

Bacterial Fermentation of Carbohydrates Activity

Kit Instructions

What's in your kit?

Carbohydrate Structures

18 Grey half-circles



9 Dark blue rods



2 Yellow rods



2 Flexible orange rod



1 Small dark green rod



1 Orange connector



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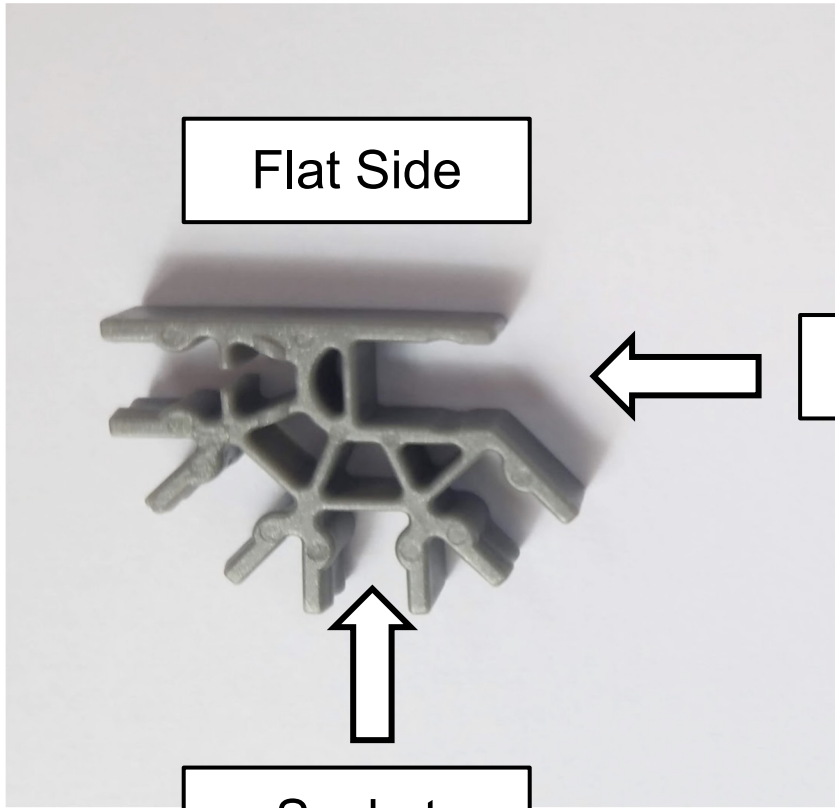
Section 3: Cellulose

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Vocabulary Guide



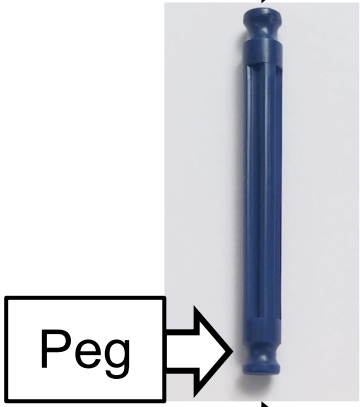
Cardinal directions describe the orientation of each piece



