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

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# Glycogen Hydrolysis Activity: Energy Storage and Release

## 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:**

1. How many glucose molecules can you count? _____
2. 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):**

1. _____
2. _____

**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**

1. **Hydrolysis = "Water Splitting"**



```

Bond + $H_2O$ → ?

```

Your drawing: _____

Products: _____

1. **Dehydration = "Water Removal"**



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2 Molecules → ?

```

Your drawing: _____

Products: _____

1. **Energy Considerations:**

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



1. **Biological Importance:**

Match the process to its purpose:

Glycogen → Glucose • • Store excess energy

Glucose → Glycogen • • Provide quick energy

Many branches • • Maintain blood sugar

Liver glycogen • • Rapid breakdown

## Phase 4: ELABORATE (10 minutes)

### Real-World Applications

1. **Marathon Running:**

Runners "hit the wall" when glycogen runs out.

Using the simulation, show:

- Full glycogen stores: _____ glucose units
- Why muscles feel weak: _____

1. **Diabetes Connection:**

People with diabetes have trouble regulating glucose.

Model these scenarios:

- Too much glucose → Build: _____
- Why balance matters: _____

1. **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**

1. **Process Order:**

Number these steps for breaking down glycogen:

___ Water molecules break bonds

___ Free glucose enters bloodstream

___ Enzymes identify bonds

___ Glucose removed from storage

1. **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

1. **Problem Solving:**

Explain: _____

1. **Data Analysis:**

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

- Bonds broken: _____
- Show your math: _____

1. **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: _____
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**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)