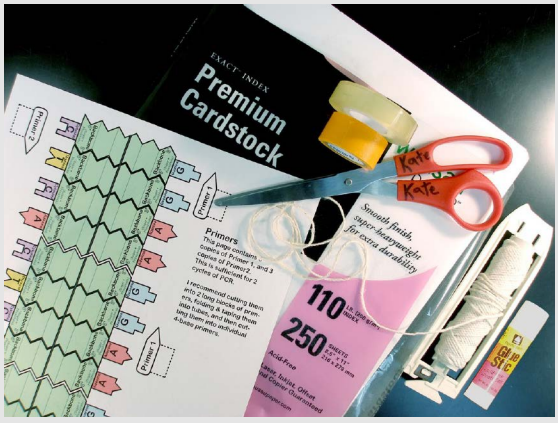
How to assemble paper PCR model

by Kate Baldwin (K8Baldwin.com)



Recommended materials:

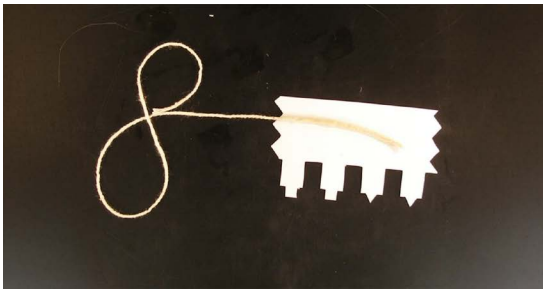
- Printed templates on card stock paper
- Scissors
- String
- Double-stick tape or a glue stick
- Regular tape

This instructional tool was made in 2009 by Kate in the Masson Lab at UW Madison. Please feel free to distribute this for teaching purposes, but please don't sell it.

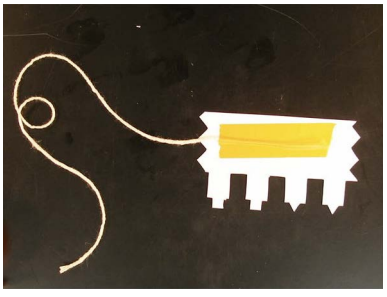
Thanks!

Example assembly: a Primer

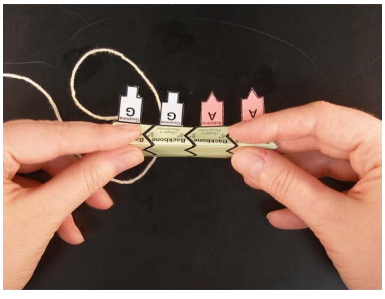
Cut out a primer



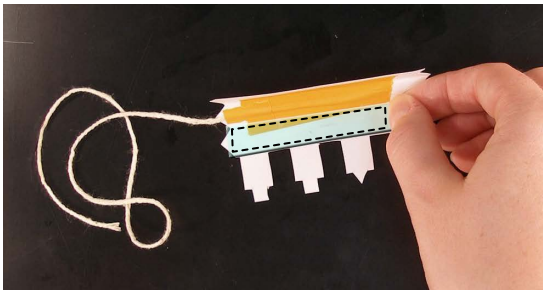
Cut ~14 inches of string and lay it on the back side of the primer so that it's dangling off the **3' end of the primer**.