Flat Side

Slot

Socket



Peg

Dark blue rod

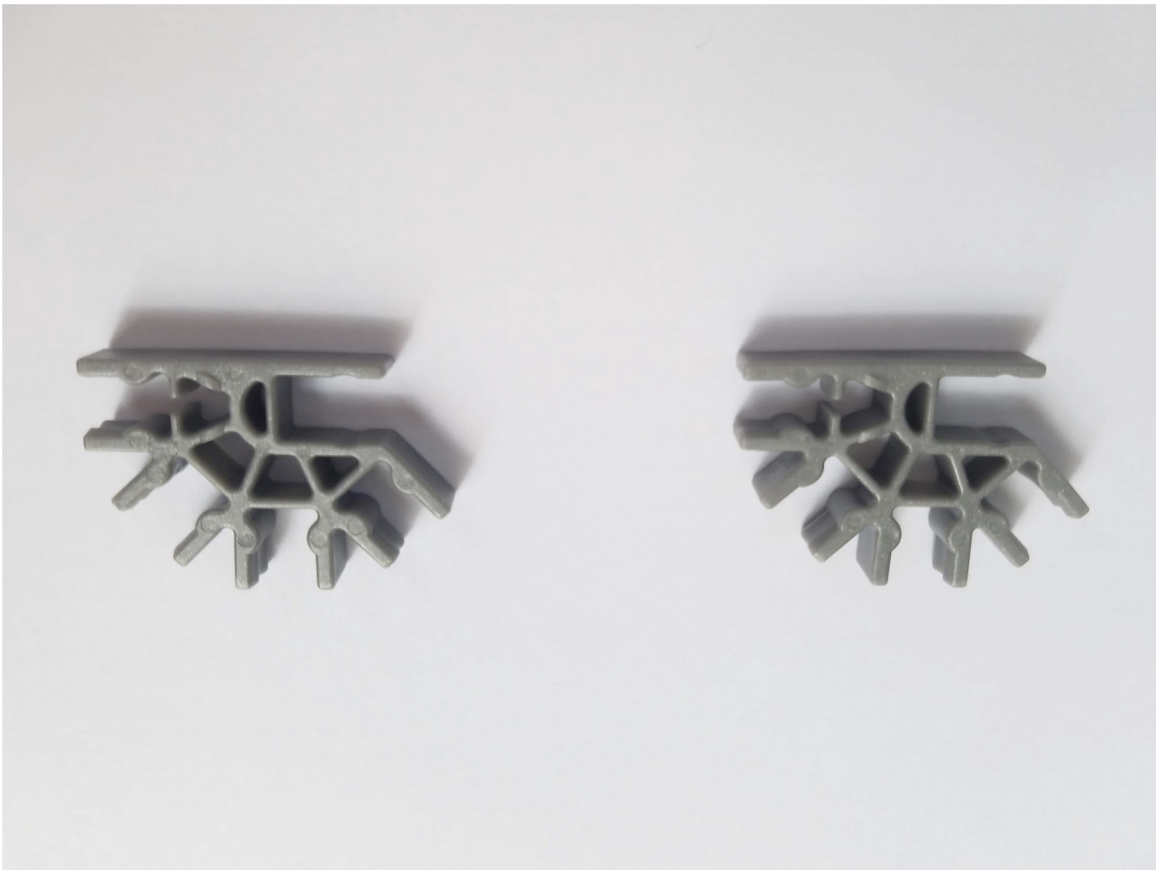
Connector end of rod

Connector end of rod



Flexible yellow rod

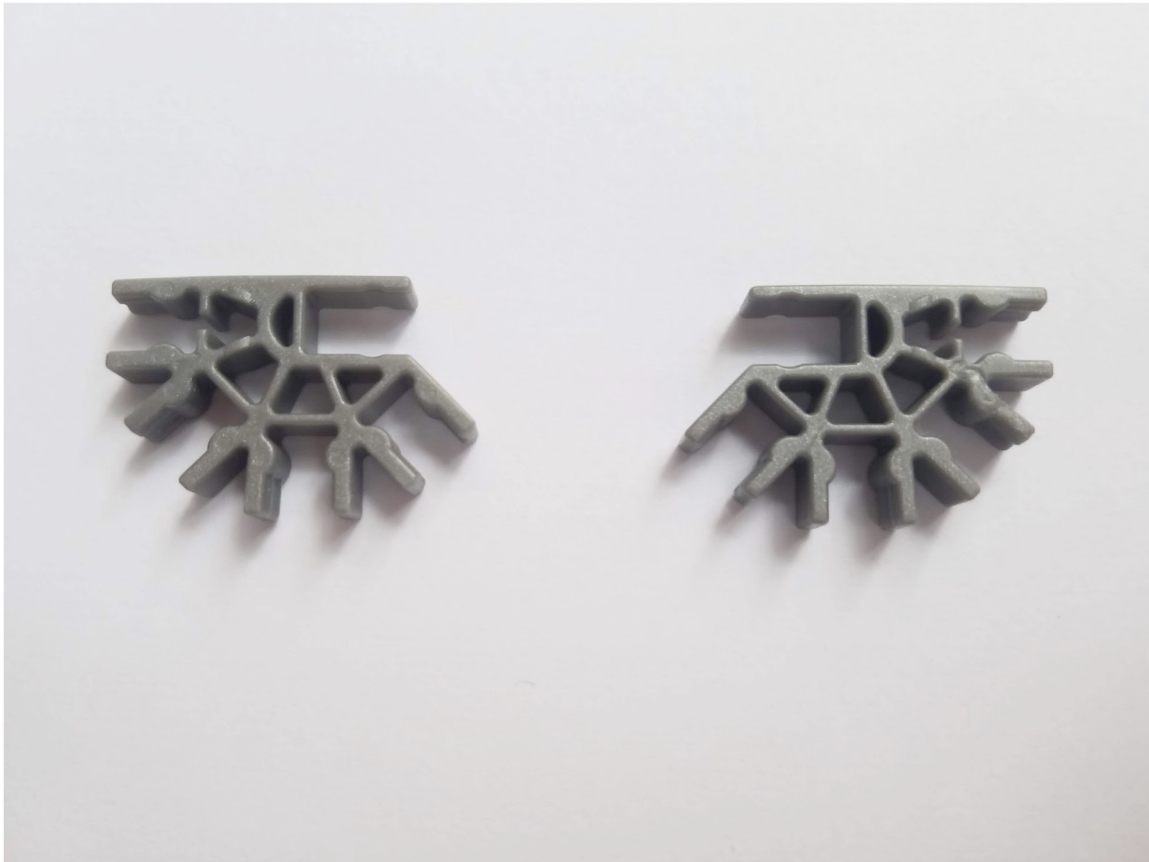
Section 1: Amylose



Section 1 Step 1

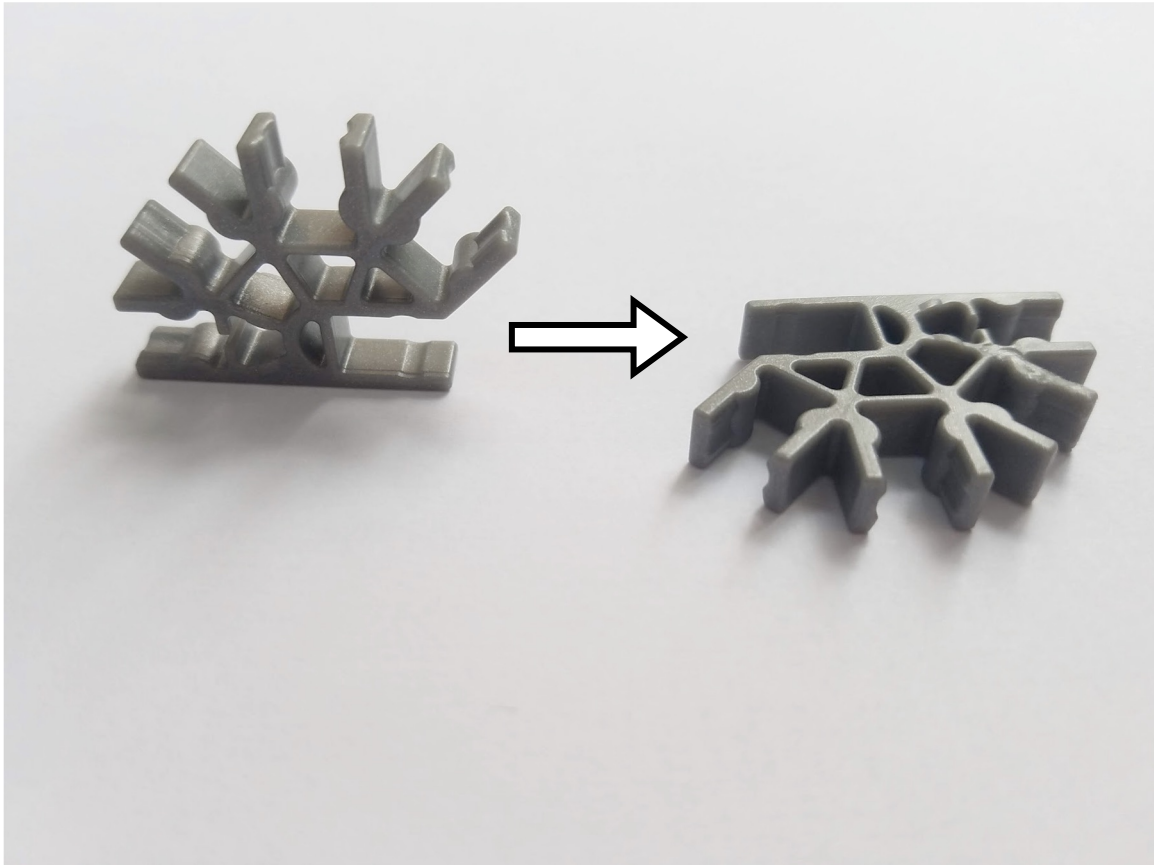
Start with two grey pieces.

Lay the pieces flat, side-by-side, with their flat sides facing North and open slots facing to the right.



Section 1
Step 2

Flip the grey piece on the right horizontally, so the slots face each other.



Section 1 Step 3

Flip the grey piece on the left up to rest on its flat side, with its slot still facing to the right (toward the slot on the other piece).



Section 1 Step 4

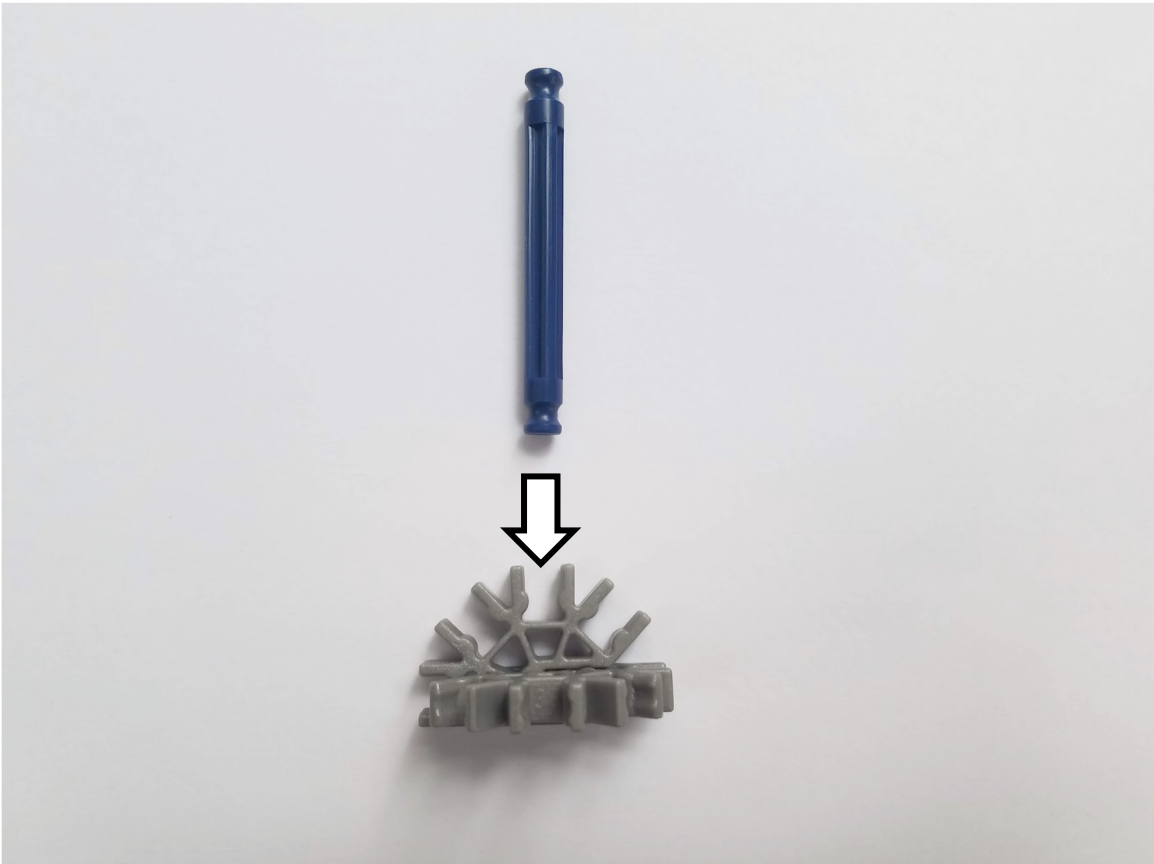
Assemble the glucose unit by carefully sliding the two grey pieces into each others' slots.

They should connect easily with some slight force.



Section 1 Step 5

Flip your glucose unit so that the “top” is laying flat on the table, with one socket facing North and the other socket facing up toward the ceiling.



Section 1
Step 6

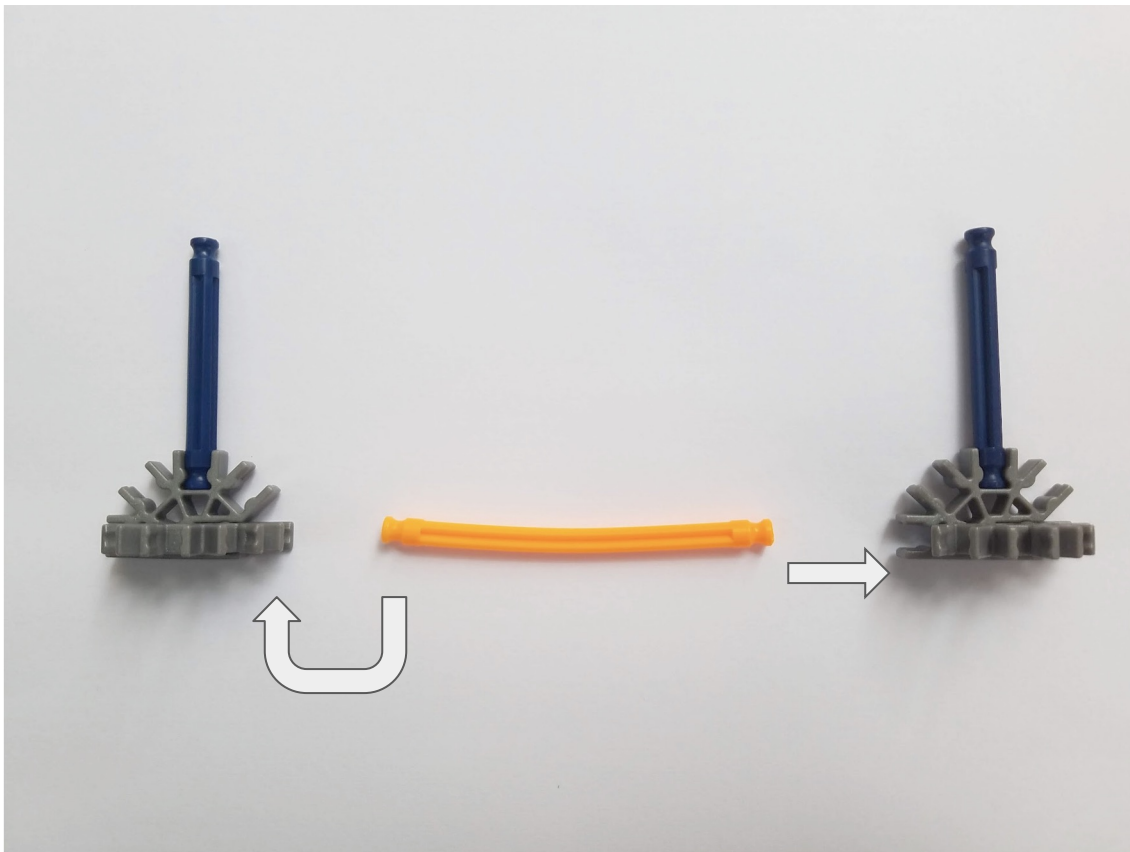
Position the peg end of a dark blue rod directly over the socket, and push down to insert the peg into the center-most (North-facing) socket.

