

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.

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

(C) (1 pt) **Predict** how the number of cells in G0 phase would compare between a crowded region of the petri dish and a sparsely populated region of the petri dish.

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

Question 2 — Analyze Model / Visual Representation

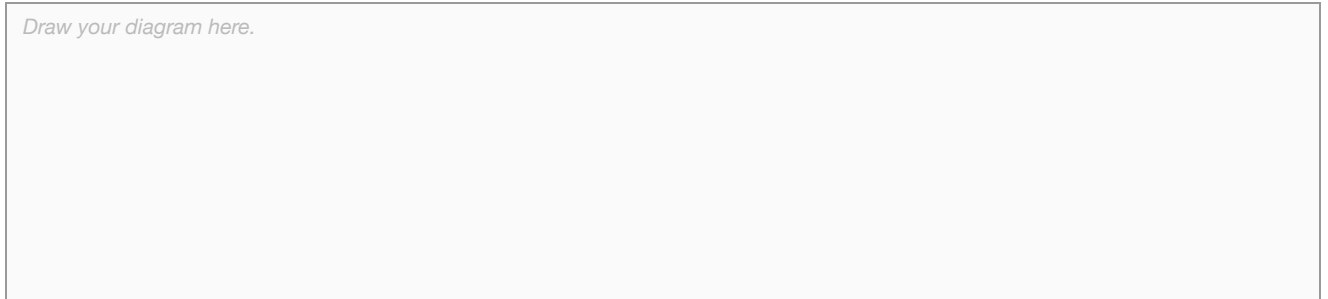
Simulation Task: Clear the simulation. With Cell Type set to "Patient 1" and Viability set to "Viable," place one starting cell. Change Cell Type to "Cancer" and place a second cell beside it. Add nutrients and press Play at 5x speed. Let the simulation run until the two populations differ clearly in size, then compare the population graph, the statistics panel, and the activity log for the normal versus the 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** why a cell that keeps increasing in volume without dividing becomes less efficient at exchanging materials with its environment.

4.6.A.1, 4.6.A.2, 4.6.B.1, 2.2.A.2