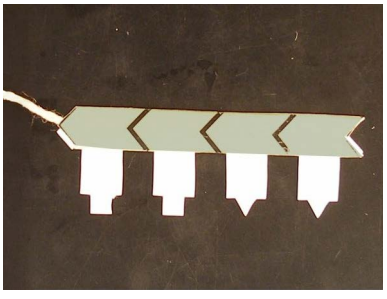
Tape down string



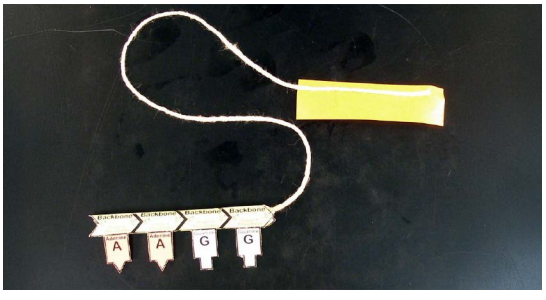
Fold down along both gray lines



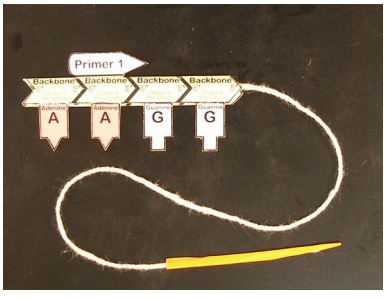
Apply double-stick tape (or glue) where indicated in preparation of sticking the paper down on it's self.



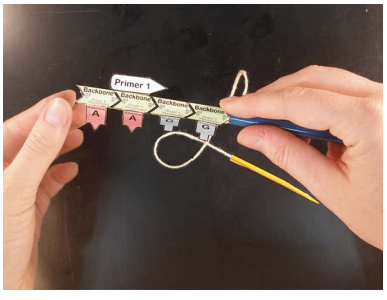
Fold on both creases to make a flat tube. Seal down on the tape.



Make the thread easier to thread by making a taped end. Roll up the tape around the end tightly.



Tape primer label on to the back of the flat tube.



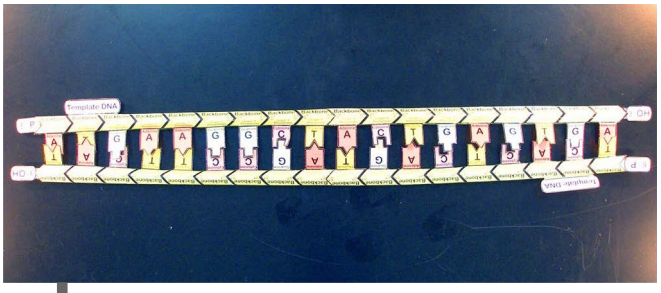
Use a pen or other round object to help puff open the tube. It's done!

How to use paper PCR model

by Kate Baldwin (K8Baldwin.com)

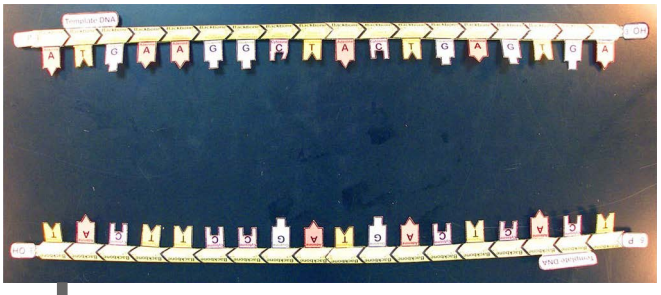
Recommended materials for 2 PCR cycles:

- Double stranded template
- 6 primers (3 of each)
- 2 copies of ‘dNTPs 1’ cut out
- 1 copy of ‘dNTPs 2’ cut out



