

DNA Keychains

Teacher Information

Overview:

For this activity, students use beads and wire to create a DNA molecule that shows the sugar/phosphate backbone as well as the paired nitrogen bases. After they are done with the keychains, we use them to see what happens during DNA replication. Visit http://accessexcellence.org/AE/AEC/AEF/1995/ross_jewelry.html to view the original activity description. I have changed the instructions to make it easier for my junior high students to construct their keychains with the least amount of challenges.

Materials Needed:

- 6 mm faceted beads - 52 beads per student (26 of two different colors)
- Seed beads (Size 6/0 or 8/0) - 24 beads per student (6 of 4 different colors)
- 20 gauge wire- 18" per student (May use 20 gauge floral wire already cut to 18" pieces)
- 26 gauge wire - 20" per student
- Lanyard hooks or key rings - 1 per student
- You will also need needle-nose pliers & wire cutters (1 for each group), plastic containers for the beads (small and large), small plastic cups for holding beads, copies of the *DNA Keychain Guide* for each group

Notes:

(1) You will want to make a few key chains on your own before attempting this with a class. I have created a PowerPoint presentation that outlines the steps and includes the diagrams from the keychain guide. It is available on website along with color copies of the guide and related activity pages - see the link below.

(2) I purchase most of my materials through online craft stores, such as Crafts Etc or ConsumerCrafts.com. Walmart or local craft stores are also good sources for wire and key chains. To offset the costs, you might consider having the students pay 50¢ each. I let my students make one keychain for free for their class assignment and then allow them to purchase materials for 50¢ to make others for their friends and family members. Usually the amount of money I raise covers a large percentage of the cost of the materials.

(3) I have six groups of tables in my classroom, so I set up six sets of materials in rectangular plastic tubs. Each set contains one container of large beads, a smaller container of seed beads, several pieces of thick wire, a roll of thin wire, 1 pair of pliers/wire cutters, and 8 small plastic cups to keep beads in one place. At the end of each class, I am able to do a quick check of the materials and can easily see what needs restocked or if there are missing items that need to be found!

(4) Challenging parts ...

- My students have the most difficulty learning how to do the "cross two in the middle." I used two large metal rings to show them the correct way to do the step. I placed both rings on one hand and "threaded" other hand through the rings in the other direction. Tell the students that the step is similar to tying a shoe - cross the wires and pull to form a knot.
- Some of the students did not keep the thin wire tight while they were building the model and ended up with key chains that did not look the greatest. Remind the students to keep the thin wire tight after each step - cross two in the middle or thread two on the sides.
- Many students decided to alternate the base pairs - A with T on one rung followed by G with C on the next - to make it easier. Students may choose to do all the A/T pairs before adding the G/C pairs or mix it up any way they would like as long as the correct bases are paired each time.

Go to <http://sciencespot.net/Pages/classbio.html#DNAKeychains> to find all the materials for this activity.



DNA Keychain Guide



Get Your Materials

1. Choose your large beads for the sugar and phosphate molecules that make up the backbone. You will need **26 beads of 2 different colors** for a total of 52 beads. Color the key provided.

2. Choose your small beads for the nitrogen bases. You will need **6 beads of 4 different colors** for a total of 24 beads. Color the key provided.

3. Get a piece of **THICK** wire from your teacher and bend it in half.

4. Cut a piece of **THIN** wire – 20 inches in length - and bend it in half.

Name	<u>Mrs. Trimpe</u>		
Backbone: Need 26 of each color			
 Sugar	 Phosphate		
Nitrogen Bases: Need 6 of each color			
 A	 T	 C	 G

Build Your DNA Molecule

5. Add two **SUGAR** beads– one on each side – to the **THICK** wire.

6. Next add two **PHOSPHATE** beads of the other color – one on each side of the wire.

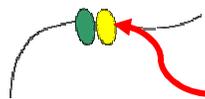
7. Place one **A bead** and one **T bead** in the middle of the **THIN** wire and hold it in place at the top of the phosphate beads. Line up the **THICK** and **THIN** wires on each side and hold at the top.

