Name: _____ **Date:** _____

Section: _____

Glycogen Hydrolysis Activity

Breaking Down Glycogen: Energy Storage in Action

Phase 1: ENGAGE (5 minutes)

Getting Started: Open peebedu.com and navigate to Glycogen Hydrolysis Lab

Read the tutorial, then click '`Start Experimenting!`'

First Look: You're looking at glycogen - how animals store extra glucose for later use!

Initial Questions: How many glucose molecules can you count? _____ What connects them together? _____ Why might branching be useful? _____

Think About It: When you exercise, your body needs glucose quickly. How does glycogen's structure help? _____

Phase 2: EXPLORE (18 minutes)

Investigation 1: Breaking Bonds

Select the Hydrolyze tool and click on 5 different bonds.

Data Table:

Pattern Discovery (find 3): _____ _____ _____

Investigation 2: Harvesting Glucose

Use the Remove tool on free glucose molecules.

Observations:

- Can you remove bonded glucose? Yes / No

- What must happen first? _____

Investigation 3: Building New Molecules

Reset, then use the Dehydrate tool to create:

- 2 glucose-glucose bonds (maltose)
- 1 glucose-fructose bond (sucrose)
- 1 glucose-galactose bond (lactose)

Results:

- Water produced per bond: _____

- Connection to hydrolysis: _____

Phase 3: EXPLAIN (15 minutes)

Understanding the Chemistry

Hydrolysis = ‘`Water Splitting`‘ Draw what happens: _____ “‘ Bond + $H_2O \rightarrow$?

“‘ Your drawing: _____

Products: _____

Dehydration = ‘`Water Removal`‘ Draw what happens: _____ “‘ 2 Molecules $\rightarrow$?

“‘ Your drawing: _____

Products: _____

Energy Considerations:

- Breaking bonds requires: energy input / energy release
- Forming bonds involves: energy input / energy release

Biological Importance: Match the process to its purpose:

Glycogen $\rightarrow$ Glucose • • Store excess energy Glucose $\rightarrow$ Glycogen • • Provide quick energy Many branches • • Maintain blood sugar Liver glycogen • • Rapid breakdown

Phase 4: ELABORATE (10 minutes)

Real-World Applications

Marathon Running: Runners '`hit the wall`' when glycogen runs out.

Using the simulation, show:

- Full glycogen stores: _____ glucose units

- Why muscles feel weak: _____

Diabetes Connection: People with diabetes have trouble regulating glucose.

Model these scenarios:

- Too much glucose → Build: _____

- Why balance matters: _____

Compare Storage Methods:

- ——— _____ Highest Some

Design Challenge:

Create the most efficient glycogen structure for:

- Quick energy release

- Reasoning: _____

Phase 5: EVALUATE (7 minutes)

Check Your Understanding

Process Order: Number these steps for breaking down glycogen: ___ Water molecules break bonds ___ Free glucose enters bloodstream ___ Enzymes identify bonds ___ Glucose removed from storage

Concept Connections: True or False (circle):

- T / F: Hydrolysis uses water to break bonds
- T / F: All glucose must be free to be used
- T / F: Branching slows down breakdown
- T / F: Energy is stored in bonds

Problem Solving: An athlete needs quick energy. Which is faster? _____

Explain: _____

Data Analysis: If you start with 50 water molecules and end with 35:

- Bonds broken: _____

- Show your math: _____

Model Application: Your body stores about 500g of glycogen. If each glucose = 180g/mol:

- Approximate glucose molecules: _____

Reflection: How did manipulating molecules help you understand energy storage? _____

Plants store glucose as starch (less branched). Based on your observations, predict:

- Breakdown speed compared to glycogen: _____

- Disadvantage for animals: _____
- –

Key Vocabulary:

- **Glycogen:** Animal starch (glucose polymer)
- **Hydrolysis:** Breaking bonds with water
- **Dehydration Synthesis:** Forming bonds, releasing water
- **Polymer:** Large molecule of repeated units
- **Monomer:** Single unit (glucose)