

Video Lesson 15

Why do honeybees love hexagons?



Part 1 | Vocabulary

Task: Read the words and expressions with your teacher.

Words and Expressions	Definition and Examples
hive (noun)	<i>a structure where bees live, either built by people or made by the bees themselves</i> ➤ Bees naturally attack anything entering their hives .
honeycomb (noun)	<i>the structure with many small hexagonal holes/cells in a hive, made by bees to store their honey</i> ➤ A hive has around 100.000 honeycomb cells.
to ripen (verb)	<i>after fruits and vegetables ripen, they are ready to be eaten</i> ➤ I placed the tomatoes by the window to ripen more quickly with the sunlight.
wax (noun)	<i>wax is a solid, slightly shiny substance made of fat or oil which is used to make candles</i> ➤ We liked Marilyn Monroe's wax statue the best when we visited the wax museum.
back to the drawing board (phrase)	<i>back to the beginning of a process to start it again, because it is not working</i> ➤ Our plan didn't work, so it's back to the drawing board .
to pipe up (phrasal verb)	<i>to suddenly start to speak or make a noise</i> ➤ Don't worry! The baby will pipe up if it needs anything.
trial and error (phrase)	<i>a way of achieving an aim or solving a problem by trying different methods and learning from the mistakes you make</i> ➤ I didn't have any instructions for reassembling the machine, so it was just a case of trial and error until I got it right.
to pay off (phrasal verb)	<i>if something you have done pays off, it is successful and worth the effort</i> ➤ All her hard work paid off in the end, and she finally passed the exam.
to peek (verb)	<i>to look at something for a short time</i> ➤ Close your eyes and don't peek . I have a surprise for you.
goggles (noun)	<i>special glasses that fit close to the face to protect the eyes from chemicals, wind, water, etc.</i> ➤ I have to buy a pair of safety goggles to start the repairs in the kitchen.

Part 2 | Watching & Reading

Task: Watch the video on YouTube with English subtitles on (<https://youtu.be/QEzlsjAqADA>) Then, read the video script with your teacher.

Why do honeybees love hexagons?

Honeybees are fascinating creatures for a number of reasons: their incredible work ethic, the sugary sweet syrup they produce and their intricate social structure. But another reason is that honeybees are, in fact, excellent mathematicians. Scientists claim the tiny insects can calculate angles, and can even comprehend the roundness of the Earth. But there's particular mathematical bee genius behind the most important aspect of honeybee life: the **hive**. Just like humans, bees need food and shelter to stay alive. The hive is not only the bees' home, but doubles as a place to store their honey. Since it's so central to survival, honeybees have to perfect the hive's architectural design. If you examine any piece of **honeycomb**, you'll see that it's constructed from tightly packed hexagonal, or six-sided, cells. Of all the possible designs, why do honeybees choose this one?

To understand, you need to think like a bee. Bees need a secure place for their entire colony to live. Similarly, there needs to be a place where their nectar can be stored and **ripened** suitably until it turns into honey. That means there's a need for some serious space efficiency. A good solution is to build little storage units, or cells, just big enough for a bee to fit into, which can also double as the containers in which nectar is stored: The bees' very own honey jars. The next thing, is to decide what the little cells should be made out of. Bees don't have beaks or arms to pick up things, but they are capable of producing **wax**. The thing is, producing it is a lot of hard work. Bees have to consume 8 ounces of honey to produce just 1 ounce of wax. So, they don't want to waste it. So, they need a design that allows them to store the largest possible amount of honey using the least amount of wax. What shape does that?

Imagining for a minute that all bees had to attend architecture academy and go to math class. Let's say they asked their geometry teacher, "What shape would give us the most

space to store our honey, but require the least amount of wax?" And then geometry teacher replied, "The shape that you're seeking is the circle." Leaving the bees to return to their trial construction site and begin building their honeycomb using circular cells. After a while, some of them might have noticed a problem with their design: small gaps between the cells. "We can't even fit in there! That's wasted space!" they might have thought. So, ignoring the geometry lesson, and taking matters into their own hands, the bees went **back to the drawing board** to rethink their beehive design. One suggested triangles, "We can use triangles. Look! They fit together perfectly." Another bee suggested squares. Finally, a third bee **piped up** and said, "Pentagons don't seem to work, but hexagons do! We want the one that will use the least amount of wax and be able to store the most amount of honey. Yes, I think that's the hexagon." "Why?" "It looks more like the circle than the others." "But how do we know for sure?" To find out, the industrious insect architects calculated the areas of the triangle, the square and the hexagon and found that the hexagon was, in fact, the shape that gave them the most storage space. They agreed on an ideal size and returned to work.

The space efficient comb that is a bee's trademark today, is probably the result of this **trial and error**, but over long periods of evolutionary history. However, it **paid off**. **Peek** into any hive (with your protective **goggles** and netting on, of course) and you'll see the end result: a beautiful compact honeycomb that any architect would have be proud to design.

Check your comprehension: Answer the questions below.

1. Why was perfecting the hive's architectural design so important to bees' survival?
2. Why isn't the circle the most optimal shape for a honeycomb cell?
3. Why do honeybees love hexagons?

Part 3 | Speaking

Task 1: Summarize the video in your own words. Focus on the main topic and the information you consider to be most relevant. Finally, express your own thoughts about the video.

Task 2: Answer the questions below.

1. How often do you eat honey?
2. Are you afraid of bees or other insects?
3. Do you know anyone who's allergic to bee stings?
4. Would you like to visit a bee farm someday?
5. Have you ever been stung by a bee? What should we do in such situations?

Task 3: Debate the statements below with your teacher.

1. Apiculture (beekeeping) is a very interesting hobby.
2. Ants are more hardworking than bees.
3. Trial and error is the best method of learning.
4. Learning geometry at school is useless.
5. "Honey is sweet but the bee stings." French proverb

Part 4 | Vocabulary Practice

Task: Use the word bank to identify the word that best completes each sentence.

Don't forget to use the proper form of the word.

back to the drawing board	goggles	hive	to peek	to ripen
wax	trial and error	to pipe up	honeycomb	to pay off

1 Sandra was determined to become a doctor and her persistence_____.
She graduated last week.

2 I'm waiting for the bananas_____. They are still green and I can't eat them.

3 We will go_____since all our predictions were wrong.

4 I've bought the best car_____in the market to make my automobile shine like no other.

5 I_____out the window to see who was ringing my bell.

6 Don't forget to wear_____and a mask the whole time you stay in the construction site.

7 Honeybees typically build their_____in a dark, dry place, such as in a tree hollow.

8 The meeting was just about over when Tom_____and asked why we hadn't looked at the budget.

9 I finally found the right key to the apartment after lots of_____.

10 People who suffer from trypophobia have an irrational fear of small holes as the ones in a_____, for instance.

Part 5 | Writing

Homework: Write an original sentence using each word from the vocabulary box.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____