This is glucose.



Section 1
Step 7

Create another of a glucose structure,
following Section 1 Steps 1-6.



Section 1

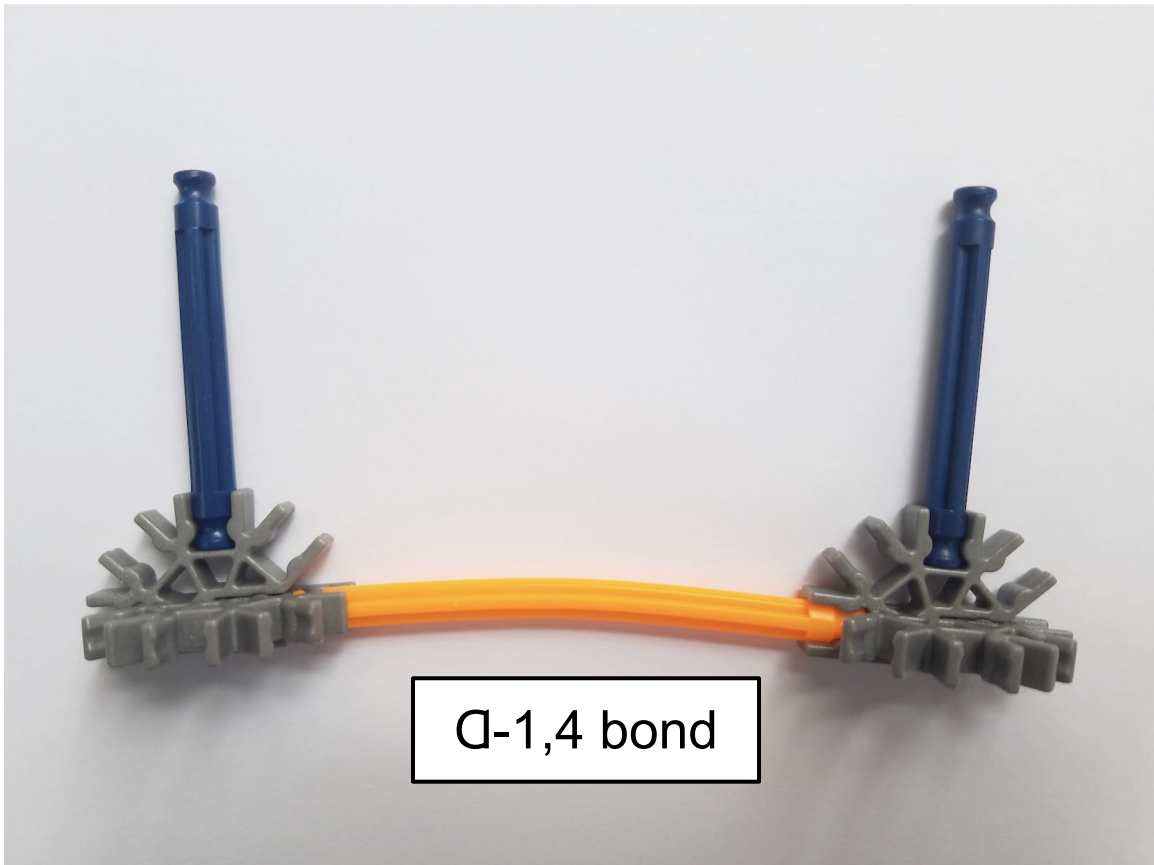
Step 8

Place your two glucose structures next to each other, with a flexible orange rod in between.

The peg ends of the orange rod should face an empty socket on each of the glucose structures.

Note: the sockets are in different orientations: The East-facing socket on the left is vertically oriented, while the West-facing socket on the right is lying flat on the table.

If this is not demonstrated by your pieces, try flipping the glucose structures or switching their positions.

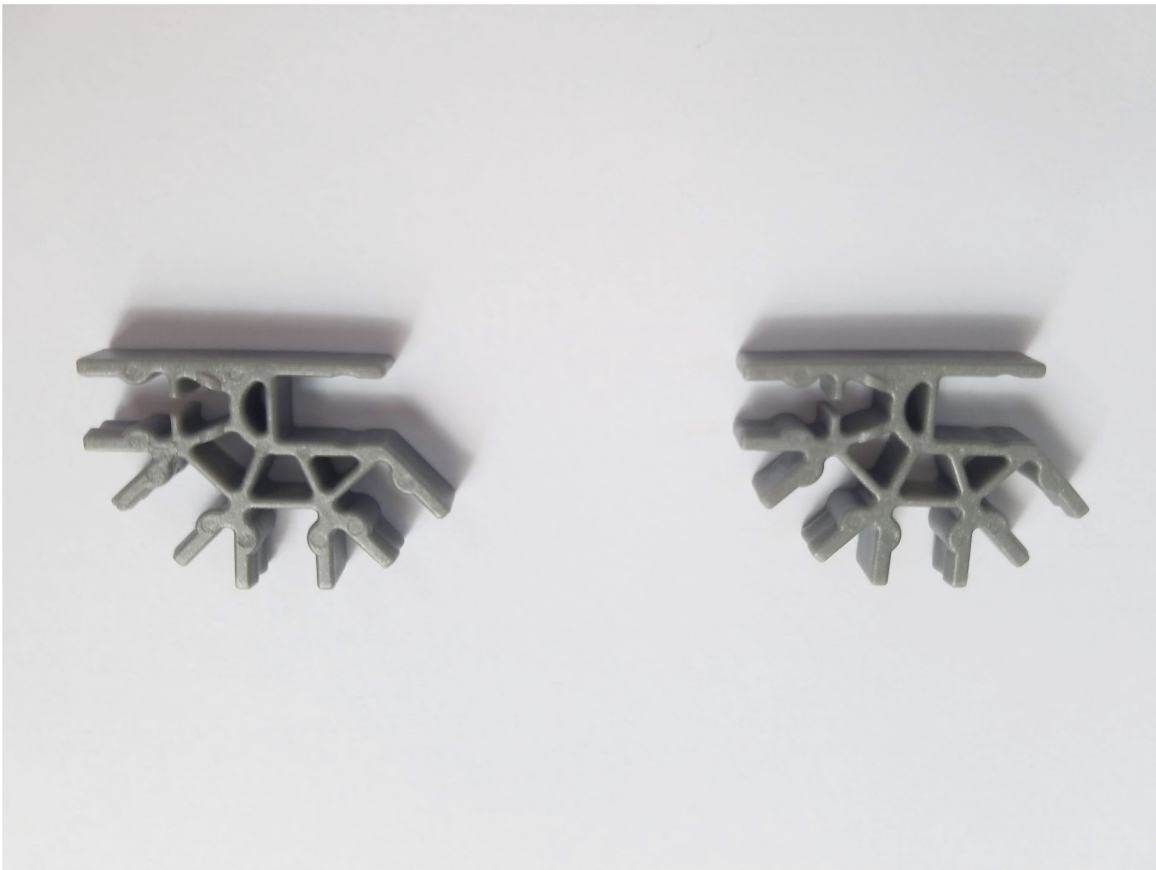


Section 1
Step 9

Connect the glucose structures together with the flexible orange rod.

This is amylose.

