This instructional tool was made by Kate Baldwin in 2009 in the Masson Lab at UW Madison. It is helpful for explaining PCR to new students. Please feel free to distribute this for teaching purposes, but please don't sell it. Thanks! Kate Baldwin, www.K8Baldwin.com.

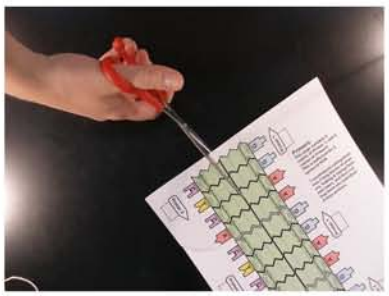
How to Assemble Paper PCR Model

By Kate Baldwin

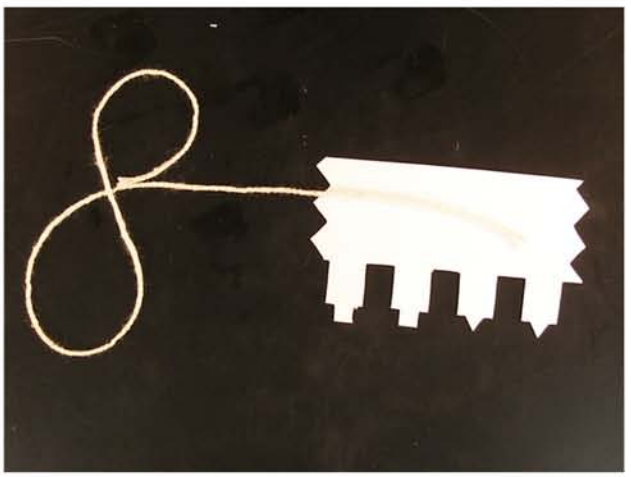
Recommended Materials:

-Printed Templates on Card Stock Paper
-Scissors
-String
-Double-Stick Tape
-Regular Tape
-Glue Stick

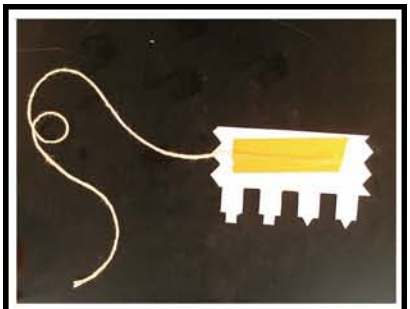
Example Assembly: a Primer



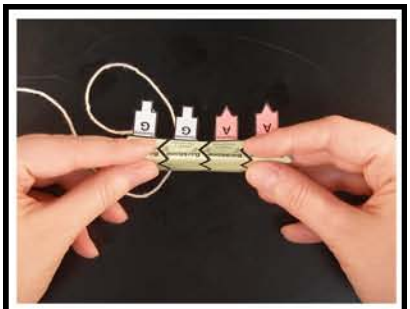
Cut out a Primer



Cut ~14 inches of String and lay it down on the back side of the primer so that it is hanging off the point in the middle. *Make sure that the dangleing end is hanging off the 3' end of the primer!*

