Molecule Mania

Name: _____ **Period:** _____ **Date:** _____

> Open **peebedu.com** and navigate to **Molecule Mania**. Click the **Let's Play!** button to begin. Read the introduction popup, which describes the four macromolecule categories you will sort: Lipids, Proteins, Carbohydrates, and Nucleic Acids.

Part 1 — Model Evaluation (MAPP Framework)

Scientific models are simplified representations of complex biological phenomena. Use the MAPP framework below to evaluate Molecule Mania as a scientific model.

M — Mode

What type of model is Molecule Mania? Describe how this computational simulation represents biological macromolecules. In your answer, identify at least three specific simulation elements and explain what each one is designed to show about molecular structure and classification.

A — Accuracy

(a) Identify two things this simulation represents **accurately** about biological macromolecules. For each, name the specific simulation feature and explain what property of macromolecules it demonstrates.

(b) Identify two things this simulation **oversimplifies or leaves out** about biological macromolecules. Consider what you cannot observe in the simulation that would be important for a complete understanding of how these molecules function in living systems.

P — Purpose

What is the learning goal of this simulation? Explain how Molecule Mania is designed to help you understand the structural characteristics that distinguish the four categories of biological macromolecules and connect molecular structure to biological function. In your answer, connect at least one specific simulation feature to why correctly identifying macromolecules matters for understanding living systems.

P — Permanency

Could this model change with new scientific evidence? Describe one way that new discoveries might change or improve a simulation like Molecule Mania. Explain why scientific models, including computational simulations, are revised as new evidence becomes available.

Small-Group Discussion

With your group, discuss the following:

- How does sorting molecules by structural features help you understand the relationship between a macromolecule's structure and its function?
- Why might the simulation include both monomers and polymers within the same macromolecule category?
- If you could add one feature to improve this simulation, what would it be and why?
- How does the simulation's use of simplified molecular diagrams compare to how scientists represent these molecules in research?

Part 2 — NGSS Questions

1.

> *Simulation Task: Click **Toggle Hints** to enable structural highlighting. Hover over **glucose** and note its ring structure and chemical formula ($C_6H_{12}O_6$). Then hover over **starch** and observe its repeating ring units. Sort both into the Carbohydrates category and click **Statistics** to check your accuracy.*

Explain how glucose molecules serve as monomers that link together to form the polymer starch. Describe the structural feature of glucose that allows many units to bond in a chain and explain why organisms store energy as starch or glycogen rather than as individual glucose molecules.

HS-LS1-6

2.

> *Simulation Task: Locate the **saturated fatty acid** and the **unsaturated fatty acid** in the molecule panel. Hover over each to read their descriptions and compare their structural diagrams. Notice the straight chain versus the kinked chain. Sort both into the Lipids category.*

Describe the structural difference between a saturated fatty acid and an unsaturated fatty acid as shown in the simulation. Explain how this difference in molecular shape affects how the fatty acid chains pack together and why this matters for the physical properties of fats and oils at room temperature.

HS-LS1-6

3.

> *Simulation Task: Hover over **glycine** (an amino acid) and observe its structural diagram, noting the amino group (NH_2), carboxyl group (COOH), and R group. Then hover over **catalase** (an enzyme) and read its description. Sort glycine into Proteins and catalase into Proteins as well.*

Explain how amino acid monomers like glycine are assembled into a protein polymer like catalase. Describe how the specific sequence and variety of amino acid R groups determines the shape of the final protein and why that shape is essential for the protein to carry out its function.

HS-LS1-6

4.

> *Simulation Task: Play through Level 1 and sort all six molecules. Hover over the **phospholipid** and note its formula ($C_{42}H_{82}NO_8P$). Then hover over **glucose** ($C_6H_{12}O_6$) and **glycine**. Compare which elements are present in each molecule from different categories.*

All four categories of macromolecules contain carbon, hydrogen, and oxygen. Identify which additional elements are found in proteins and nucleic acids but not in most carbohydrates and lipids. Explain why the presence of these additional elements is necessary for the specific functions those macromolecules perform in living systems.

HS-LS1-6

5.

> *Simulation Task: Click **Toggle Hints** to turn on structural highlighting, then advance to Level 2 or higher so that more molecules appear. Sort at least three molecules from different categories and observe the structural diagrams carefully. Click **Statistics** and compare your accuracy across the four categories.*

Choose two macromolecule categories and describe one key structural feature that helps you visually distinguish molecules in each category from the others in the simulation. Explain how the structure of each macromolecule type is related to its primary biological function.

HS-LS1-6

6.

> *Simulation Task: Hover over an **adenine nucleotide** in the Nucleic Acids category and examine its structural diagram. Note the three components visible: the phosphate group, the sugar (pentose ring), and the nitrogenous base. Then hover over **DNA** and observe how multiple nucleotides connect to form the double helix.*

In the box below, draw a labeled diagram of a single nucleotide. Include and label the three main components (phosphate group, sugar, and nitrogenous base). Then draw an arrow showing where the next nucleotide would attach to form a polymer chain.

Draw your diagram here.

HS-LS1-6

7.

> *Simulation Task: Click **Reset Progress** and play a full round. As you sort each molecule, read its educational fact by hovering over it. Pay attention to molecules that are described as energy sources (glucose, triglyceride, glycogen, starch) and molecules described as structural or functional (cellulose, phospholipid, catalase, DNA).*

Living organisms build macromolecules from smaller molecules obtained through food or the environment. Choose one macromolecule you sorted in the simulation and trace how an organism obtains the raw materials (monomers and elements) needed to construct it. Explain how matter is transferred from the environment into the organism and why the cycling of carbon and nitrogen through ecosystems is essential for organisms to build the macromolecules they need to survive.

HS-LS2-3