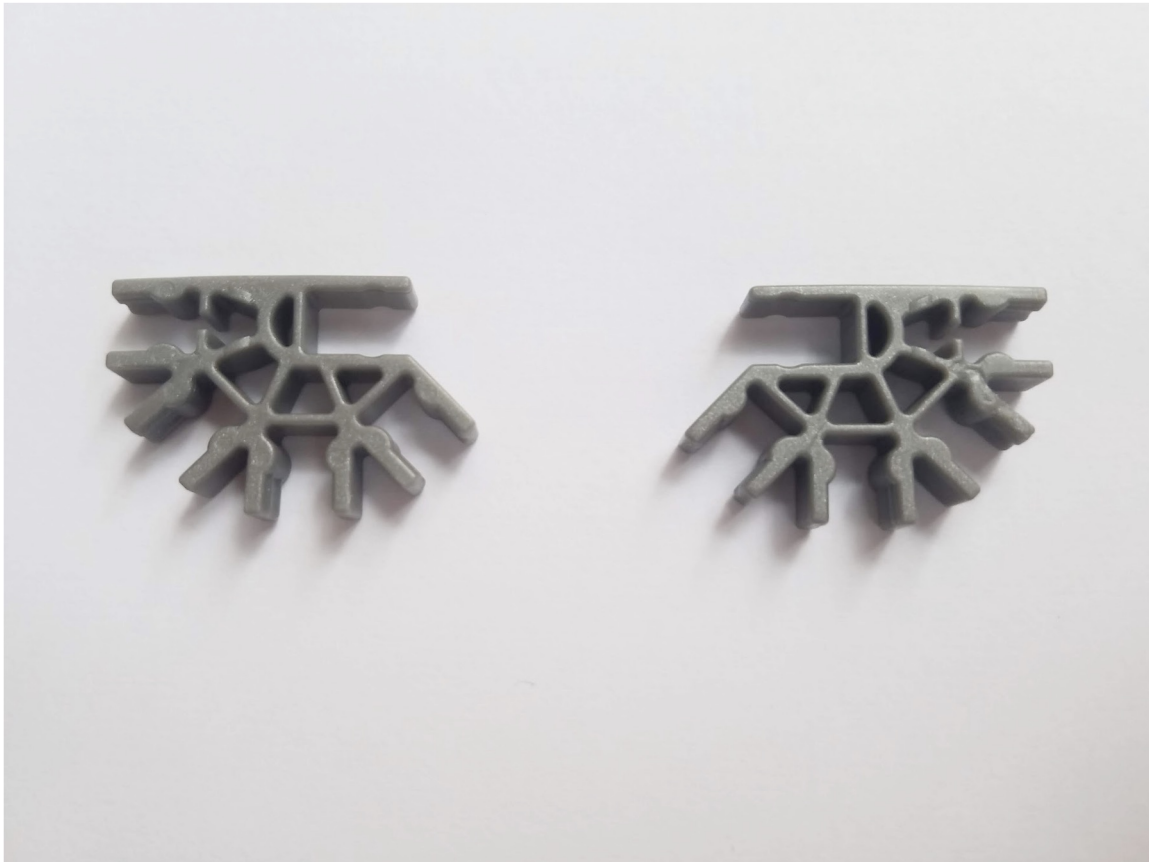
Section 2: Amylopectin



Section 2 Step 1

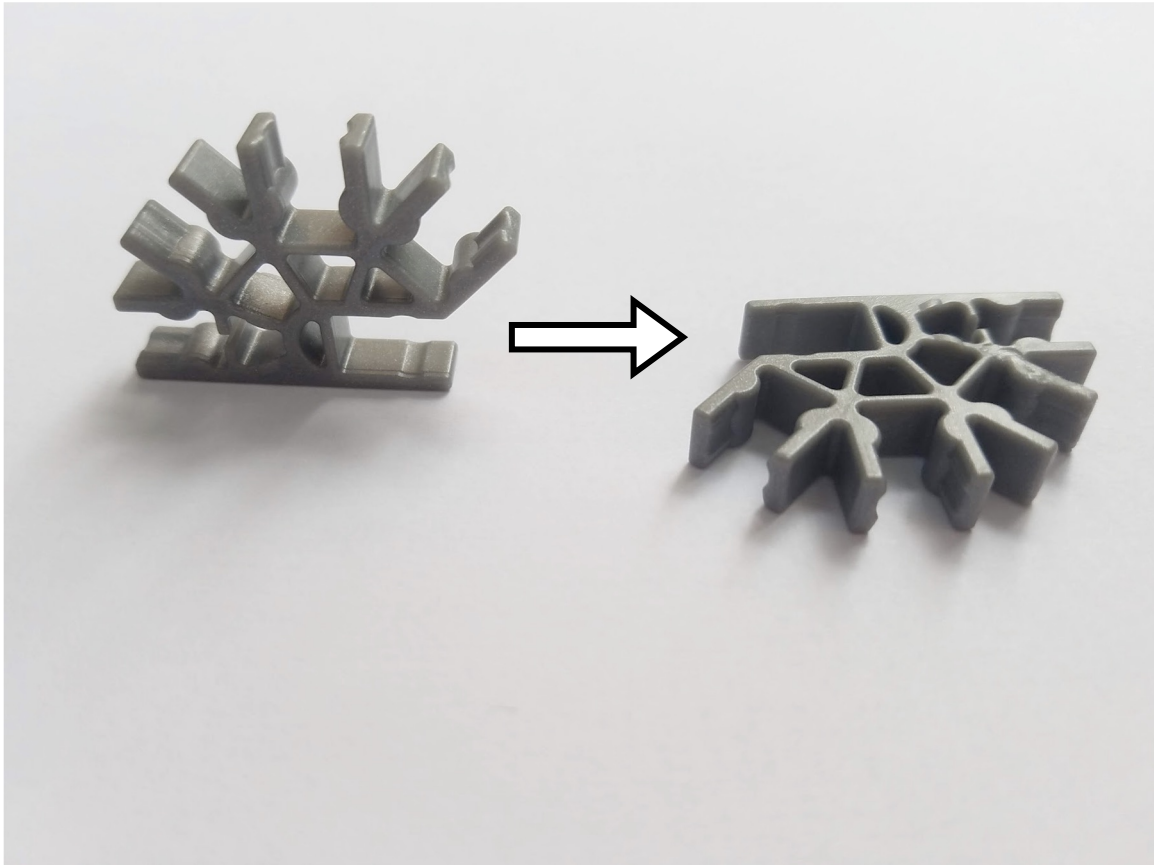
Start with two grey pieces.

Lay the pieces flat, side-by-side, with their flat sides facing North and open slots facing to the right.



Section 2 Step 2

Flip the grey piece on the right horizontally, so the slots face each other.



Section 2

Step 3

Flip the grey piece on the left up to rest on its flat side, with its slot still facing to the right (toward the slot on the other piece).



Section 2 Step 4

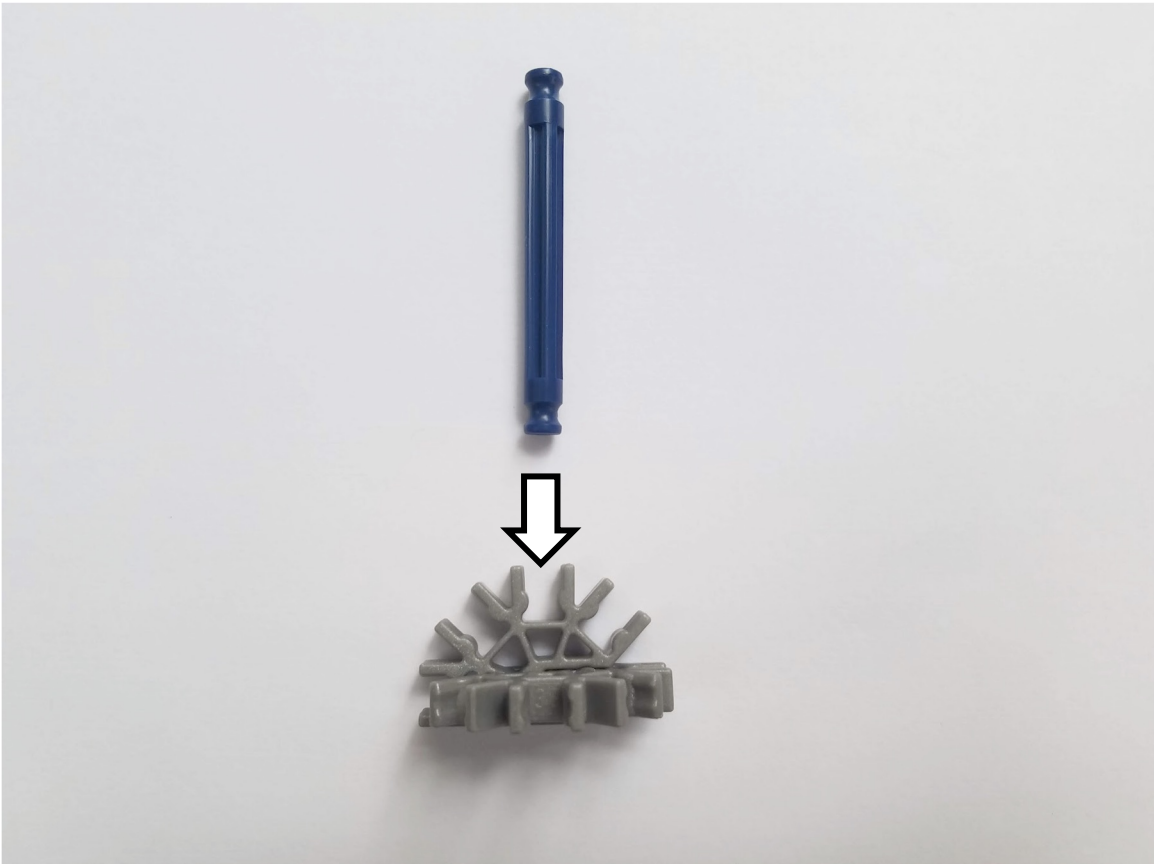
Assemble the glucose unit by carefully sliding the two grey pieces into each others' slots.

They should connect easily with some slight force.



Section 2 Step 5

Flip your glucose unit so that the “top” is laying flat on the table, with one socket facing North and the other socket facing up toward the ceiling.