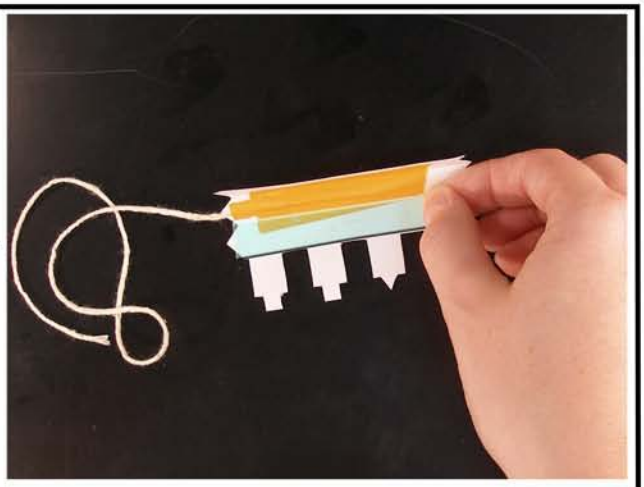


Tape Down String



Fold down along both grey lines

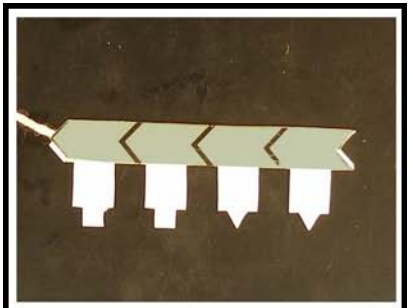
Apply double-stick tape where indicated



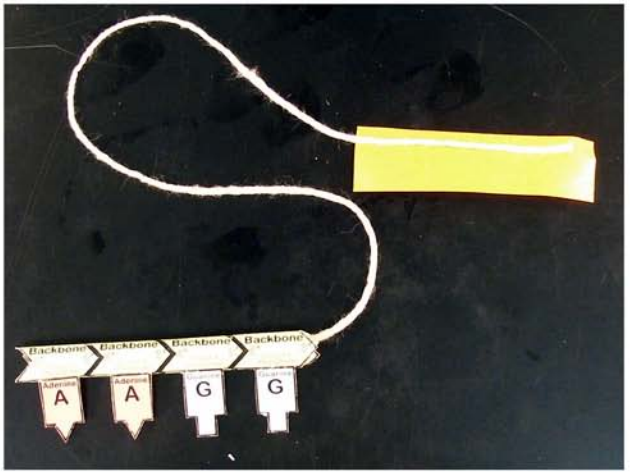
How to Assemble Paper PCR Model

By Kate Baldwin

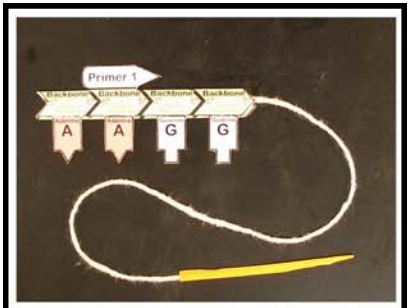
Example Assembly: a Primer Continued



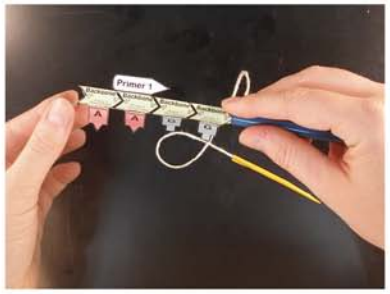
Fold on both creases to make a flat tube. Seal down on the tape.



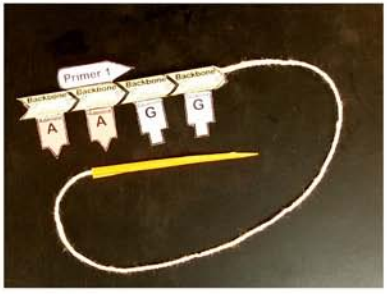
Make the string easier to thread by making a taped end. Roll up the tape around the end tightly.



Tape Primer Label on to the back of the flat tube.



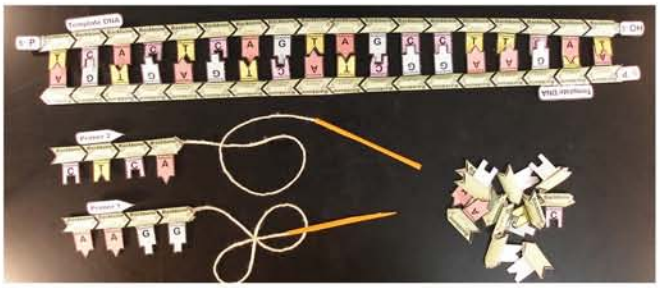
Use a pen or other round object to help you puff open the tube.



The Primer is Made.

