PEEBEDU

Cellular Energy and Thermodynamics

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

> Open **peebedu.com** and navigate to **Cellular Energy and Thermodynamics**. Click the **Start Exploring** button to begin. Read the introduction popup, which describes how cells use free energy to maintain order and how ATP couples exergonic and endergonic reactions.

Free Response Questions

Question 1 — Conceptual Analysis

> **Simulation Task:** *In the simulation, use the energy balance sliders to set cellular energy input to its maximum level and observe the cell. Then gradually reduce the energy input to zero and observe the cellular failure animation. Finally, use the restore energy feature to return the cell to its functioning state.*

(A) (1 pt) **Describe** the relationship between energy input and the level of organization maintained by a living cell.

(B) (1 pt) **Explain** why a cell's membranes, proteins, and ion gradients deteriorate when the cell's energy supply is completely removed.

(C) (1 pt) **Predict** what would happen to the internal organization of a cell if its rate of energy input dropped permanently below its rate of energy loss.

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

Question 2 — Analyze Model / Visual Representation

> **Simulation Task:** *Use the ATP Molecule Builder to build one ATP molecule from ADP and inorganic phosphate. Then break the ATP molecule and observe the energy released. Next, use the enzyme selection system to catalyze one step in the metabolic pathway and observe how the molecule counter tracks the energy transformation.*

(A) (1 pt) **Describe** the difference between reactions that release energy and reactions that require energy in terms of the direction of energy change.

(B) (1 pt) **Explain** how a cell uses the energy released by one reaction to drive a different reaction that would not occur on its own.

(C) (1 pt) **Represent** energy coupling by drawing a labeled diagram that shows an energy-releasing reaction providing the energy needed to synthesize ATP from ADP and inorganic phosphate, and ATP hydrolysis providing the energy to drive an energy-requiring cellular process.

Draw your diagram here.

(D) (1 pt) **Explain** how the enzymes that the simulation lets you select for each step of the metabolic pathway make the controlled, sequential transfer of energy through that pathway possible.

3.3.A.2, 3.3.A.3