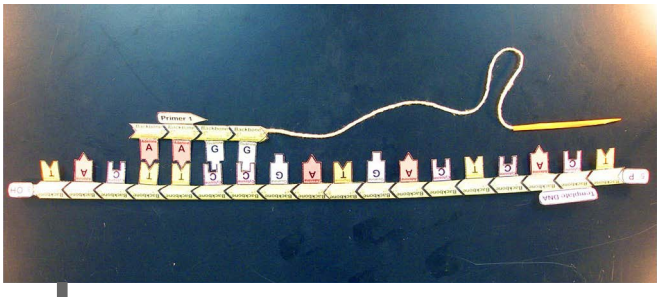
Double stranded template DNA

95°C **"Melting" aka "Denaturing"**



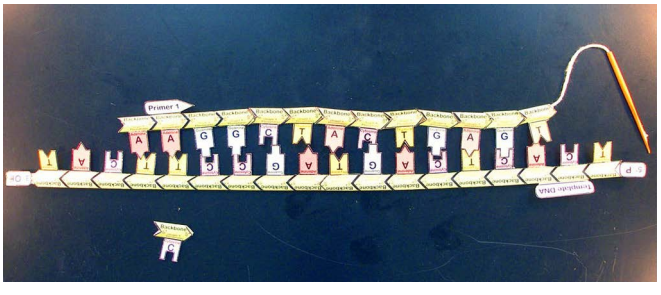
The template DNA separates into 2 single stranded pieces of DNA

~55°C **"Annealing"**



The primer anneals to it’s complimentary bases. These photos only focus on one piece of DNA, but the other primer fits on the other strand.