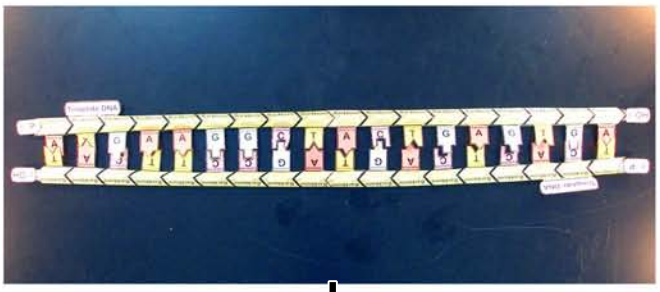
How to Use Paper PCR Model

By Kate Baldwin



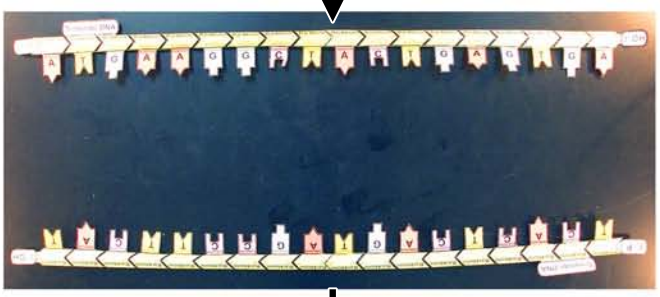
Recommended Materials for 2 PCR Cycles:

-Double Stranded Template
-6 primers (3 of each)
-2 copies of “dNTPs 1” cut out
-1 copy of “dNTPS 2” cut out



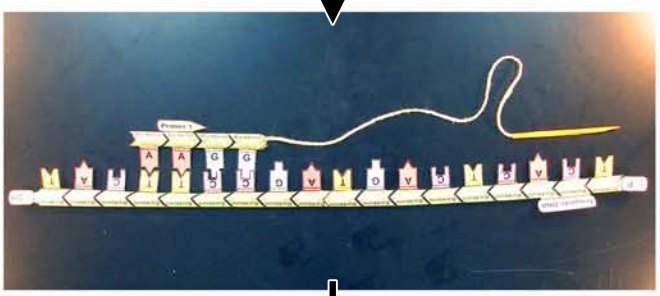
Double Stranded Template DNA

95°C ↓ “Melting,” “Denaturing”



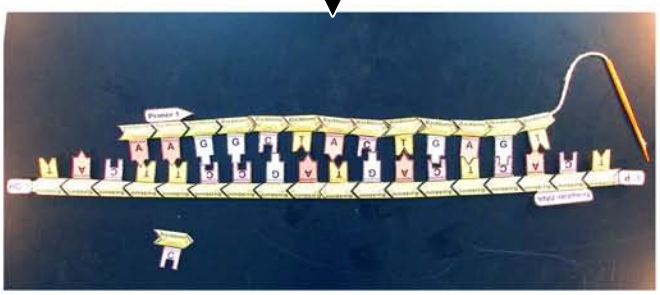
The template DNA separates into 2 single stranded pieces of DNA.

~55°C ↓ “Annealing”



