

Name: \_\_\_\_\_ Period: \_\_\_\_\_ Date: \_\_\_\_\_

Open [peebedu.com](http://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.

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### 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.

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**(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.

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## **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.

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## **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.

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## **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?

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## Part 2 – Free Response Questions

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### Conceptual Analysis

#### Question 1 – Lipid Structure and Function

*Simulation Task: Click the **Toggle Hints** button to enable structural highlighting. Locate the **saturated fatty acid** and the **unsaturated fatty acid** and hover over each to read their descriptions and chemical formulas. Sort both into the correct category. Then find the **phospholipid** and **cholesterol** and sort them as well. Click **Statistics** to check your Lipids accuracy.*

**(A)** (1 pt) **Describe** the structural difference between saturated and unsaturated fatty acids, including how the presence or absence of double bonds between carbon atoms affects the shape of the fatty acid chain.

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**(B)** (1 pt) **Explain** why the structural difference between saturated and unsaturated fatty acids causes them to have different physical properties at room temperature.

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**(C)** (1 pt) **Predict** how increasing the proportion of unsaturated fatty acids in an animal cell membrane would affect the membrane's fluidity at low temperatures.

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**(D)** (1 pt) **Justify** your prediction by explaining how the kinks introduced by double bonds in unsaturated fatty acid tails affect the arrangement of phospholipids within the lipid bilayer.

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## Analyze Model / Visual Representation

### Question 2 — Macromolecule Composition and Structure

*Simulation Task: Play through Level 1 and sort all six molecules into their correct categories. Hover over **glucose** and note its chemical formula. Then hover over the **phospholipid** and note its formula. Finally, hover over **glycine** (an amino acid) and observe its structural diagram, paying attention to which element groups are labeled. Compare the elements present across these three molecules from different categories.*

**(A)** (1 pt) **Describe** the elemental composition of biological macromolecules, including which elements are most prevalent and which additional elements are required for specific macromolecule types.

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**(B)** (1 pt) **Explain** the relationship between the elemental composition of a macromolecule and its classification into one of the four macromolecule categories, including why the presence of certain elements indicates a specific type of biological molecule.

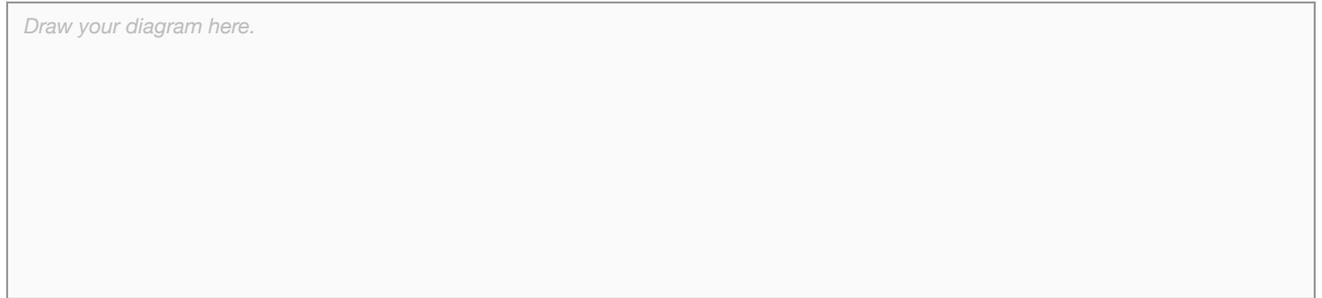
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**(C)** (1 pt) **Represent** the structural components of a nucleotide.

*Draw your diagram here.*



**(D)** (1 pt) **Explain** how the availability of elements required to build biological macromolecules functions as a limiting abiotic factor in ecosystems.

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