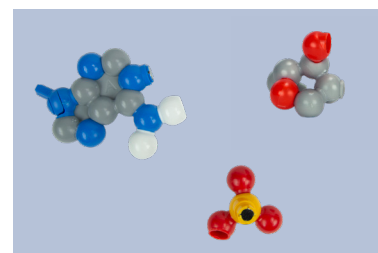


Assembly Instructions

Why aren't all my nucleotides assembled?

By assembling the nucleotides you will become familiar with the features and capabilities of the nucleotides in the *Dynamic DNA Kit*. We believe this will help you determine the best use of *Dynamic DNA* in your various courses, based on your students and curriculum. (We discovered some teachers didn't realize the nucleotides in our previous DNA Discovery Kit could be separated into their three component groups.) ***We think your students will enjoy discovering how to assemble the nitrogenous base, sugar and phosphate groups, the way Francis Crick and James Watson did when they determined the structure of DNA with their metal plates and connecting pieces!***

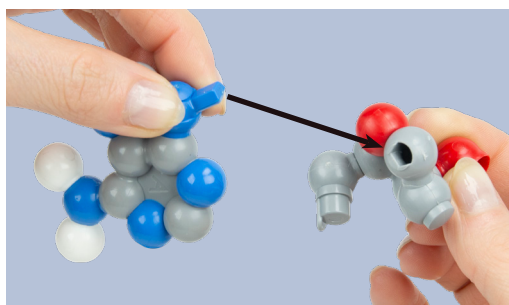


Nucleotide components

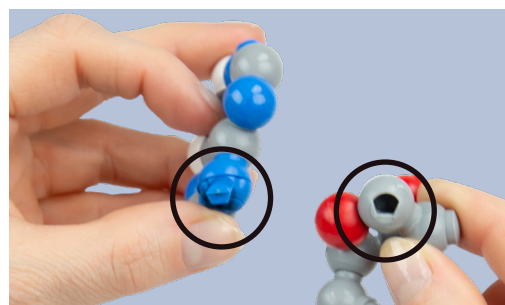
Assembling Nucleotides

Please note: the post and hole fittings between the nitrogenous base and sugar group is distinctly different than the post and hole fitting between the sugar group and phosphate groups. **No magnets are used in assembling the components of each nucleotide bases. Magnets are used to simulate the bond connections between the A-T and G-C nucleotides.**

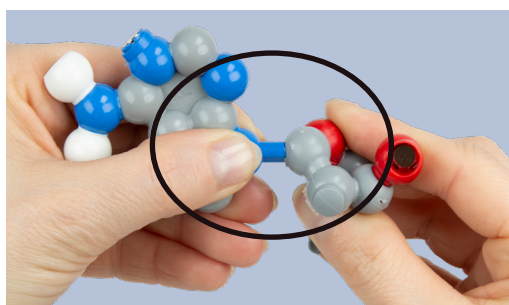
1. Insert the post on the nucleotide base into the hole in the sugar. Hold the blue swivel part tightly and line up the post with the hole in the sugar. Make sure the orientation of the two shapes match before you insert. *You will need to push hard.*



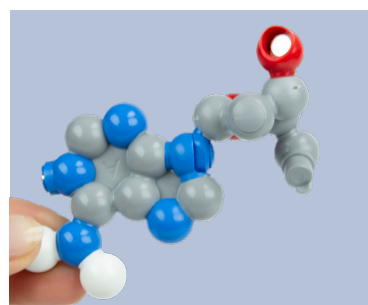
Hold the swivel post tightly.



Note the distinct shapes of the post and hole and line them up before insertion.



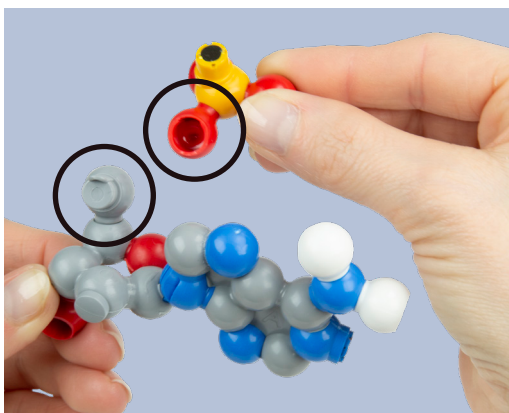
Push firmly to insert the post.