Section 2
Step 6

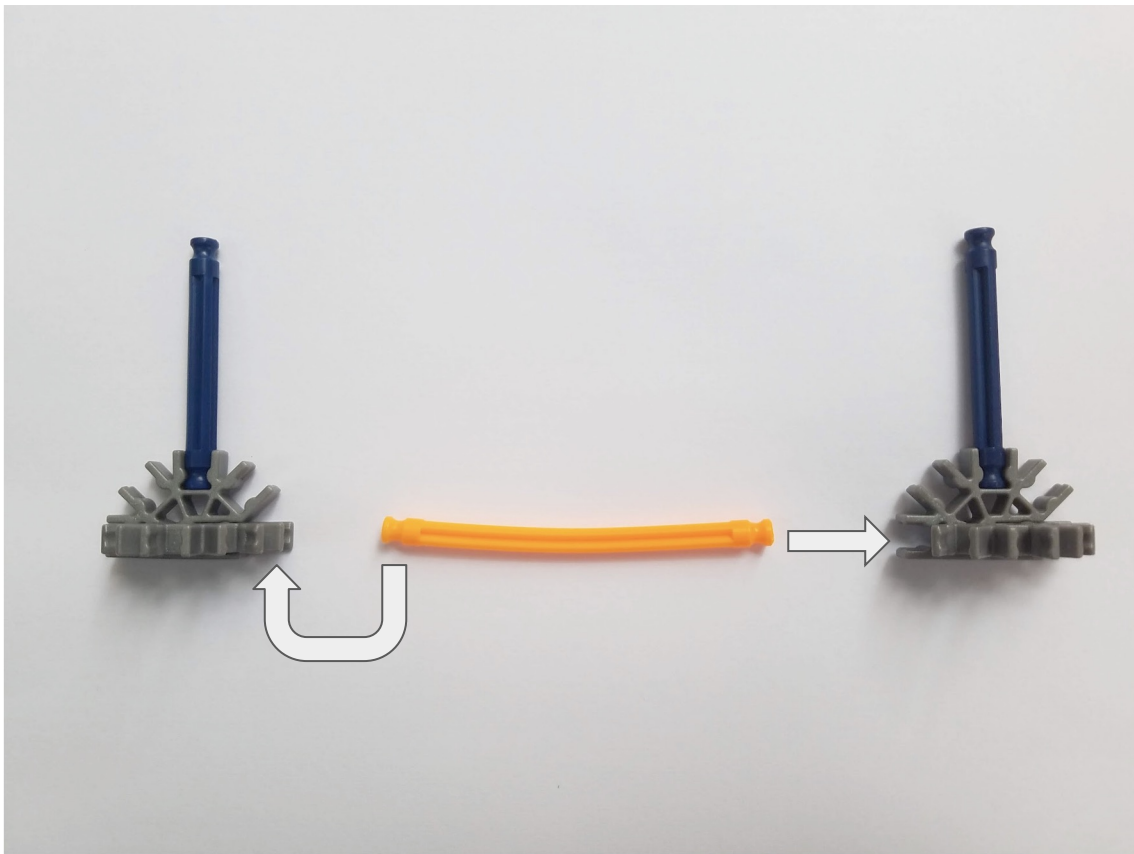
Position the peg end of a dark blue rod directly over the socket, and push down to insert the peg into the center-most (North-facing) socket.

This is glucose.



Section 2
Step 7

Create another glucose structure,
following Section 2 Steps 1-6.



Section 2

Step 8

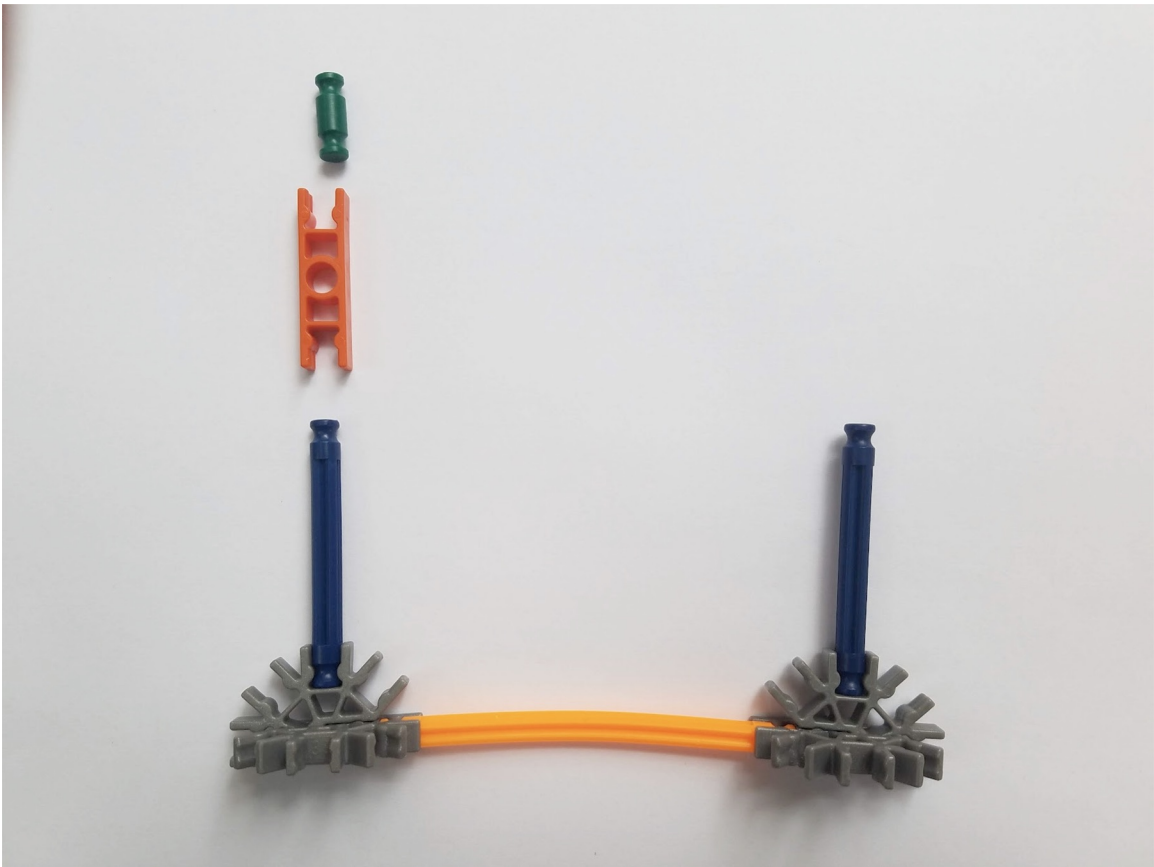
Place your two glucose structures next to each other, with a flexible orange rod in between.

The peg ends of the orange rod should face an empty socket on each of the glucose structures.

Note: the sockets are in different orientations:

The East-facing socket on the left is vertically oriented, while the West-facing socket on the right is lying flat on the table.

If this is not demonstrated by your pieces, try flipping the glucose structures or switching their positions.

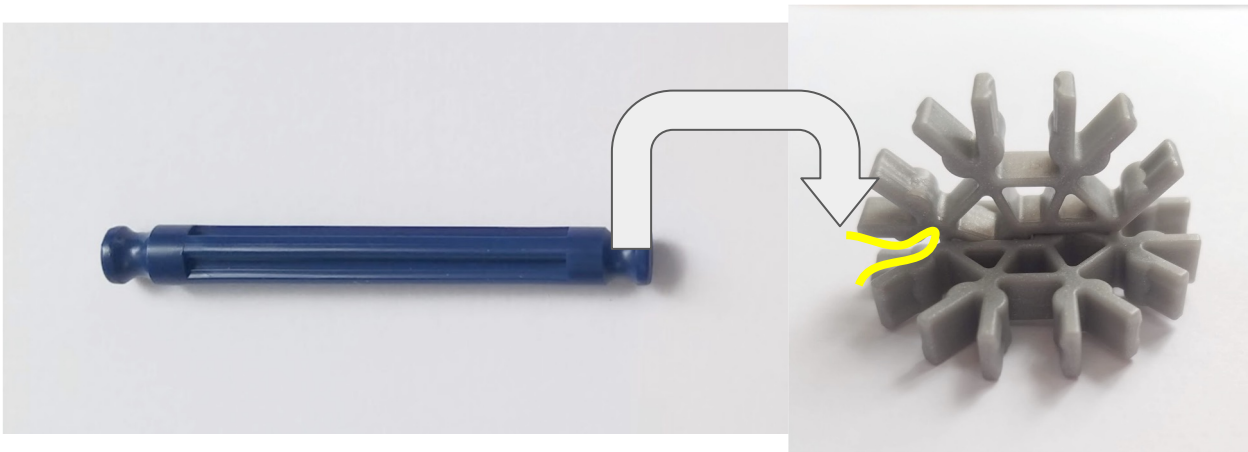


Section 2 Step 9

Add a dual-socket orange connector and a small, dark green rod to the dark blue rod on the left of the second (new) structure.

Add the orange piece to the blue rod first. (Either socket side can be used.)

Add the small green rod to the opposite end of the orange connector.

