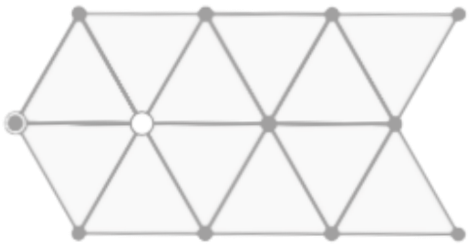
The Royal Institution
Science Lives Here
Masterclass network

Ri Off the Shelf Masterclass: The mathematics of bees

Worksheet 4 – How much wax?!

Below you have three potential honeycomb structures – one from triangles, one from squares, and one from hexagons. Each honeycomb is made of 12 shapes. Use a calculator to work out how many unique edges each honeycomb has, then calculate how much wax and honey has been used to create it.

For 1 gram of wax, 6 grams of honey are used.



Triangles

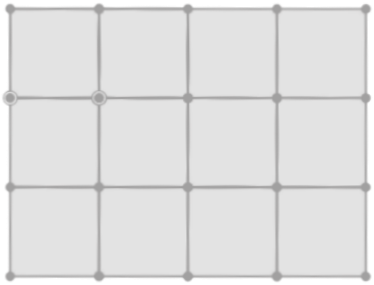
This structure can store 500g of honey. Each edge takes 3g of wax to construct.*

Number of unique edges: 23

Total amount of wax needed (g): 23 x 3 = 69g

Total amount of honey used (g): 69 x 6 = 414g

Honey stored ÷ honey used = 500 ÷ 414 = 1.2



Squares

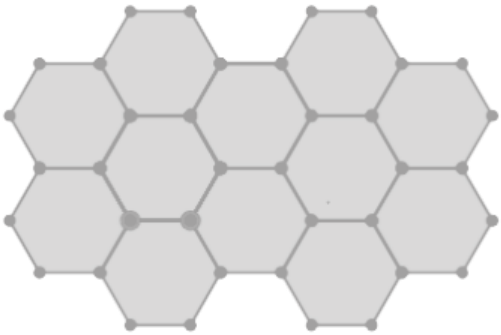
This structure can store 650g of honey. Each edge takes 2.5g of wax to construct.*

Number of unique edges: 31

Amount of wax needed (g): 31 x 2.5 = 77.5g

Amount of honey used (g): 77.5 x 6 = 465g

Honey stored ÷ honey used = 650 ÷ 465 = 1.4



Hexagons

This structure can store 750g of honey. Each edge takes 1.5g of wax to construct.*

Number of unique edges: 49

Amount of wax needed (g): 49 x 1.5 = 73.5g

Amount of honey used (g): 73.5 x 6 = 441g

Honey stored ÷ honey used = 750 ÷ 441 = 1.7

1. Which of the shape structures had the best efficiency of storing honey? _____
2. Why does sharing cell walls matter? _____

   _____
3. Which would you pick if you were a bee? _____

*This is just for illustration, typically a single cell may take around 0.01g of wax to construct and store 0.2g of honey.