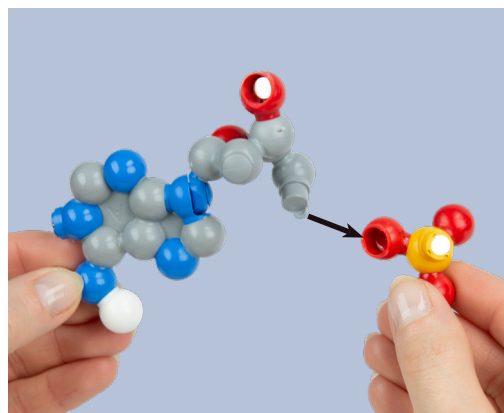
Finished connection

Assembly Instructions

2. Insert the gray post on the sugar into the hole in the red oxygen of the phosphate group. Make sure the extended *paddle* on the post is lined up with the hole on the phosphate group before you insert. *You will need to push hard.*



Look for the paddle on the post.



Note the distinct shapes of the paddle and hole and line them up before insertion.



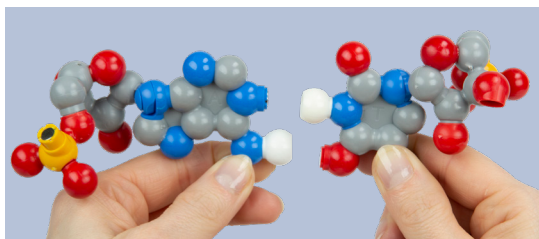
Push firmly to insert the post.



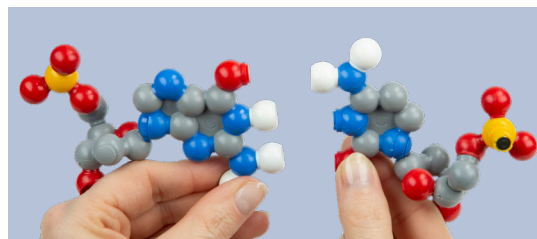
Finished connection

Assembly Instructions

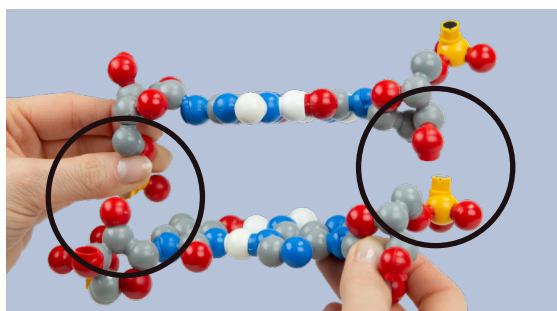
Joining the A-T and G-C Base Pairs



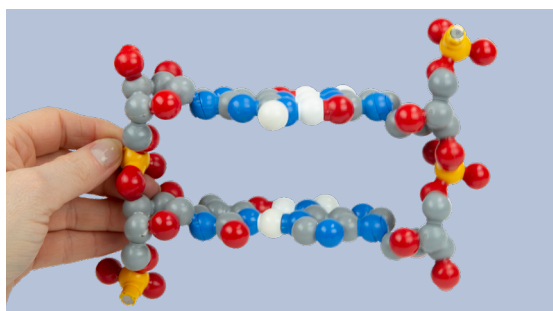
Connect the A-T base pair.



Connect the G-C base pair.



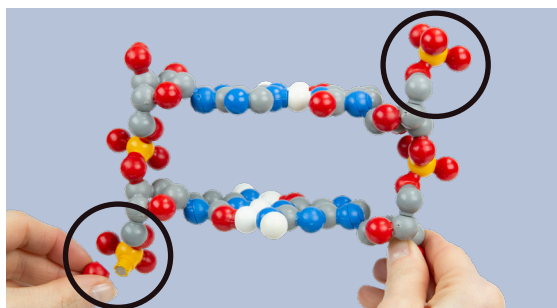
Connect the 2 base pairs.



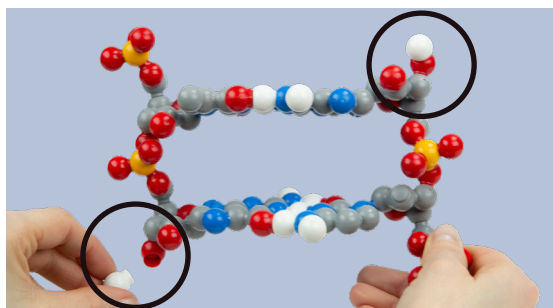
Joined base pairs

Attach 2 red oxygen caps to the 5' phosphate and 2 white hydrogen caps to the 3' sugar.