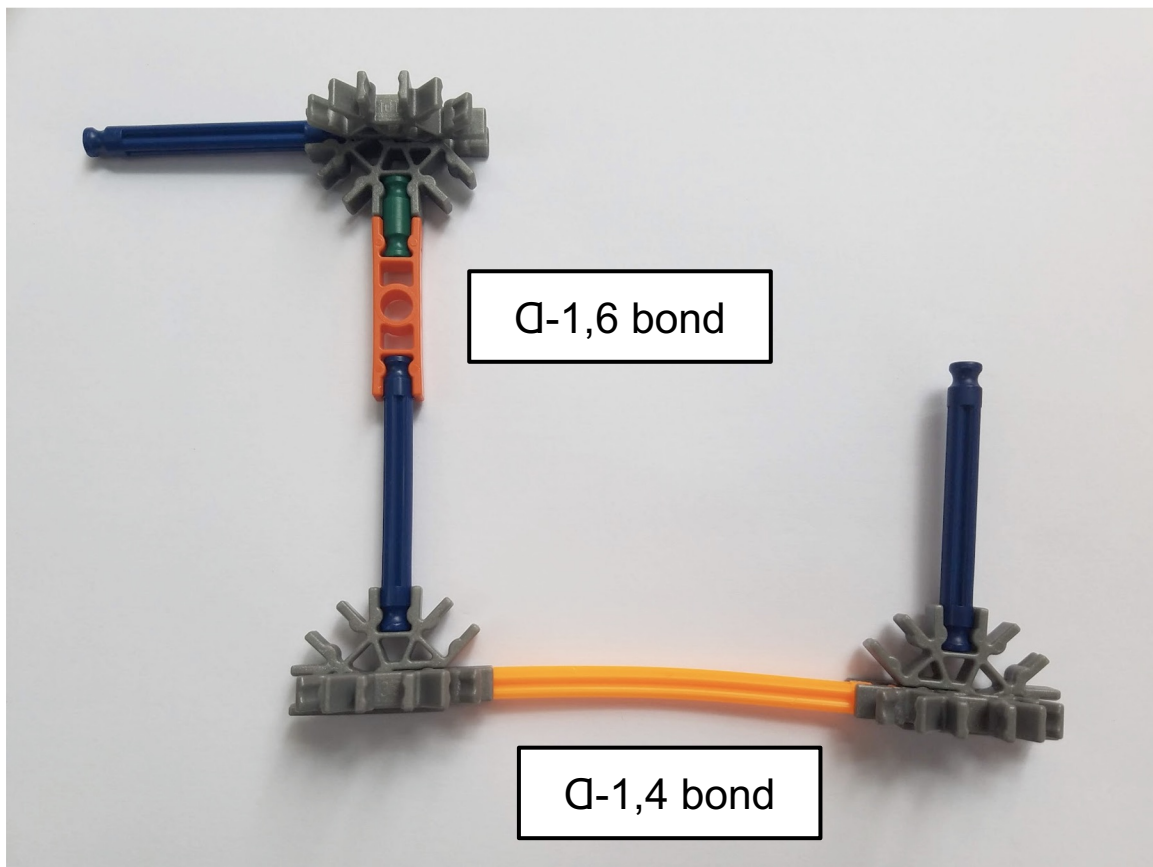


Section 2 Step 10

Repeat Part 1 Steps 1-4 to create a partial glucose structure from scratch.

Orient this piece so that there is an empty South-facing socket flat on the table. The other middle socket should be in the vertical plane, facing up toward the ceiling.

However, for this 'glucose,' you will insert one end of the dark blue peg into the West-facing, vertically-oriented "corner" of the grey unit.



Section 2

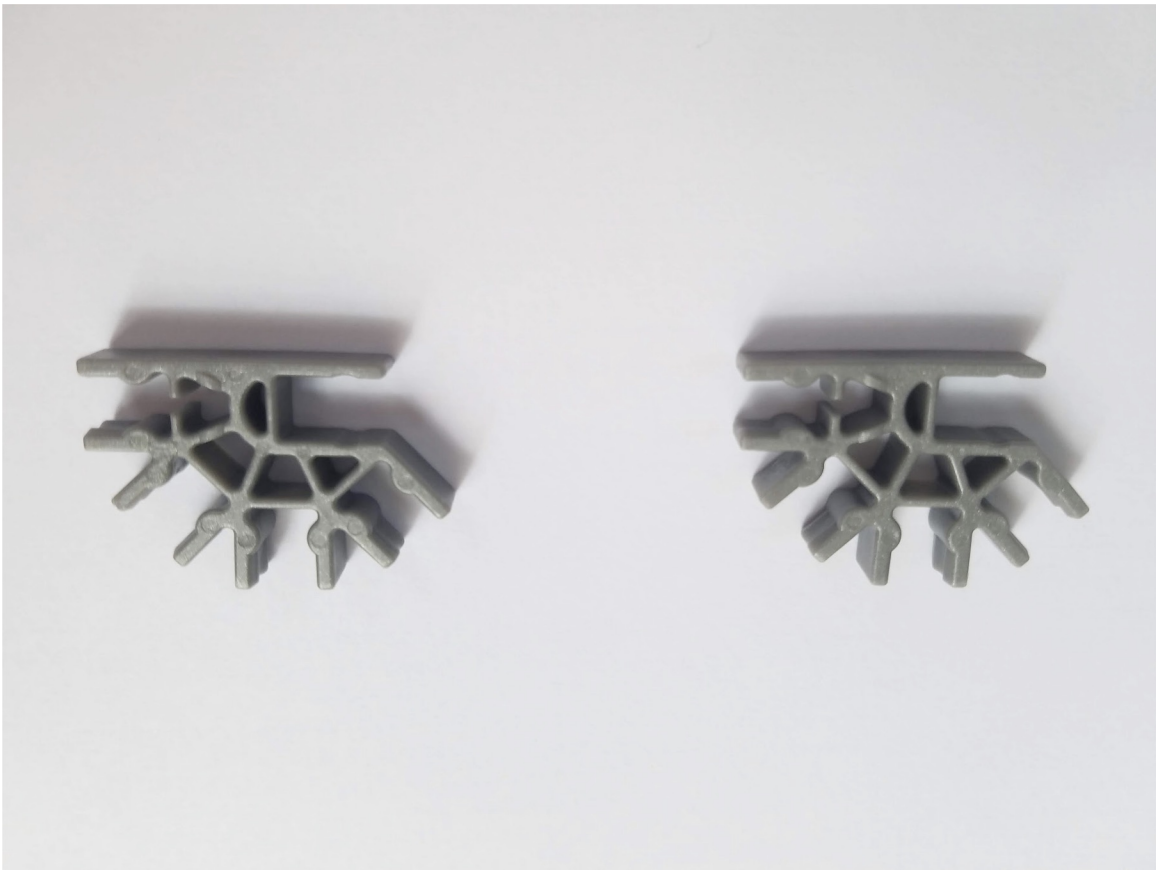
Step 11

Connect the West-facing glucose-and-dark-blue-rod assemblage that you have just created in step 11 to the small green peg on the structure from step 10.

The socket from the newly built glucose assemblage should lie flat to accept the dark green rod in its South-facing socket.

This is amylopectin.

