UNIVERSITY OF NEBRASKA
STATE MUSEUM

Honeycomb

It's all about shape!

Bees live in hives and build beautiful honeycomb structures. But why is the honeycomb shaped the way it is?

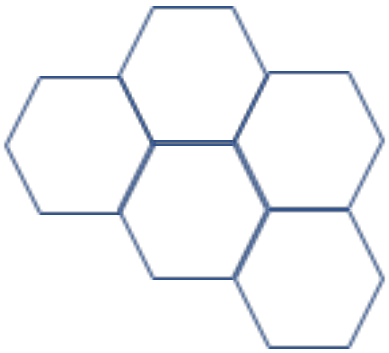
What you need:

- Masking tape (or other tape)
- 12 cans of food all the same size (3" in diameter) OR 1 can and 2 pieces of paper
- 6 strips of paper each 4.75" long and about ¼" wide
- Marker
- Ruler or measuring tape
- Scissors

What you'll do:

1. Place strips of masking tape in the shape of a rectangle onto a tabletop or the floor. The inside of the taped rectangle should measure 8.5" by 14".
2. If you have 12 cans skip to step three. If you do not have 12 cans, you can use paper instead. Place a can on the upper left corner of one of your pieces of paper and trace around the outside of the can so that you have a circle. Repeat this process so you have 12 circles and cut them out.
3. Cut 6 strips of paper each 4.75" long and about ¼" wide.
4. Take some of your cans (or circles) and arrange them to form the largest possible rectangle inside your taped rectangle without touching any tape. How many cans (circles) did you use? Do you have extra space that is not being used?
5. Now arrange the cans (circles) to fit as many as possible into the taped rectangle without touching any tape. How many cans (or circles) did you use? Do your cans (circles) still form the shape of a rectangle?
6. Choose one of the two center cans (circles). Put an X on it with a marker or a piece of tape. How many cans (circles) are touching the marked can (circle)?
7. Create a large hexagon shape (like the one at the bottom of this paper). Take one strip of paper and put it on the outside edge of two of the cans (circles) that touch your marked center can (circle). Do this with the other five strips of paper.
8. What shape did you form with your paper strips? A hexagon! How many sides does it have? Do you see another hexagon shape in your arrangement?
9. Now imagine each can or circle is a hexagon. How many hexagons could you fit into the taped rectangle?

CUT



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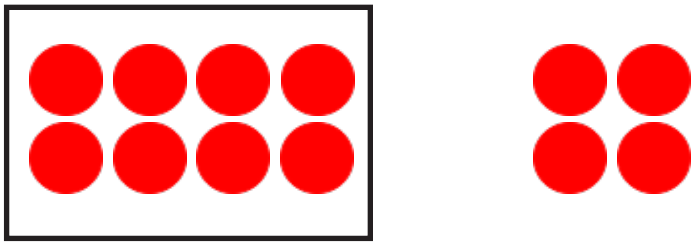
In step 4 you could fit 8 cans or circles into the rectangle. When you moved the cans (or circles) to form hexagons you were able to get 12 hexagons into the same area! Hexagons are much more space efficient. You can get a lot of hexagons into a small area without as much wasted space.

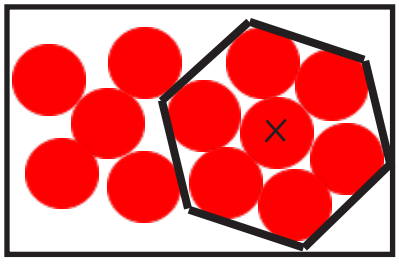
The hive where honeybees live is full of honeycomb and the honeycomb is made of hexagonal cells. The queen lays eggs in hexagon-shaped chambers. After 3-4 days the eggs hatch and the larvae begin to grow. The larvae eventually pupate in that chamber and emerge as adults about 21 days later.
The hexagon chambers are made of wax. A worker bee has special glands in its abdomen that take the sugar in honey and convert it into wax. This wax is secreted or oozed out onto the bee's abdomen forming small flakes. Workers take the flakes and chew them with a bit of honey and pollen until they are soft and moldable and then build chambers for the eggs and the larvae. They need to eat a lot of honey to make the wax to build chambers. To make 1 ounce of wax, a bee needs to eat 8 ounces of honey! To make the honey they need to collect a lot of nectar. By building hexagonal-shaped chambers bees can build more chambers and use less wax. Very efficient!

In our model beehive, a bee would be about 3 inches wide! How does this compare to bees you have seen in nature? Go outside...do you see any bees looking for nectar and pollen?

Arrangement for Step 4:



Arrangement for Step 7:



SHAPE