Assembly Tip: The red 5' oxygen cap fits tightly and may be hard to remove if it is pushed to the bottom of the phosphate post. It is easier to remove if it is attached only halfway down the post. It will become easier to remove with use. If it is too hard to remove by hand, use pliers.



Attach 2 red oxygen caps.



Attach 2 white hydrogen caps.



Joined and capped base pairs

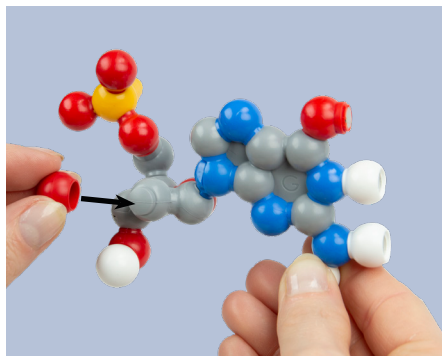
Follow the same capping instructions when building the 6 and 12 base pair sets.

Note: You should be able to easily twist and untwist up to six base pairs of *Dynamic DNA* - as you get more comfortable with the model. You'll need to set the DNA on a table to complete a 12 base pair double helix and you may wish to feed a rod through the middle. You'll likely need a rod to twist all 12 base pairs of DNA (or more) at one time.

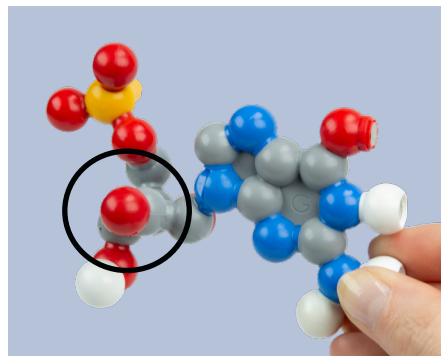
Assembly Instructions

Modeling RNA

To convert the DNA bases adenine, guanine and cytosine to RNA bases, add a red oxygen cap to the sugar.

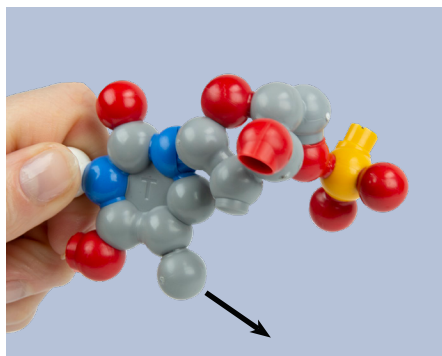


Attach a red oxygen cap.

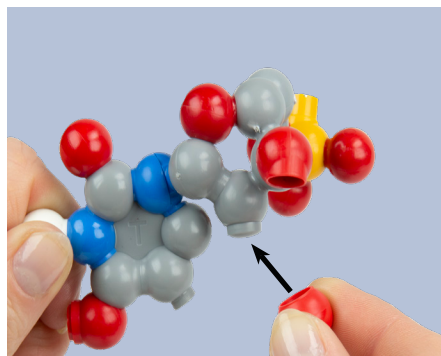


Completed RNA base

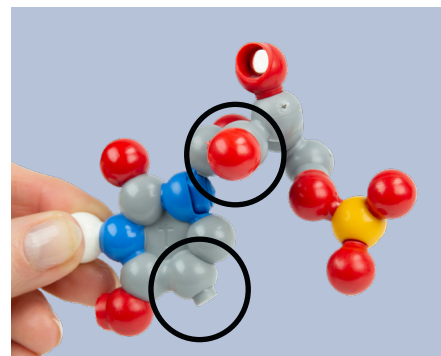
To convert thymine to uracil, remove the gray carbon and add a red oxygen cap (for ribose sugar).



Remove the gray carbon.



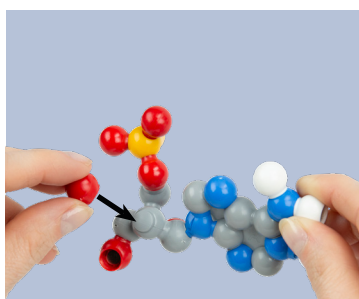
Add a red oxygen cap.