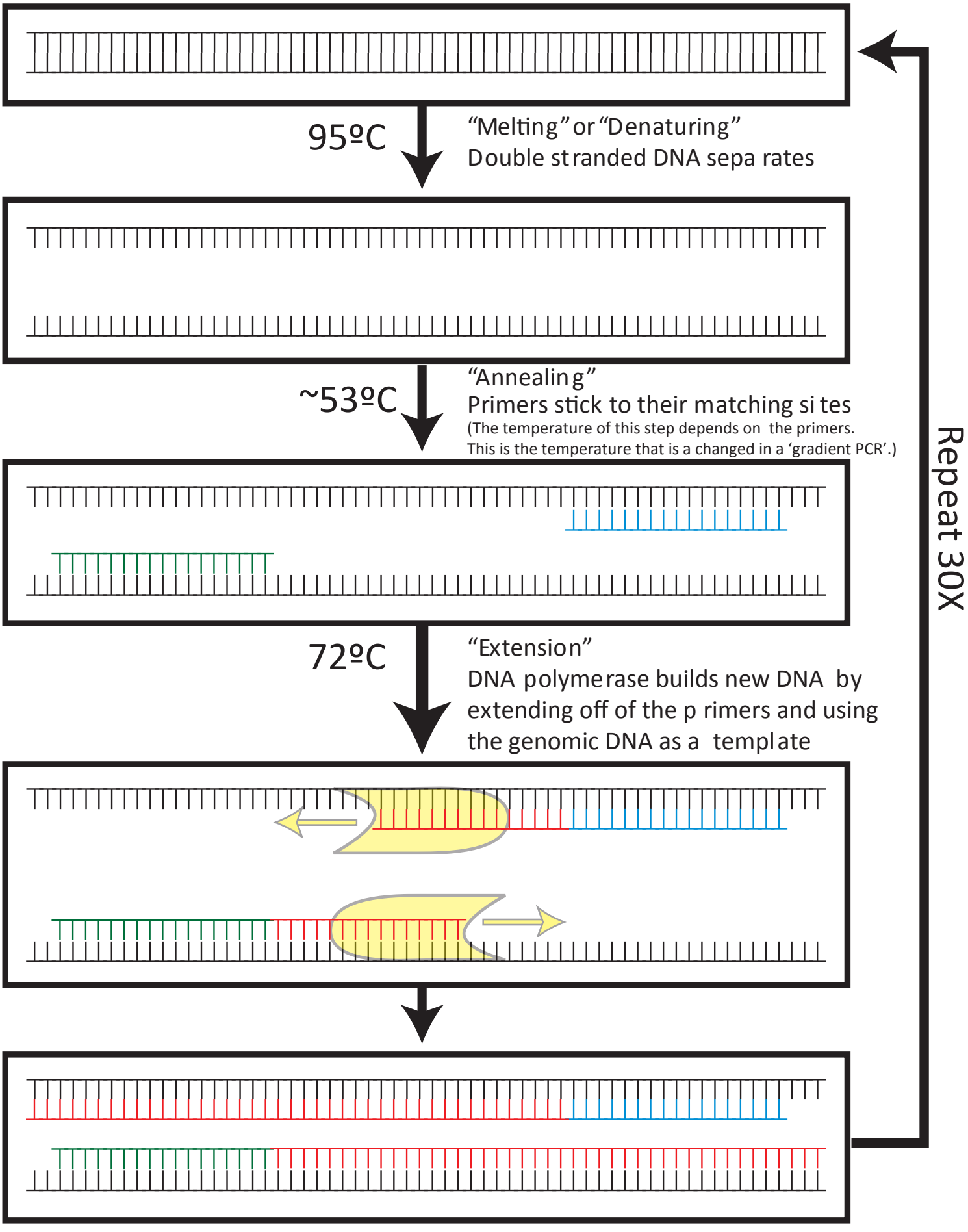
The primer anneals to its complimentary bases.
Here we only focus on one piece of the DNA, but the other primer would fit on to the other piece and the same process would occur.

