

Teacher's Guide for Why Beehives Have a Hexagonal Shape

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Welcome Dear teachers

Thank you for choosing this lesson. As you may have guessed, this lesson encourages students to explore nature and the geometric art designs it includes, and directs students to study the geometric design of the beehives and to prove that the hexagon is the best design for them.

Students should be able to deal with triangles and circles and be familiar with their formulas. These were covered in middle school, and therefore the high school students are able to understand this lesson.

In the first activity, you may ask your students questions to motivate them and involve them in discussion such as "Is the reason for such design related to the size or weight or strength or the shape of the bee?"

In the third activity, you may guide the students to the fact that the comparison should be using the radius of the circle and therefore all areas should be calculated in terms of the radius of the circle.

In the fourth activity, mention that the height and thickness of the cell wall does not affect the amount of building material used as long as the triangular, square and hexagon shapes are all with the same height and thickness and will vary only in the number of sides, and therefore vary only in the perimeter and the number of shared sides among these polygons when they are pasted next to each other.

After the end of the fifth section, you can mention that if there are a circle and hexagon which have the same perimeter, then the area of the circle is always larger than the hexagon, and the proof is simple.

In the sixth section, we addressed the three dimensions for the beehive and the student should be familiar with geometry and areas, calculus, and he must be knowledgeable of ways to solve differential equations.

At the end, I would like to mention that a study was conducted on measuring hardness and ability to resist pressure of honeycomb and the outcome was that a hexagon is better than the triangle and square and there are also references that we will mention about that.