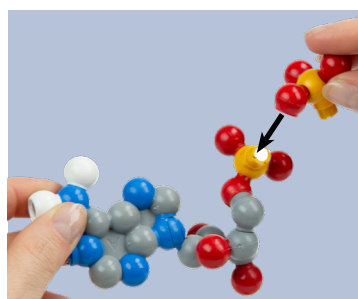
Completed uracil

Modeling ATP and More

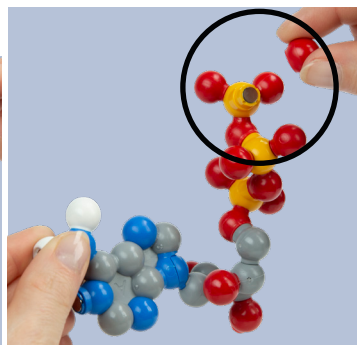
To model **adenosine triphosphate (ATP)**, add a red oxygen cap to the sugar to convert the deoxyribose to ribose. Then attach two more phosphates to the phosphate. Finally, make sure there is a red oxygen cap on the last phosphate group.



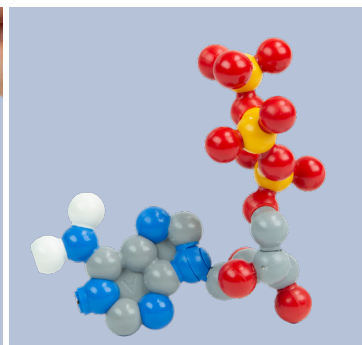
Add a red oxygen cap.



Add 2 more phosphates.



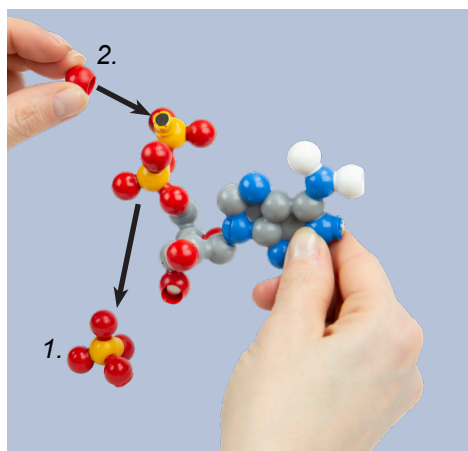
Add a red oxygen cap.



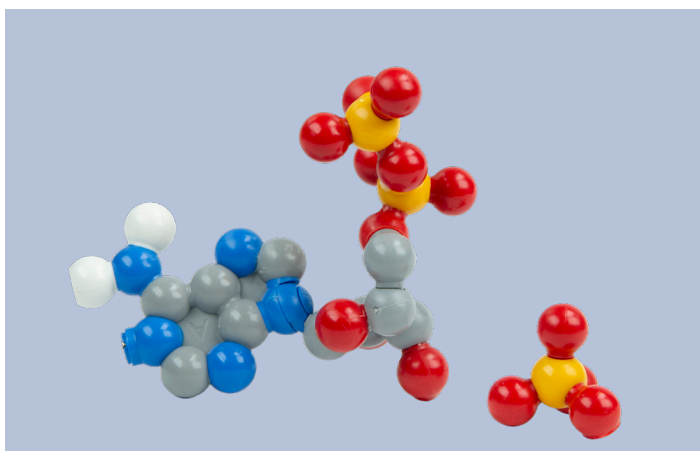
Completed ATP

Assembly Instructions

To convert ATP to adenosine diphosphate (ADP), remove the end phosphate and add a red oxygen cap on the last phosphate group. Make sure to keep the red oxygen cap on the sugar (for ribose). You'll have one inorganic phosphate leftover.

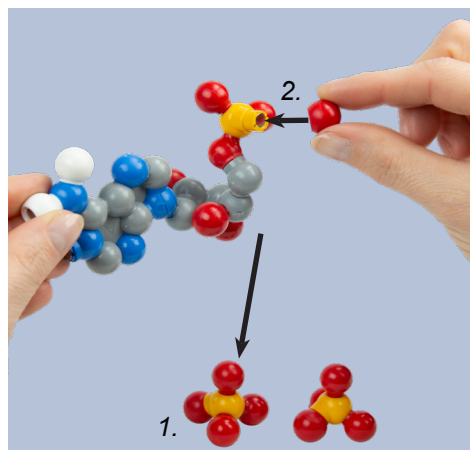


Remove the end phosphate and add a red oxygen cap.