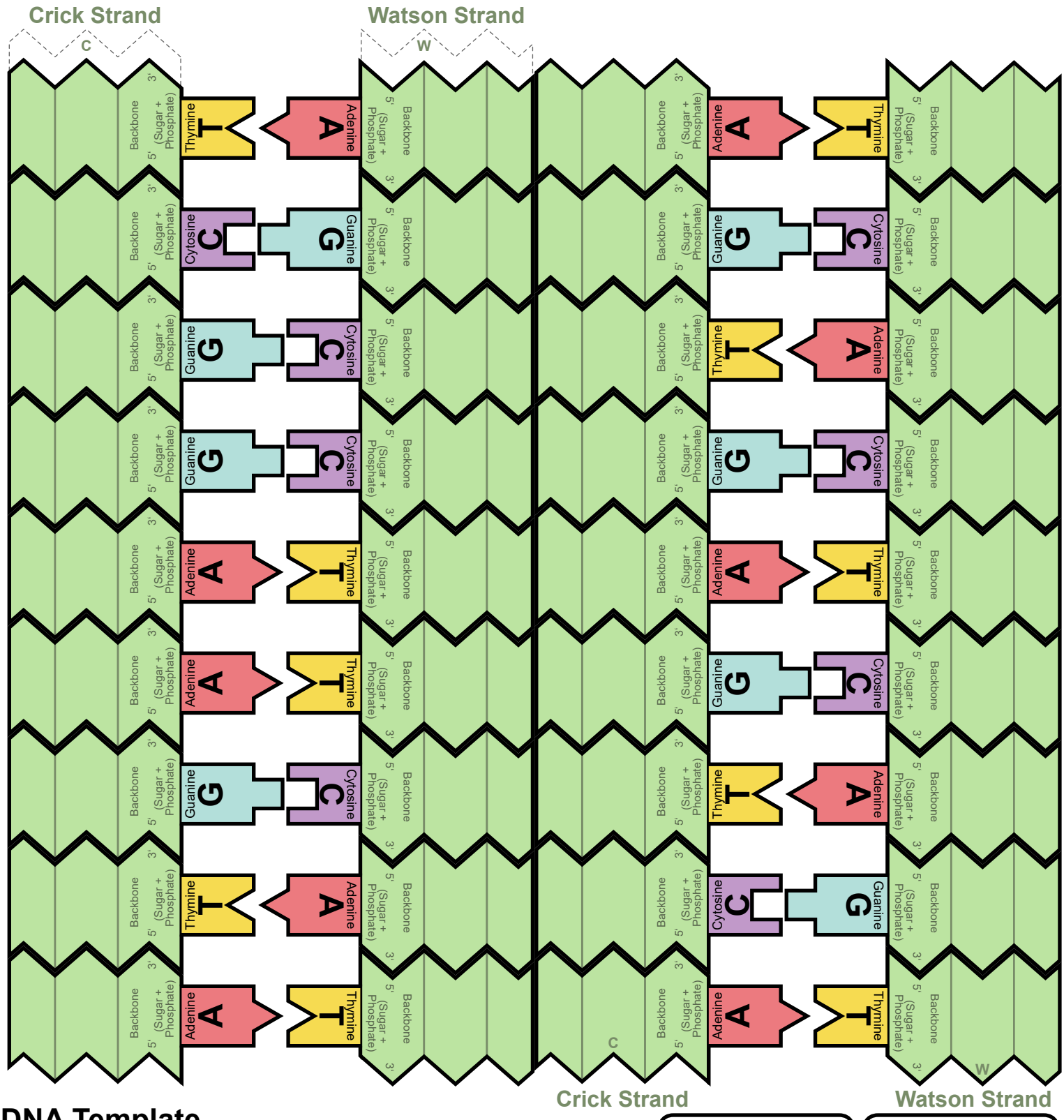
72°C **"Extension"**



Starting at the primer, DNA polymerase makes new DNA complementary to the template DNA. Thread the dNTPs on to the string hanging off the primer, all the way until the end of the template.

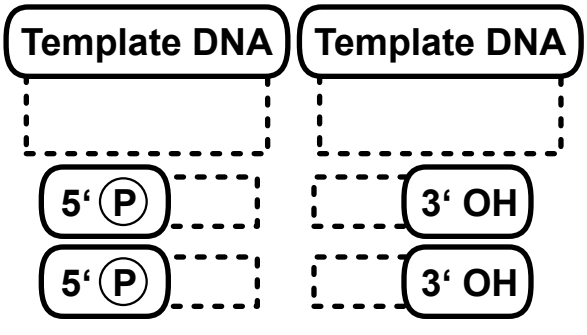
Repeat 30X

Do another round of PCR using both of your new strands as template in addition to your initial template. In real life, it repeats 30X!



DNA Template

Because the template DNA is longer than a page of paper, you will need to tape two pieces together to make each strand of the template DNA. In order to make sure that you tape the correct pieces together, I labeled the strands. The first half of the "Crick Strand" should be connected to the second half of the "Crick Strand," and the same for the "Watson Strand". I recommend taping together the full strands before folding them into tubes.