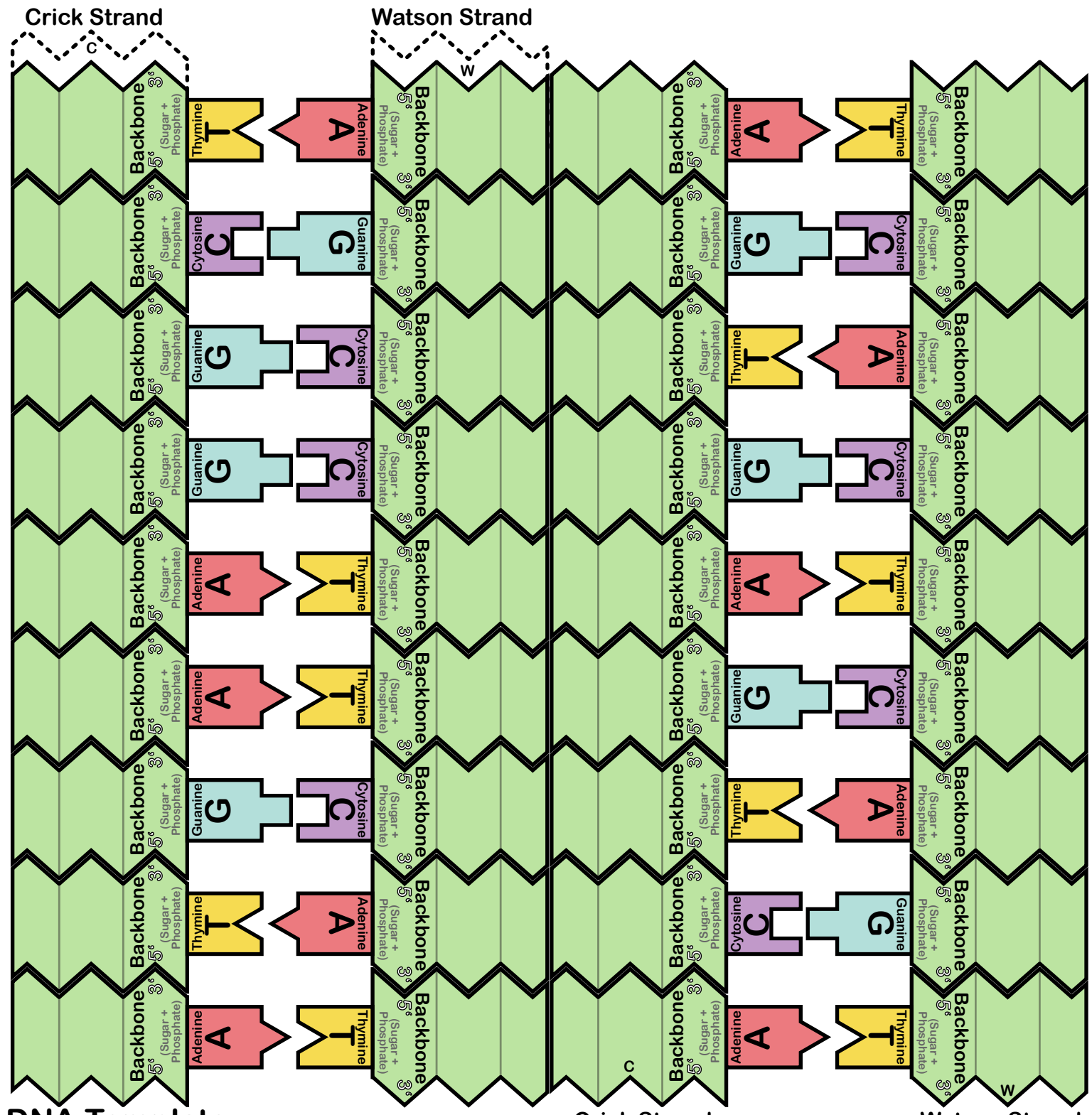
72°C ↓ “Extension”



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

Now repeat by doing another round of PCR using both of your new DNA strands as template as well and your initial template strands.


95ºC
"Melting" or "Denaturing"
Double stranded DNA sepa rates
~53ºC
"Annealing"
Primers stick to their matching si tes
(The temperature of this step depends on the primers.
This is the temperature that is a changed in a 'gradient PCR'.)
72ºC
"Extension"
DNA polymerase builds new DNA by
extending off of the p rimers and using
the genomic DNA as a template
Repeat 30X