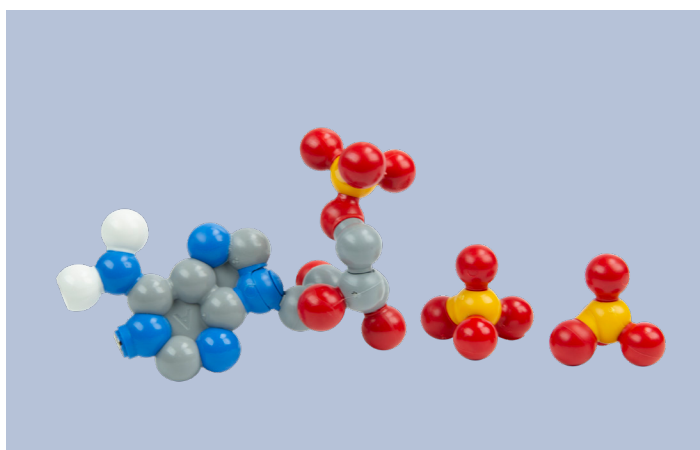


Completed ADP

To convert ADP to adenosine monophosphate (AMP), remove the end phosphate and add a red oxygen cap on the last phosphate group. Make sure to keep the red oxygen cap on the sugar (for ribose). You'll have two inorganic phosphates leftover.



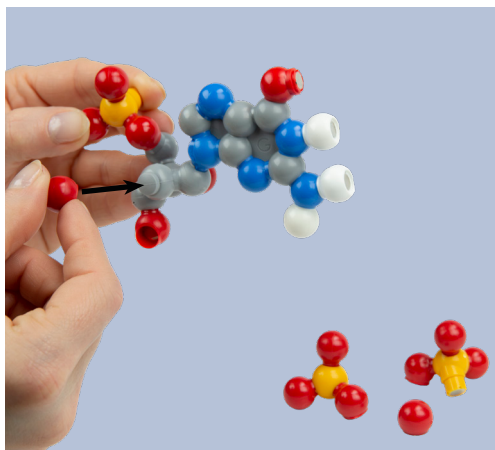
Remove the end phosphate and add a red oxygen cap.



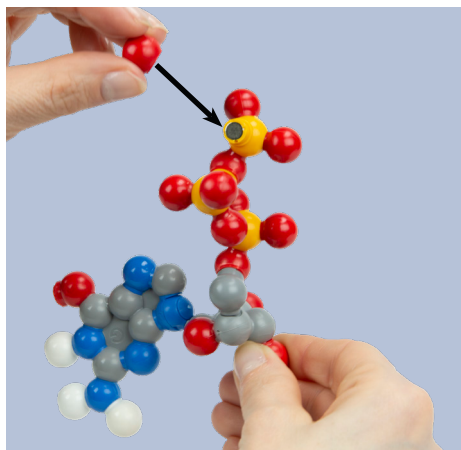
Completed AMP

Assembly Instructions

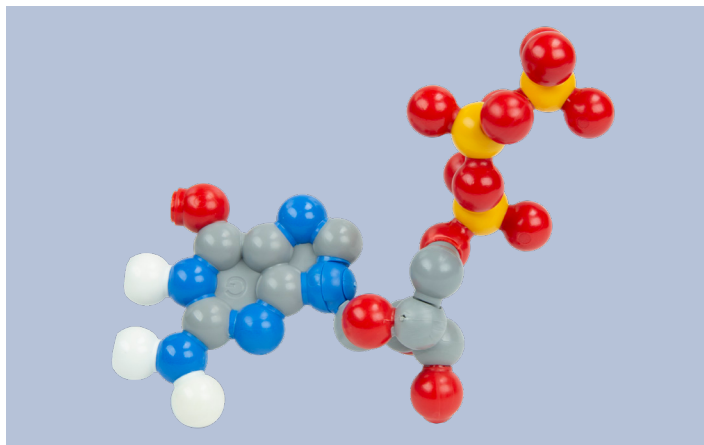
To model guanosine triphosphate (GTP), start with the guanine nucleotide and add the red oxygen cap on the sugar (for ribose). Then attach two more phosphates to the phosphate. Finally, make sure there is a red oxygen cap on the last phosphate group.



Add a red oxygen cap.



Add 2 more phosphates and a red oxygen cap.



Completed GTP

Follow this same process with the thymine and cytosine nucleotides to make thymidine triphosphate (TTP) and cytidine triphosphate (CTP).