8. Slide one **SUGAR** bead down one end of the thin wire and thread the thick wire through as you push it towards the bottom of the keychain - both wires are need to be threaded "inside" the large bead . Add another **SUGAR** bead on the other side in the same way.

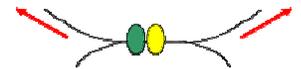
9. Slide one **PHOSPHATE** bead down one end of the thin wire and thread the thick wire through as you push it towards the bottom of the keychain - both wires are need to be threaded "inside" the large bead . Add another **PHOSPHATE** bead on the other side in the same way.

10. Pull the large beads down towards the bottom of the keychain and pull on the ends of the thin wire to make the small beads fit tightly in place.

11. Hold one of the thin wires near the end and add a **G bead** and a **C bead**. **Thread the end** of the other thin wire back through the G and C beads in the opposite direction make the wires form an **X** shape. **Pull the ends** as if you were “tying” a knot.



Thread the other end of the wire through the beads in the opposite direction.



Pull on both ends of the thin wire to “tie” it together

12. Add more big beads (**SUGARS & PHOSPHATES**) to the backbone – **TWO** on each side. Thread the **THIN** wire through the large beads as you add them to the **THICK** wire.

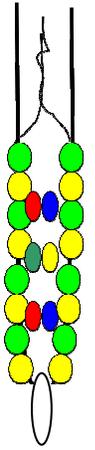
13. Continue building the DNA molecule following the same process – you’ll need 26 large beads on each side and 12 pairs of bases in the middle.

Remember the process...

Thread two wires through two big beads on the sides, Cross two wires through two small beads in the middle & tie.

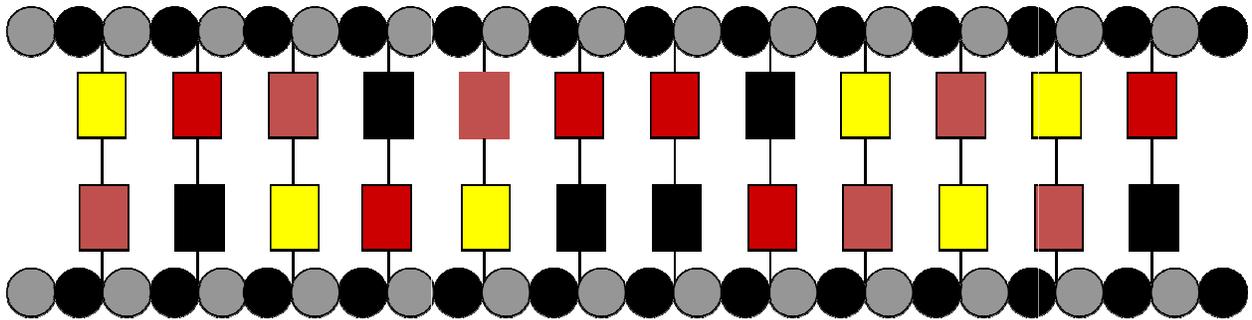
Finish Your DNA Molecule

14. Once you have added all the base pairs, twist the ends of the thin wire together tightly and add a key ring to the other end of the keychain.
15. Use pliers to twist the ends of the thick wire and the thin wires together all at once.
16. Use the wire cutters/pliers to cut off the ends leaving it about ½ inch long. Use the wire cutters/pliers to bend and “tuck” the ends in between the large beads so it won’t poke you.
17. Twist your DNA strand around a pencil or finger and gently pull on the ends to create the double helix shape.



CAUTION: Untwisting and twisting your keychain too many times will make it break!

*When you are done, color the **BASES** on a paper model of your DNA keychain. Be sure the colors of the bases match exactly!*



Write your name on the back of the paper model.

Turn in your keychain and the paper model to your teacher.