Biology 12
DNA

Names: _____
Per: _____ Date: _____

Modelling DNA Replication

Due: _____

Objective: make a stop animation film of DNA replication

Materials:

- 24 pentose sugars (_____)
- 24 phosphate groups (_____)
- 24 nitrogenous bases (_____)
  - 4 colours, 6 of each
- 48 bonds (_____)
- 1 DNA helicase (_____)
- 2 DNA polymerases (_____)
- 1 DNA ligase (_____)

Stop animation app (look for FREE one)
- "Stop Motion Studio" (iOS)
- "Stop Motion Maker" (Android)
- "Stop Motion" (Windows)

Procedure

1. BEFORE YOU BEGIN
   a. If you are planning on eating the candy later, make sure to wash your hands and don't place the candy directly on the tables or floor. Place paper towel on the table as you work with the candy.
   b. Have cell phone or tablet secured to the edge of the table above the poster paper. Alternatively, attached a camera to a tripod. Using a stable platform will give you a better end video as it won't be too wiggly! Clear an area on the floor where you can place your poster paper.
   c. When taking your pictures, ensure that all extraneous objects are not in the photos. It is very distracting in the video if random items pop in and out of view. Marks will be deducted.
   d. The smoothest stop motion videos require many small movements and a lot of photos. Take lots of pictures!
   e. Lastly, work as a team. At each step, read through the procedure and ensure you all understand what is supposed to be going on in the video. Have one or two people help move the objects while the other makes sure the frame is clear then takes the pictures. Work together to edit and create your final project.

2. Building the nucleotides
   a. Nitrogenous base sequence for one strand of DNA… A G T T C G
      i. What would the matching strand look like? _____
   b. Build one nucleotide then take a **PICTURE** of all "The Candy DNA Representatives" on the sheet provided.
   c. Continue to create the remaining 23 nucleotides with the supplies provided (leave them loose)
   d. Where in the cell is DNA located? _____
      i. Make a large circle on the paper to represent this organelle and write its name on the top
      ii. Put all the individual loose nucleotides in the circle and take a **PICTURE**

3. Building the parent DNA
    a. Use the nucleotides to make a strand of DNA following the base sequences in step 1a and 1b
        i. The process of matching up A with T and C with G is referred to as _____
    b. You should have used up half of the nucleotides to create the parent DNA
        i. Use a sticky note to label the top strand with 3' on the left and 5' on the right
        ii. Use a sticky note to label the bottom strand with the 5' on the left and the 3' on the right
        iii. Take a **PICTURE** of the strand of parent DNA in the center of the circle with the loose nucleotides around it.
4. Beginning DNA replication
    a. Unwinding
        i. DNA _____ is an enzyme used to "unzip" the parent strand of DNA
            - Take a **PICTURE** of the enzyme breaking the bonds between the of nucleotides (you should take 6 pictures minimum as each bond is broken)

If you wish to make the video a bit more realistic, only unzip the first four then begin the next portion.