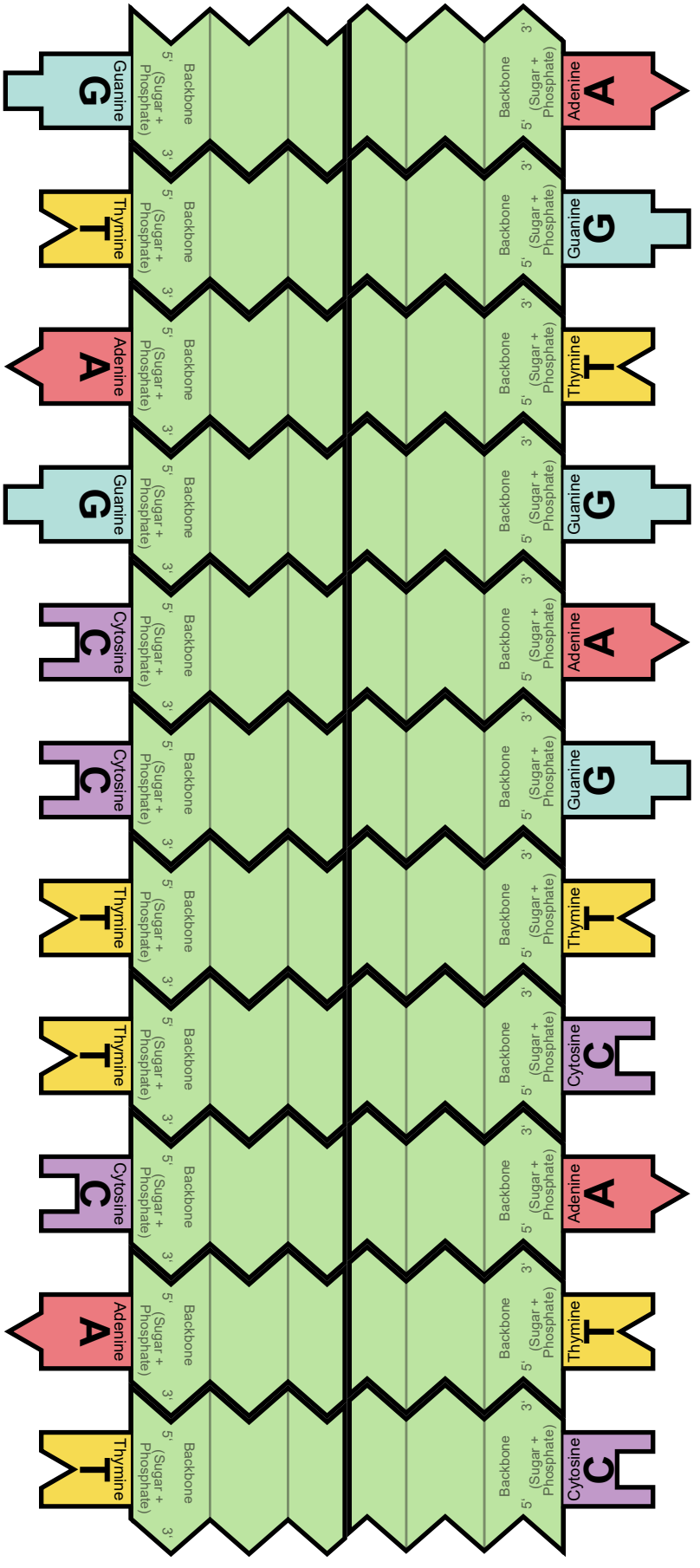


Primers

This page contains 3 copies of Primer 1, and 3 copies of Primer 2.

This is sufficient for 2 cycles of PCR.

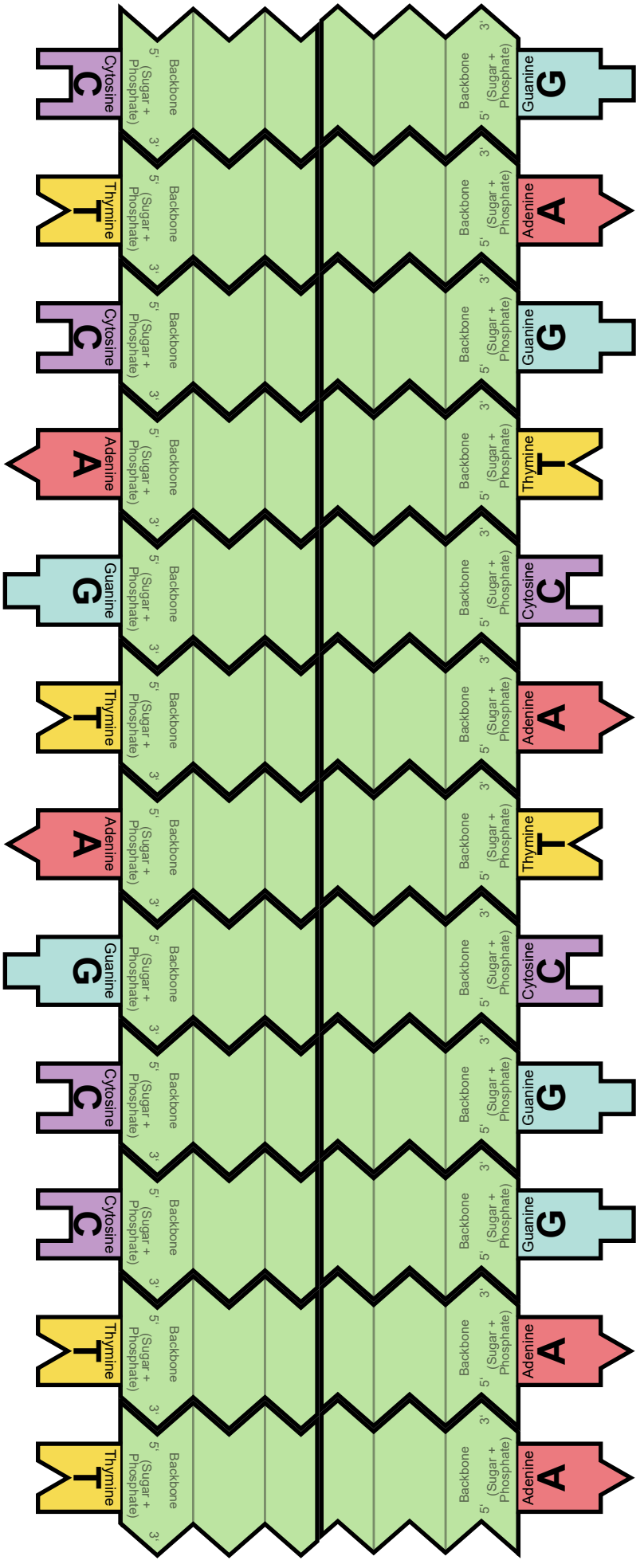
I recommend cutting them into 2 long blocks of primers, folding & taping them into tubes, and then cutting them into individual 4-base primers.



