so they share an edge.



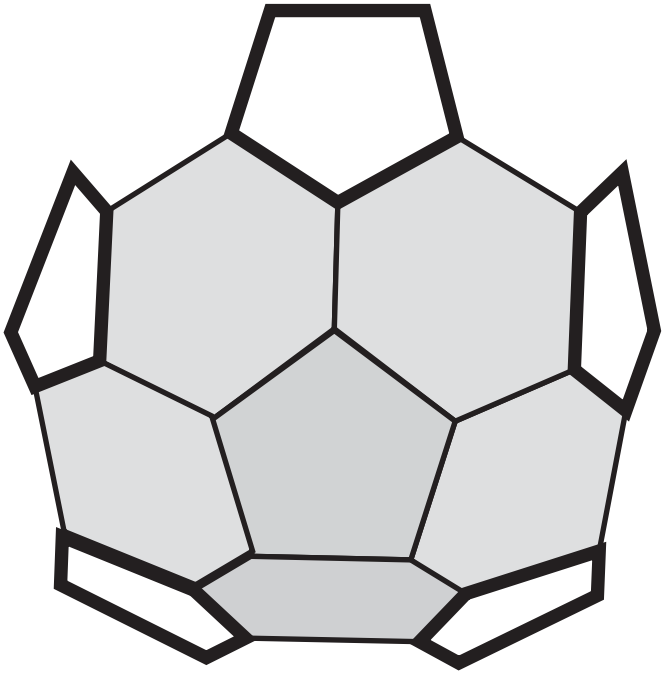
B Tape the edges together. Gluing an overlapping connector can be used instead of tape.



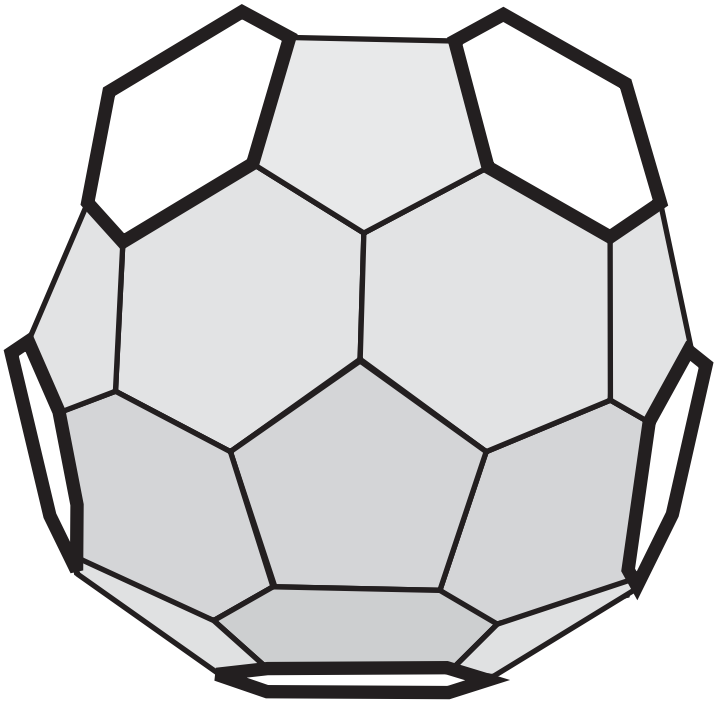
C Connect four more hexagons to the other edges of the pentagon. Also, connect the edges of adjacent hexagons. You should notice the structure curving upwards like a shallow bowl.



STEP 8 Add five pentagons so that their corners fit into the nooks between the hexagons.