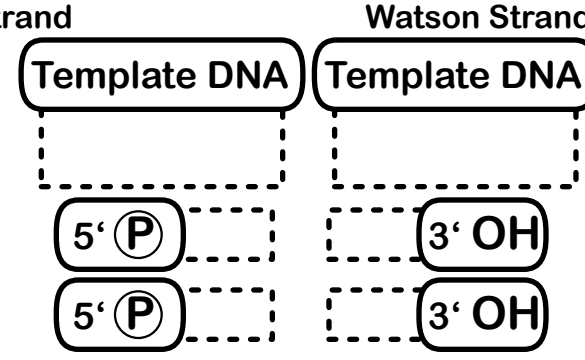


DNA Template

Crick Strand

Watson Strand

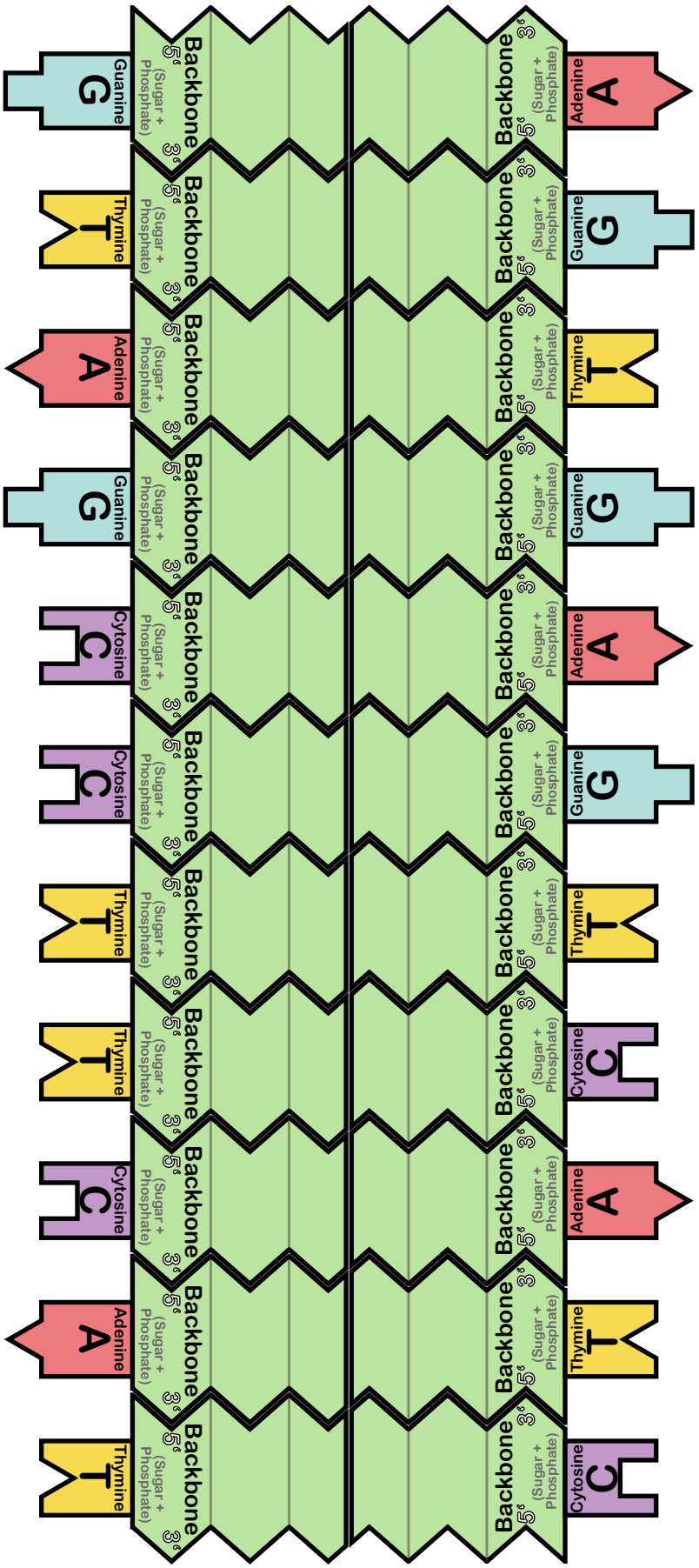
Because the template DNA is longer than a page of paper, you will need to tape two pieces together to make each strand of the template DNA. In order to make sure that you tape the correct pieces together, I labeled the strands. The first half of the "Crick Strand" should be connected to the second half 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 Primer2. This is sufficient for 2 cycles of PCR.