dNTPs 1

This page contains all the dNTPs you need for the first cycle of PCR.

I recommend cutting out the two blocks of nucleotides, and then folding & taping each into tubes, and then cutting them into individual nucleotides.



dNTPs 2

This page contains some of the dNTPs you need for the second cycle of PCR.

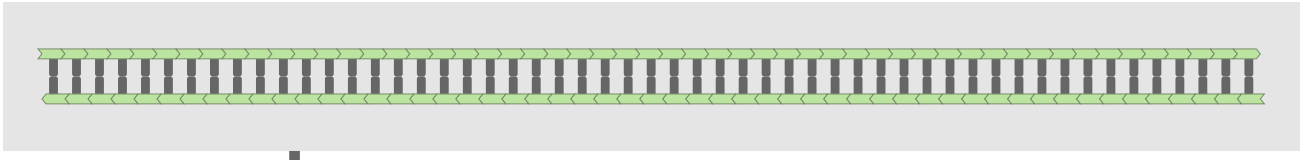
If you would like to do a second cycle of PCR, print and cut out this page, **in addition to a second copy of 'dNTPs 1'**.

I recommend cutting out the two blocks of nucleotides, and then folding & taping each into tubes, and then cutting them into individual nucleotides.

Cycle of PCR diagram

by Kate Baldwin (K8Baldwin.com)

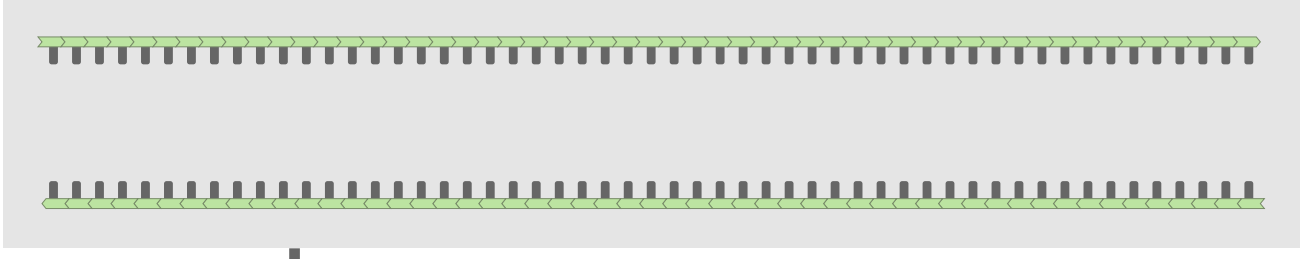
Starting template DNA



95°C

"Melting" aka "Denaturing"

