AP BIOLOGY · UNIT 1 · TOPIC 1.4

Carbohydrates

Learning objective 1.4.A Describe the structure and function of carbohydrates.

Name: Date: Period:

Use the tool **Linear or Branched**. Work on the **Grow a polysaccharide** tab for Parts 1 to 3, then switch to **Shape to job** for Part 4.

Part 1 · Predict, then check

All three of these polysaccharides are built from the same monomer. Before you press any preset, predict how many **free ends** each one will have at 24 monomers. Then press each preset and record what the tool reports.

Polysaccharide	Free ends I predict	Free ends actually	Branch points
Cellulose			
Starch			
Glycogen			

Part 2 · What never changes

Move the **Monomers** slider and the **Branching** slider to the settings below. At each setting, record the number of covalent bonds and the number of free ends the tool reports.

Monomers	Branching	Covalent bonds	Free ends
12	none		
12	high		
40	none		
40	high		

1. (a) Describe the pattern in the Covalent bonds column of the Part 2 table.

(b) State the relationship between the number of monomers and the number of covalent bonds.

Part 3 · Why the shape matters

Press Cellulose, then press Highlight free ends. Do the same for Glycogen, and compare the two structures.

2. (a) Identify the monomer from which all three polysaccharides are built.

(b) Identify the type of bond that joins these monomers.

3. Cellulose and glycogen contain the same monomer. Describe how their structures differ.

4. Using the free-end counts from the tool, explain why a highly branched polysaccharide can release glucose faster than a linear polysaccharide with the same number of monomers.

Part 4 · Structure to function

Switch to the **Shape to job** tab and work the cards. Then answer these on your own, in complete sentences.

5. (a) Describe the function of cellulose in a plant.

(b) Explain how the unbranched structure of cellulose suits this function.

6. A student claims that more branching always makes a polysaccharide better. Using both cellulose and glycogen as evidence, evaluate the student's claim.

What the model simplifies

Monomers are drawn as plain circles and bonds as plain lines. The CED states that the molecular structure of specific carbohydrate polymers is beyond the scope of the AP Exam, so this tool models only what is in scope: monomer, covalent bond, and whether the polymer is linear or branched.

Real branching is regular rather than random: glycogen branches roughly every eighth to twelfth glucose. The tool places branches with a random draw so the branching slider produces a visible trend.

Real polysaccharides run to thousands of monomers. The tool caps at 40 so the whole structure fits on screen. Free-end counts scale with size, so a real glycogen molecule has far more than the tool shows.