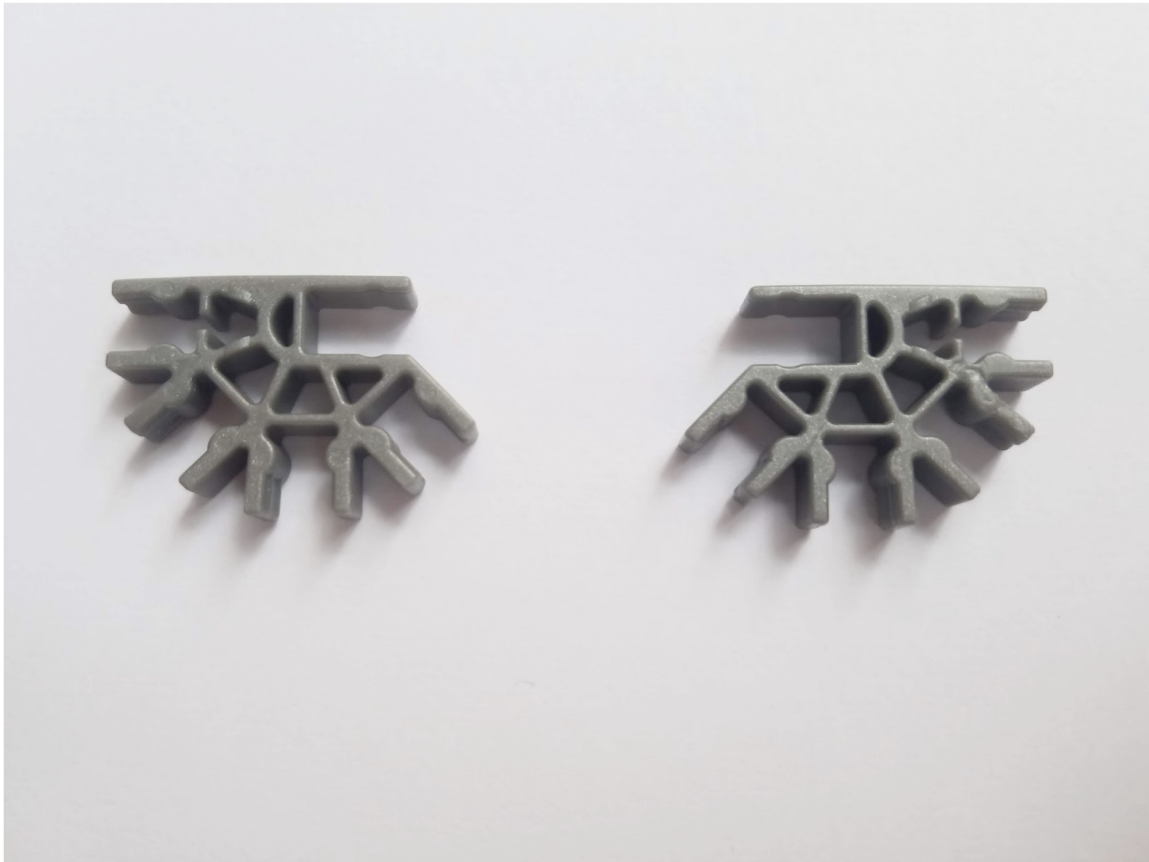
Section 3: Cellulose



Section 3 Step 1

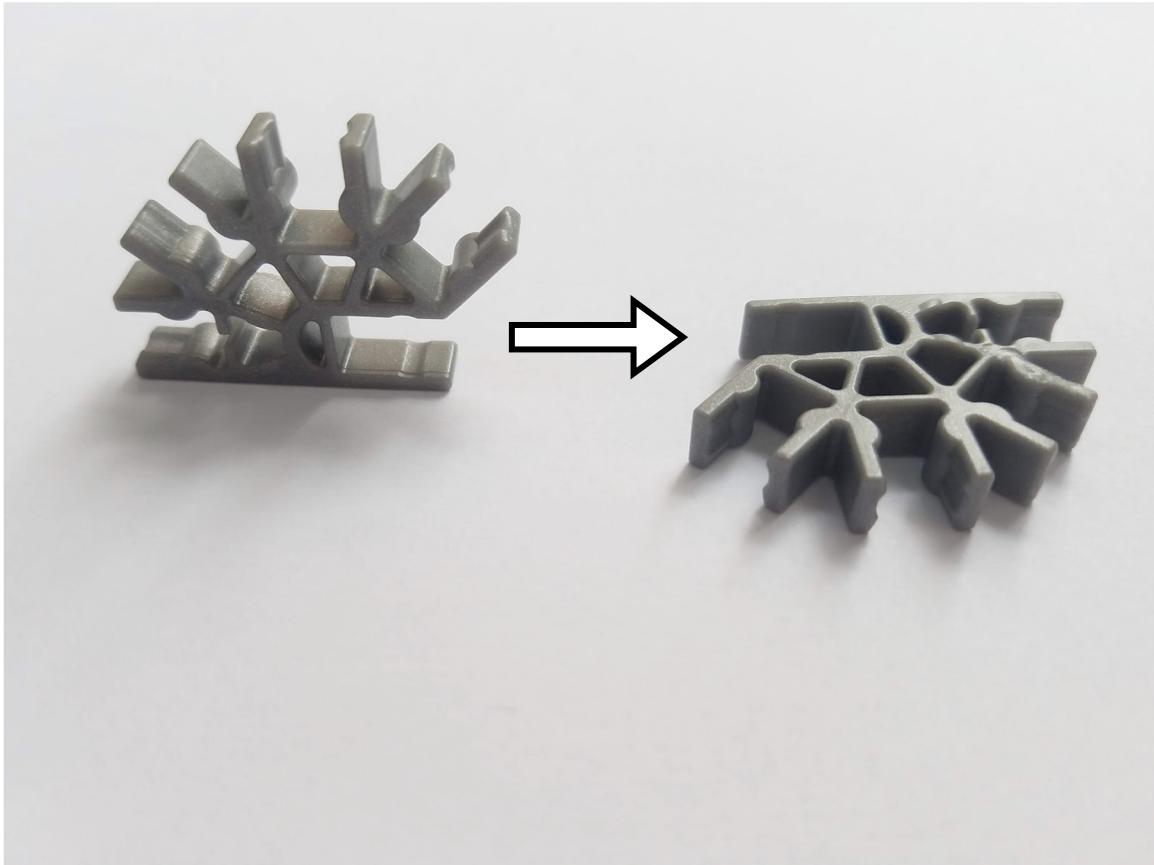
Start with two grey pieces.

Lay the pieces flat, side-by-side, with their flat sides facing North and open slots facing to the right.



Section 3 Step 2

Flip the grey piece on the right horizontally, so the slots face each other.



Section 3 Step 3

Flip the grey piece on the left up to rest on its flat side, with its slot still facing to the right (toward the slot on the other piece).



Section 3 Step 4

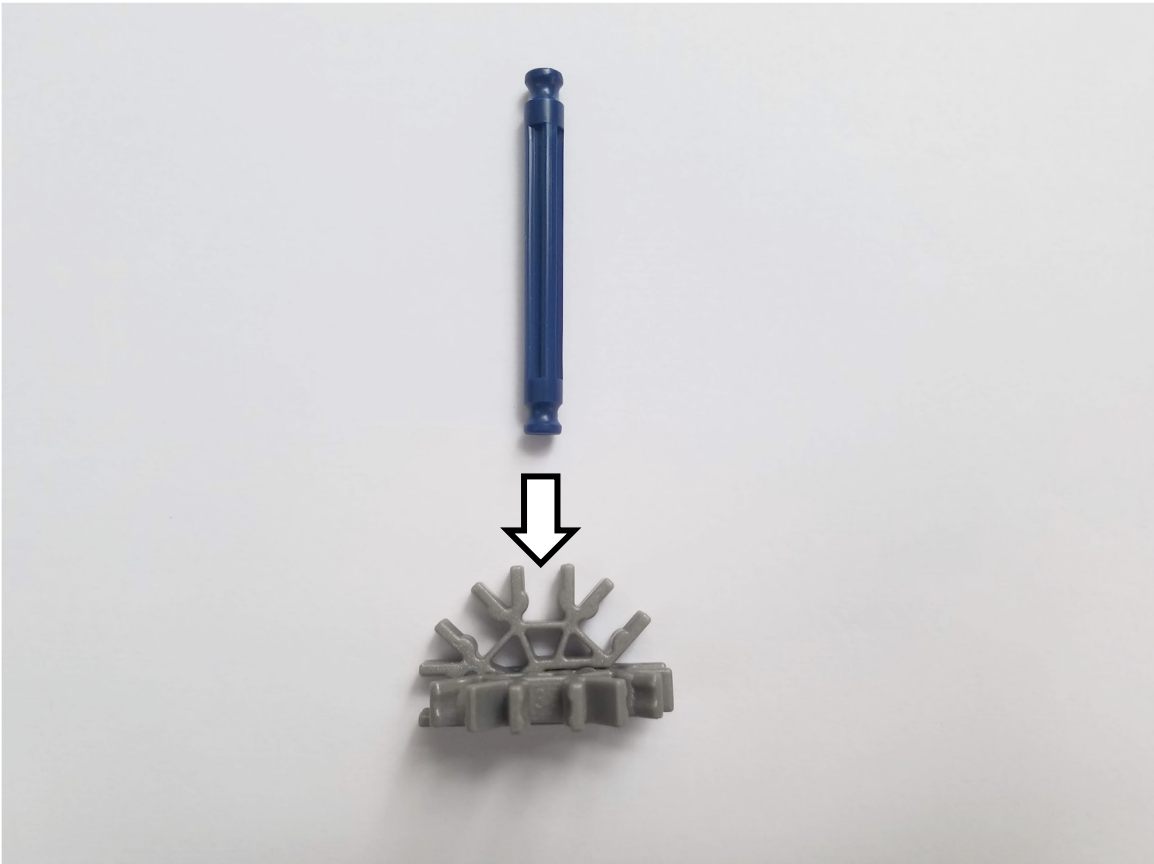
Assemble the glucose unit by carefully sliding the two grey pieces into each others' slots.

They should connect easily with some slight force.



Section 3 Step 5

Flip your glucose unit so that the “top” is laying flat on the table, with one socket facing North and the other socket facing up toward the ceiling.



Section 3
Step 6

Position the peg end of a dark blue rod directly over the socket, and push down to insert the peg into the center-most (North-facing) socket.

This is glucose.



Section 3
Step 7

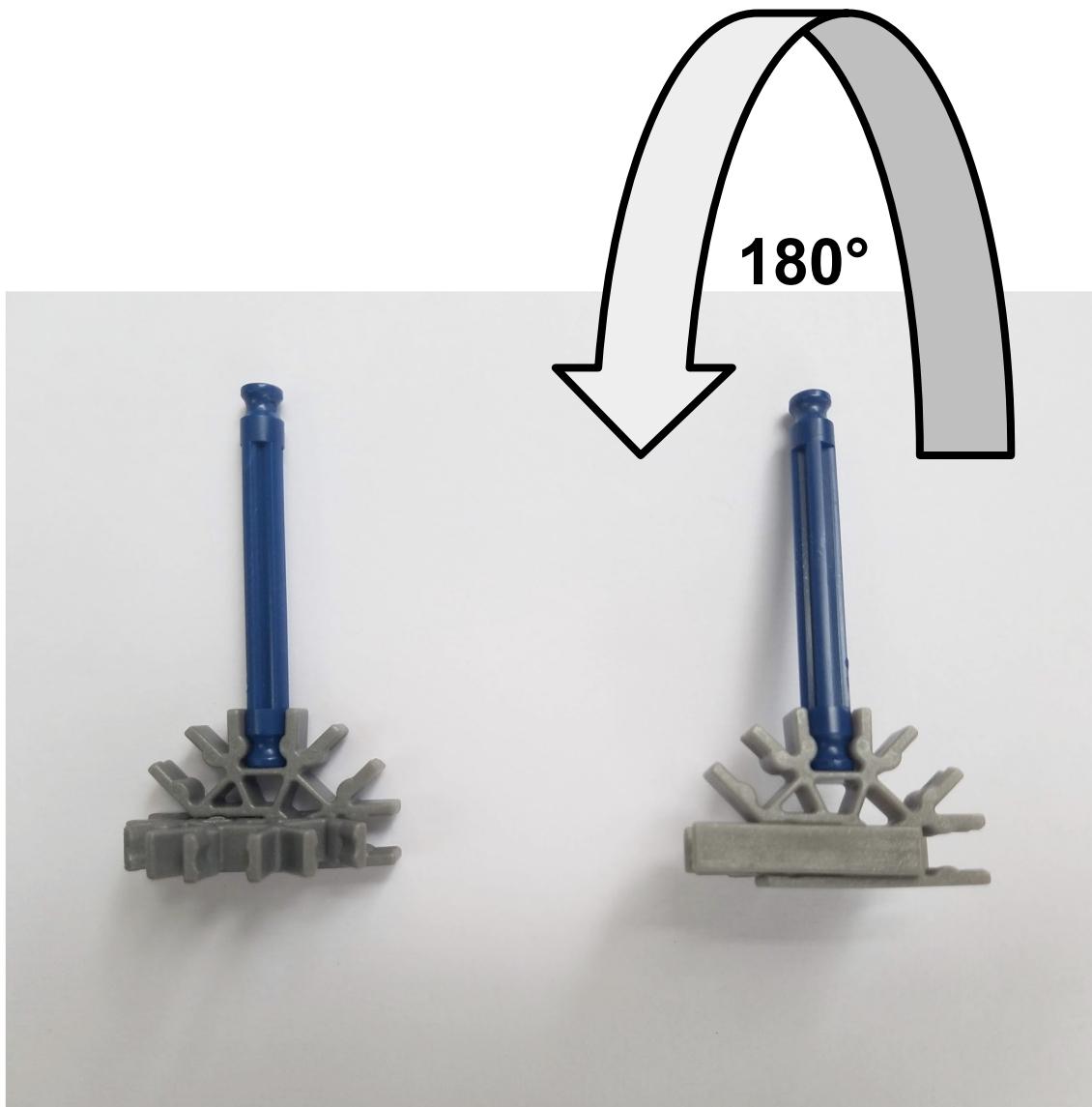
Create another glucose structure,
following Section 3 Steps 1-6.