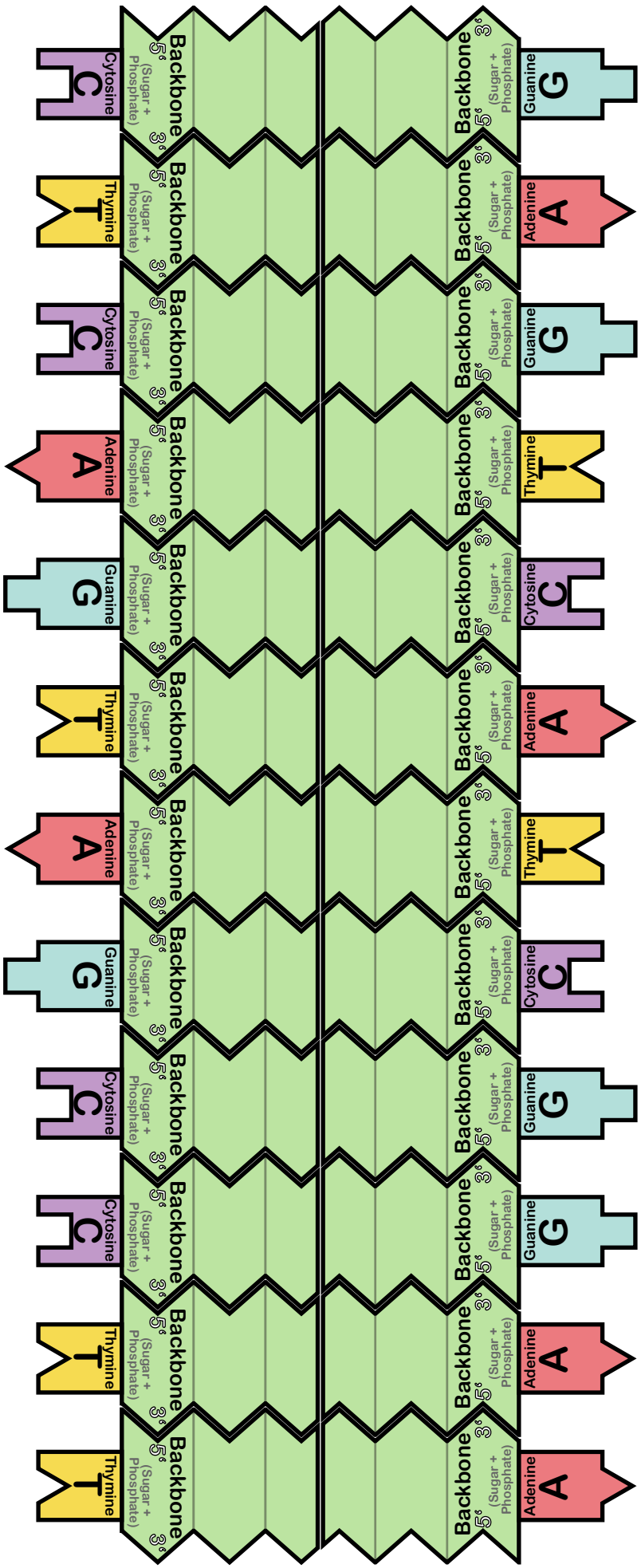
I recommend cutting them into 2 long blocks of primers, folding & taping them into tubes, and then cutting them into individual 4-base primers.



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 *t h e n* folding & taping each into tubes, and then cutting them into individual nucleotides.



dNTPs 2

This page contains *s o m e* 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 *t h e n* folding & taping each into tubes, and then cutting them into individual nucleotides.