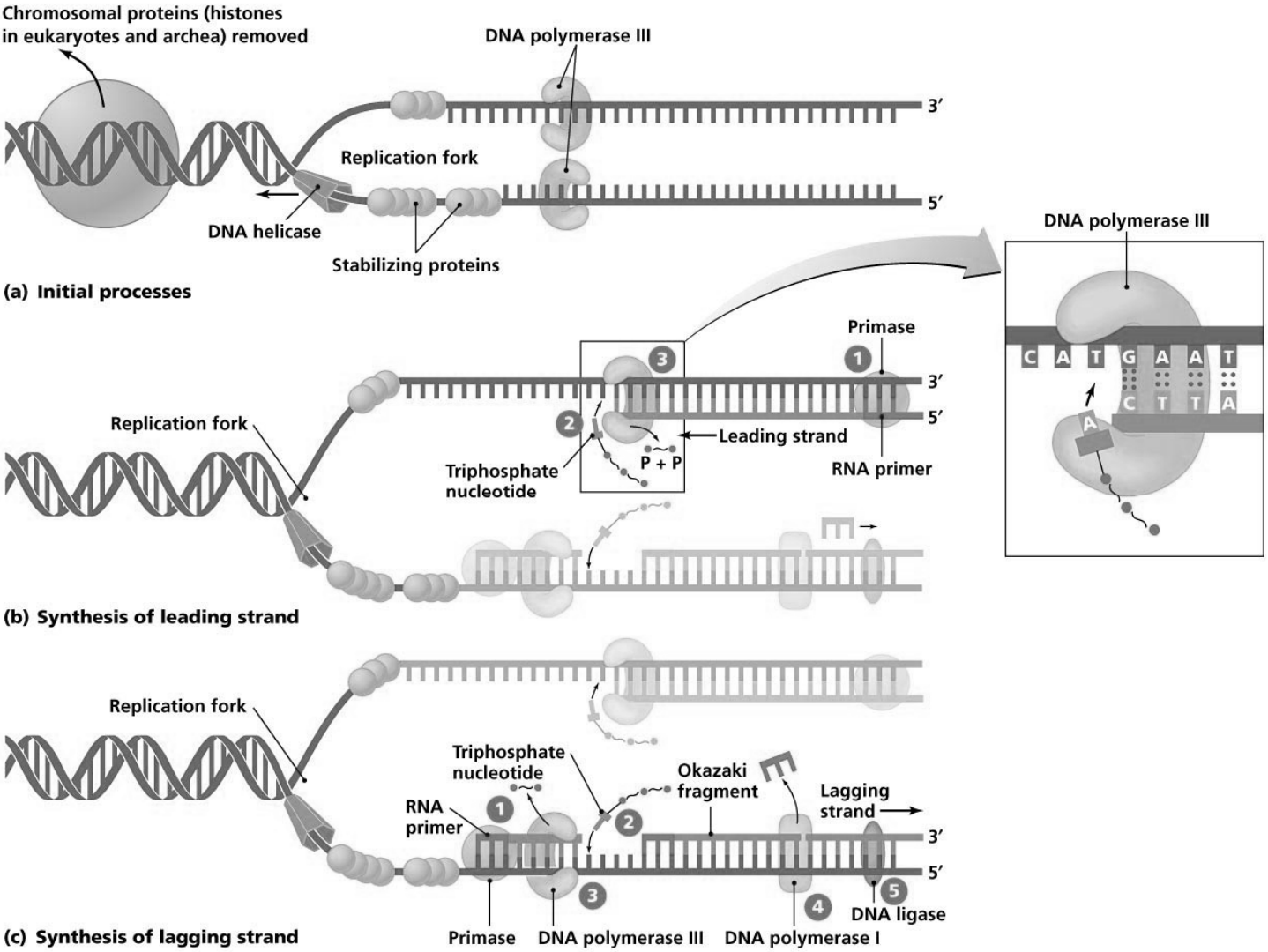
5. Making the Daughter Strands
    a. DNA _____ is an enzyme used to bring in loose nucleotides to match up to the parent strand.
        i. This enzyme can ONLY move in the 5' to 3' direction on the new strands so creating the daughter strands is differently for each half
        ii. Leading Strand: enzyme starts at the 3' end of the parent strand (which is the 5' end of the daughter strand) and places a matching nucleotide onto open piece of parent DNA
            - Label the leading strand and mark the end of the strand as 5' with sticky notes
            - Take a **PICTURE** of the enzyme as it adds each base
        iii. Lagging Strand: enzyme has to work backwards from the split to the end and as more parent DNA opens up, it goes back to creating the daughter strand in pieces (refered to as _____ fragments)
            - Label the lagging strand and mark the end of the strand as 3' with sticky notes
            - Take a **PICTURE** of the enzyme as it adds each base (show it making at least 2 fragments)

If you only unzipped a portion of the parent strand, as the daughter strands are being made you can continue to have the parent DNA being unzipped by the first enzyme.

        iv. DNA _____ is used to seal the backbone of the lagging strand fragments
            - Take a **PICTURE** of the enzyme connecting the backbone of the fragments together

6. Proofreading
    a. FYI (but doesn`t have to be included in the movie): the daughter strands are then proofread by another enzyme (another version of DNA polymerase) to check for errors and correct them if needed.
    b. If you want to demonstrate this in the video, feel free to so for BONUS MARKS
        i. Note: you will have to make an error in one daughter strand to show the process AND you will need to make or bring an additional enzyme to represent the "proof-reader"

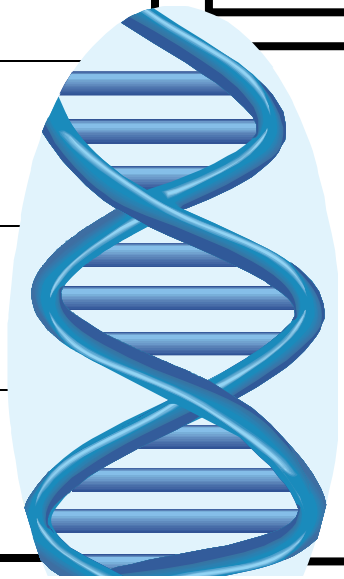
7. New DNA Created!
    a. Label the parent strands and the daughter strands
        i. DNA replication is referred to as being _____ as the new strands consist of one old and one new strand
    b. Take a **PICTURE** of the final product.
    c. Hold up the strands and twist them to demonstrate the double helix structure of DNA
        i. Have someone take a **PICTURE** of the two or three of you holding up the candy DNA
8. Finish the Movie
    a. Pull it all together into a polished product!
    b. Make sure that the video does not run too quickly.
        i. Lengthen the frame rate or duplicate the photos until it runs smoothly.
        ii. Video should be at least 45 seconds or it is probably running too fast to understand.



The Candy DNA Representatives…

Pentose Sugar				
Phosphate Group				
Nitrogenous Bases	Adenine	Thymine	Guanine	Cytosine
Bonds				
DNA Helicase				
DNA Polymerase				
DNA Ligase				

Nucleotide



Project Creators