Name: **Date:** **Section:**

DNA Replication Simulator Activity: Modeling DNA Synthesis

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)

1. Click this tool and then click the DNA

What happens? _____

It's like: □ Untangling string □ Cutting paper □ Mixing paint

Tool 2: Helicase (The Unzipper)

1. 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)

1. 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)

1. Click DNA Polymerase

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

You should see two orange circles appear!

1. **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)

1. 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

1. **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

1. **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

1. **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!

1. **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:

1. **Copy Errors:**

What if DNA Polymerase puts in the wrong base?

This is called a _____

Good or bad? _____

1. **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? _____

1. **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

1. **Order the Steps:**

Put these in order (1-5):

___ Add primers

___ Join fragments

___ Relax DNA

___ Build new strands

___ Unzip DNA

1. **True or False:**

2. **Explain to a Friend:**

Your friend asks: "Why is DNA copying so complicated?"

Your 2-sentence answer:

3. **What If?**

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.