Section 3

Step 8

You should have 2 glucose structures.
Lay them flat on the table as shown in
the picture above.



Section 3 Step 9

Flip the structure on the right so its flat side faces up toward the ceiling.

The un-connected (North-facing) end of the dark blue rod should touch the table, but the entire rod will not lay flat on the table.



Section 3 Step 10

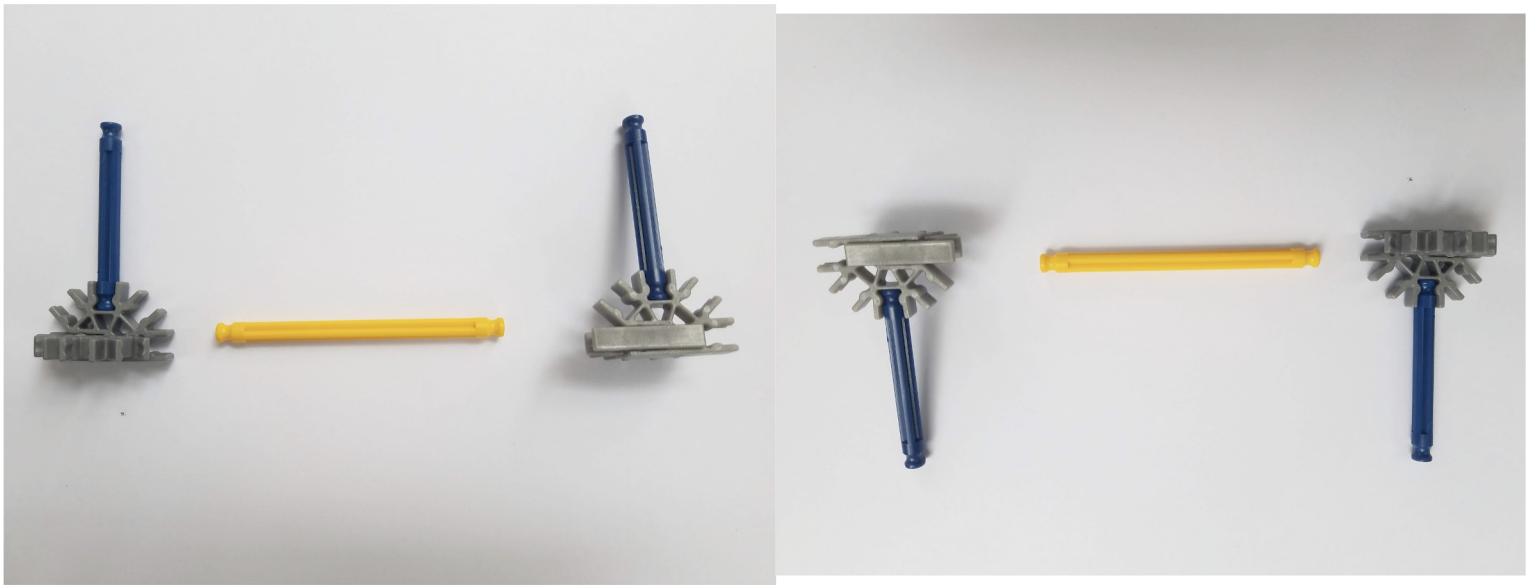
Place your two structures next to each other, with a yellow rod in between them.

The yellow rod pegs should face an empty socket on each of the glucose structures.

The East-facing socket in the glucose unit on the left should lie flat on the table. The West-facing socket in the glucose unit on the right should be elevated slightly off the table.

The 2 sockets are at 90 degrees to each other (in different planes), but the rod can still connect to both pieces.

If this is not demonstrated by your pieces, try re-orienting the glucose structures and dark blue rods by flipping them or switching their positions.



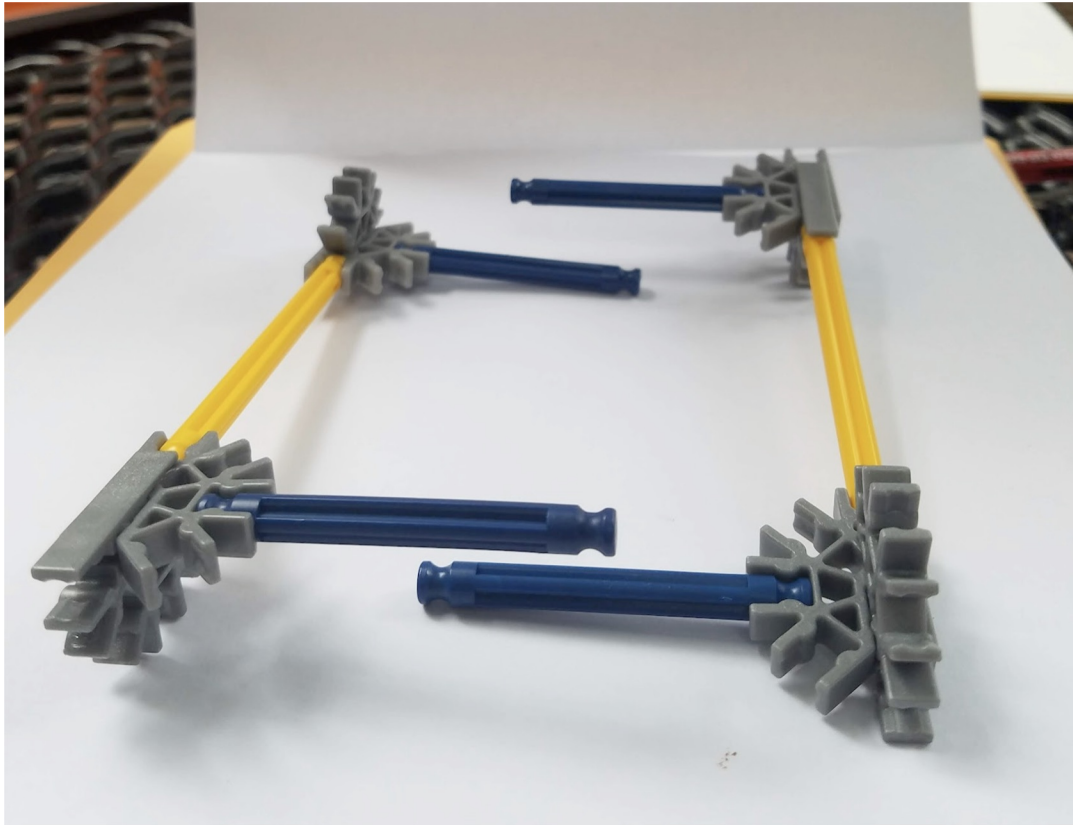
Section 3 Step 11

Repeat Section 3 Steps 1-10
to create the same structure, rotated
180 degrees.



Section 3 Step 12

Arrange the assemblages in two “layers”. The dark blue rods from the top layer should face South, and the dark blue rods from the bottom layer should face North.



Section 3 Step 13

Align your two identical structures so that the un-connected ends of the dark blue rods are facing each other.

The dark blue rods from each structure will not be in contact with each other.

Each pair of rods will appear 'stacked'



Section 3

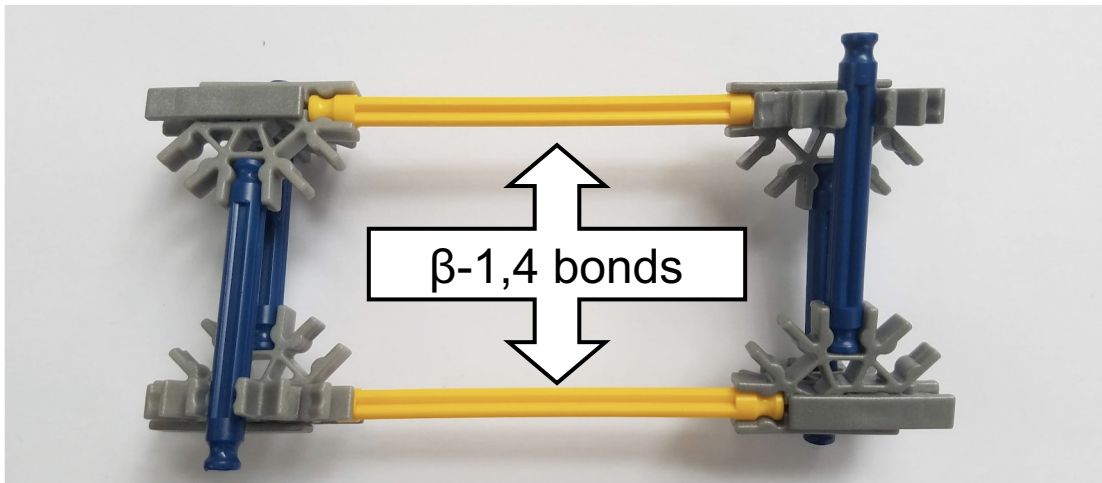
Step 14

When your dark blue rods are stacked, they can be inserted into the sockets on their sides.

The peg of one dark blue rod will “plug” into the socket that is parallel to the table.

On the other side, the rod and the socket will be in different planes (with the socket oriented vertically). You will need to snap the dark blue rod (just below the peg) straight down into the vertical socket.

This “snap” insertion will take more force than other socket-rod connections that have already been built.



This is cellulose.

Your final cellulose structure contains
4 glucose units connected by
2 yellow β -1,4 bonds.

This is just a representation of two
layers (a small section) of cellulose
which repeats.