PEEBEDU

Cell Cycle Simulator

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

Open **peebedu.com** and navigate to **Cell Cycle Simulator**. Click **Begin Exploring** to dismiss the introduction popup. Read the Cell Cycle Stages Reference panel at the bottom of the screen, which describes each phase of interphase and mitosis. Place a starting cell, add nutrients, and press **Play** to watch a cell progress through the cycle.

Free Response Questions

Question 1 — Conceptual Analysis

Simulation Task: *In the simulator, set Cell Type to "Patient 1," Viability to "Viable," Starting Phase to "G1 Phase," and Cell Age to "Young (0%)." Place one starting cell, add nutrients using the "Concentric Circles" pattern, and press Play at 1x speed. Observe the cell as it progresses through each stage. After the first division occurs, increase the speed to 5x and let the simulation run until the population reaches at least 20 cells. Note the population graph and activity log.*

(A) (1 pt) **Describe** the events that occur during each stage of interphase and the process by which a eukaryotic cell divides its contents into two daughter cells.

(B) (1 pt) **Explain** why a population of cells with abundant nutrients grows exponentially, whereas the same population of cells without nutrients stops increasing in number even though the cells remain alive.

(C) (1 pt) **Predict** how a population of cells in a nutrient-rich environment where a density-dependent factor limits space would compare in growth rate to the same cells in an environment with unlimited space.

(D) (1 pt) **Justify** your prediction.

Question 2 — Analyze Model / Visual Representation

> **Simulation Task:** *Clear the simulation. Place one "Patient 1" viable cell and one "Cancer" cell side by side. Add nutrients and press Play at 5x speed. After 2 minutes of simulation time, click "Spray Colchicine" and observe what happens to both cell populations. Compare the population graph, the statistics panel, and the activity log for normal versus cancer cells.*

(A) (1 pt) **Describe** the role of regulatory proteins and checkpoints in controlling whether a cell progresses through the cell cycle or exits the cycle.

(B) (1 pt) **Explain** why cancer cells continue to divide under conditions where normal cells stop dividing or undergo programmed cell death.

(C) (1 pt) **Represent** the growth of a normal cell population and a cancer cell population over time by drawing a labeled graph with time on the x-axis and number of cells on the y-axis, showing both populations starting from the same initial number.

Draw your diagram here.

(D) (1 pt) **Explain** how a bacterial population repeatedly exposed to an antibiotic could develop resistance through natural selection, even though individual bacteria cannot become resistant within their lifetime.

4.6.B.1, 4.6.A.2