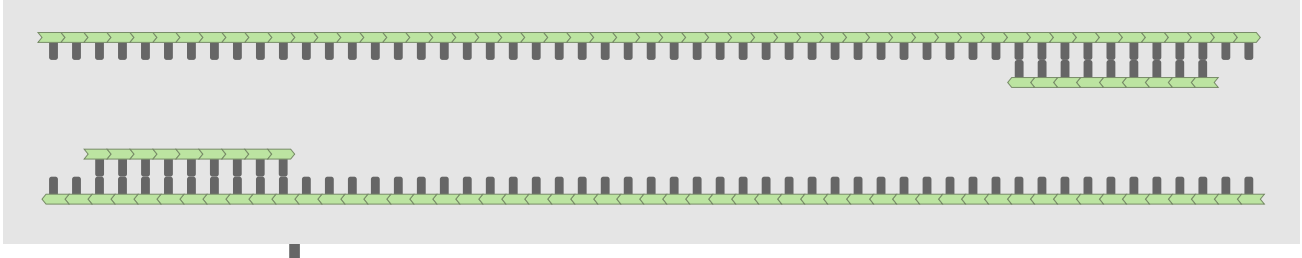
→Double stranded DNA separates.



~55°C

"Annealing"

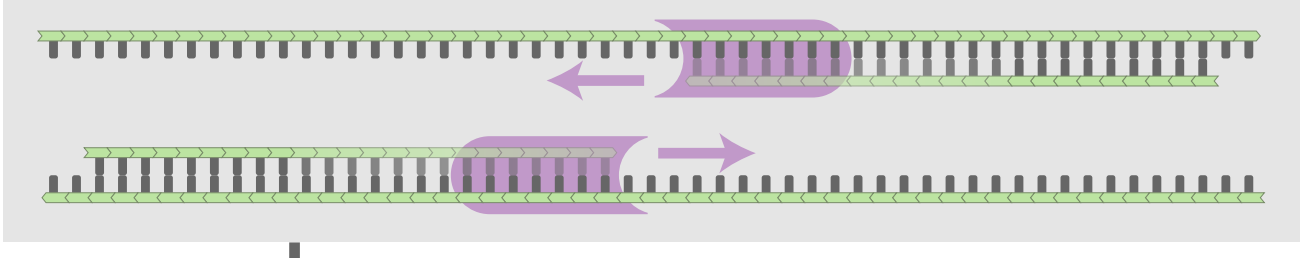
→Primers stick to their matching sites. The exact temperature depends on primer composition and length.



72°C

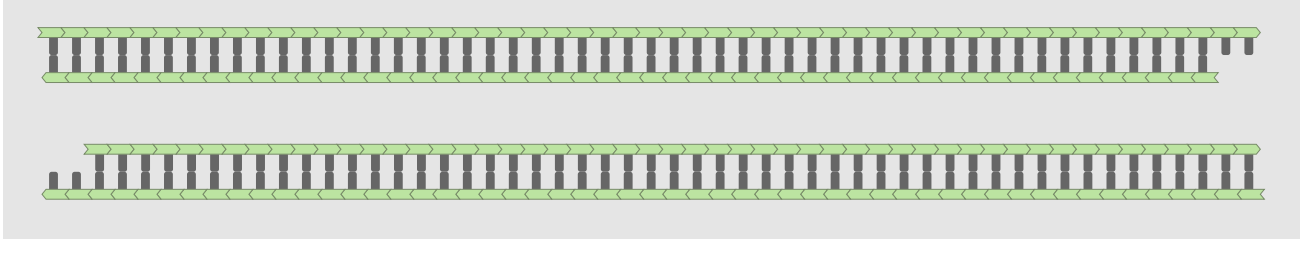
"Extension"

→DNA Polymerase builds new DNA by extending off the primers and using the original DNA as the template.



After 1 cycle

→There is twice as much DNA corresponding to the area between the primers.



Repeat 30X