Name: _____ **Date:** _____

Section: _____

DNA Replication Simulator Activity

DNA's Amazing Copy Machine

Phase 1: ENGAGE (5 minutes)

Getting Started: Open peebedu.com and navigate to DNA Replication Simulator

Watch the DNA spin in the introduction - click '`Unzip the Mystery!`'

The Mystery: Every time your body makes a new cell, it needs to copy all the DNA instructions. That's like copying 1,000 big books perfectly! How does your body do this without making mistakes?

_____

What You Know:

- DNA looks like a twisted _____
- DNA has 4 bases: A, T, G, C
- G always pairs with ___

Big Question: How would YOU copy a twisted ladder? Draw your idea:

[Space for drawing]

Phase 2: EXPLORE (18 minutes)

Using DNA's Copy Tools

Think of each enzyme as a special tool in a toolbox. Let's use them in order!

Tool 1: Topoisomerase (The Relaxer) Click this tool and then click the DNA

What happens? _____

It's like: Untangling string Cutting paper Mixing paint

Tool 2: Helicase (The Unzipper) Apply Helicase to the DNA

Watch carefully! The DNA: _____ Breaks apart completely Unzips down the middle Gets twisted more

The Y-shape is called a replication _____

Tool 3: Primase (The Starter) Click Primase and apply it

Look for pink rectangles labeled '`RNA`' How many on bottom strand? ___ How many on top strand? ___

These are like '`START HERE`' stickers!

Tool 4: DNA Polymerase (The Builder) Click DNA Polymerase

- First click the BOTTOM strand
- Then click the TOP strand

You should see two orange circles appear!

Building Time! Now YOU get to build DNA!

- Look for the glowing base
- Check what it needs (A needs T, G needs C)
- Drag the matching base from the pool

First match: Template ___ needs ___

Keep going! The bottom strand builds in one long piece. The top strand builds in small chunks. Weird, right? _____

Tool 5: Ligase (The Gluer) When building is done, apply Ligase

What does it do? _____ The small chunks were called Okazaki _____

Phase 3: EXPLAIN (12 minutes)

Understanding the DNA Copy Machine

Match the Tools: Draw lines to connect:

Tool Name: What It Does: _____

Topoisomerase • Glues pieces together Helicase • Unzips the DNA Primase • Relaxes twisted DNA DNA Polymerase • Adds starter tags Ligase • Builds new DNA

The Copy Process - Fill in the Blanks:

First, _____ relaxes the twisted DNA Then, _____ unzips it down the middle Next, _____ adds RNA primers as start points _____ builds the new DNA strands Finally, _____ glues any pieces together

The Pattern Discovery: Circle what you noticed:

- Both strands copy the same / differently
- One strand is continuous / in pieces
- The other strand is continuous / in pieces

This happens because DNA can only be built in one direction!

Draw It Out: Show the difference between the two strands:

Bottom strand: _____→ (one long arrow) Top strand: ←___ ←___ ←___ (multiple short arrows)

Phase 4: ELABORATE (10 minutes)

DNA Copying in Real Life

Think About It:

Copy Errors: What if DNA Polymerase puts in the wrong base? This is called a _____ Good or bad? _____

Speed Facts: Your cells copy DNA at 50 bases per second! To copy all your DNA takes about 8 hours.

Why don't you notice? _____

Medicine Connection: Some medicines stop bacteria from copying their DNA.

Which tool would you block? _____ Why would this kill bacteria? _____

Design Your Own:

If you were designing a DNA copy system:

- Would you copy both strands the same way? Yes / No
- What would you add for accuracy? _____

Phase 5: EVALUATE (5 minutes)

Check Your Understanding

Order the Steps: Put these in order (1-5): ___ Add primers ___ Join fragments ___ Relax DNA ___ Build new strands ___ Unzip DNA

True or False: _____ _____ _____ _____

Explain to a Friend:

Your friend asks: '`Why is DNA copying so complicated?`'

Your 2-sentence answer:

What If? What if Ligase stopped working? _____

Problem: _____

Effect on the cell: _____

Amazing Fact Check: I can name all 5 enzymes I understand why strands copy differently I successfully built DNA in the simulation

Wonder Question: If DNA copying is so complex, how did it evolve? Your thoughts: _____

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DNA Replication Dictionary:

- **Helicase:** The unzipper enzyme
- **Replication Fork:** Y-shaped opening in DNA
- **Okazaki Fragments:** Small DNA pieces on one strand
- **DNA Polymerase:** The building enzyme
- **Ligase:** The gluing enzyme

Key Vocabulary

See activity for vocabulary specific to this topic.