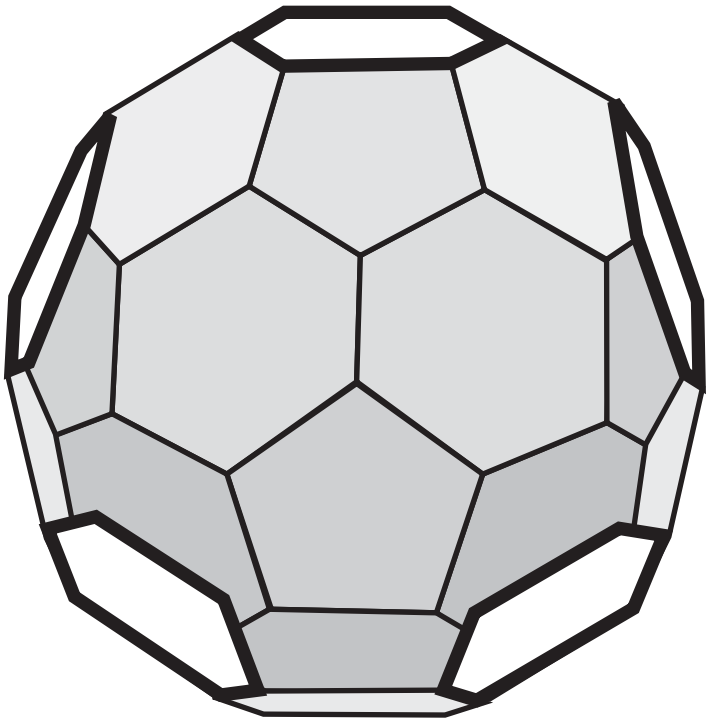


STEP 9 Add five hexagons to the nooks between the pentagons.

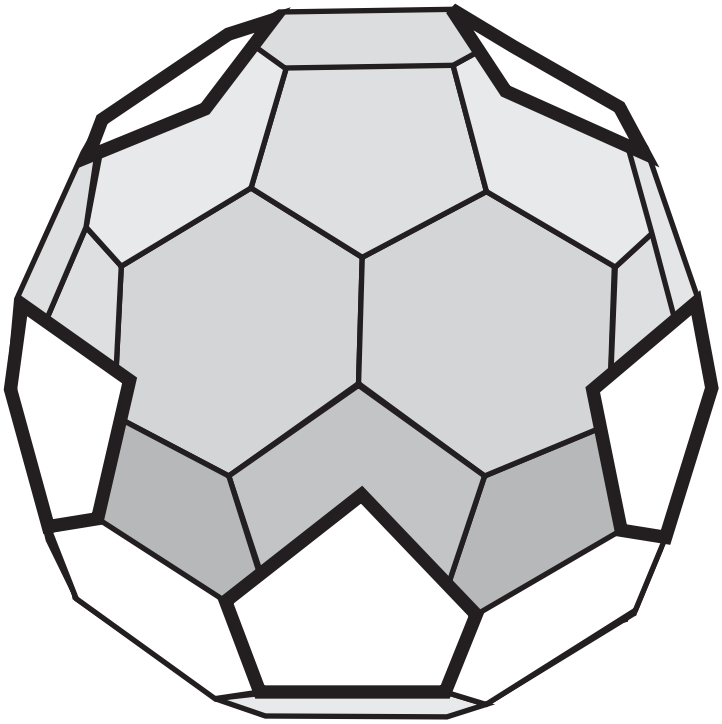


At this point you have finished half of the structure. Notice the repeating pattern with each pentagon surrounded by a layer of hexagons.

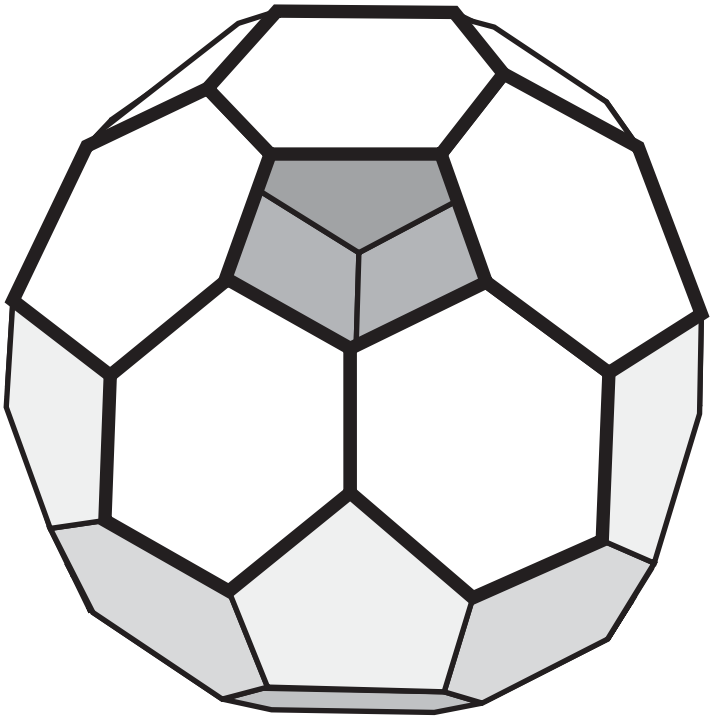
STEP 10 Add another five hexagons to the nooks between the last set of hexagons. This begins to close in the structure.



STEP 11 Add five pentagons.



STEP 12 Add five hexagons.



STEP 13 Add final pentagon.