PEEBEDU

Reaction Diagram Sandbox

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

> Open **peebedu.com** and navigate to **Reaction Diagram Sandbox**. Click the **Start Drawing** button to begin. Read the introduction popup, which describes two interaction modes (Move and Assign), drawing tools for building reaction pathways, and key features including real-time energy calculations and solution checking.

Free Response Questions

Question 1 — Conceptual Analysis

> **Simulation Task:** *Drag Molecule A and Molecule B onto the canvas and use Assign Mode to create the reaction A + B → C. Then drag Enzyme E1 onto the reaction arrow and click Run Simulation. Observe how the reaction rate changes with and without the enzyme present.*

(A) (1 pt) **Describe** the property of biological catalysts that allows chemical reactions in cells to proceed at rates compatible with life.

(B) (1 pt) **Explain** why the reaction A + B -> C proceeds faster when an enzyme is present than when it is absent, even though the overall energy change of the reaction is the same in both cases.

(C) (1 pt) **Predict** what would happen to the rate of an enzyme-catalyzed metabolic reaction in a cell if a signaling pathway activated by a hormone caused the cell to produce a molecule that binds to the enzyme's active site.

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

Question 2 — Analyze Model / Visual Representation

> **Simulation Task:** *Load the preset template "6 Molecules - Metabolic Cycle" and click Run Simulation. Observe how molecules flow through the pathway. Then use Assign Mode to add a negative feedback arrow from the final product back to an earlier step and run the simulation again to observe the change.*

(A) (1 pt) **Describe** why metabolic pathways in cells consist of many sequential small reactions rather than a single large reaction.

(B) (1 pt) **Explain** why a cell that cannot couple energy-releasing reactions to energy-requiring reactions loses its ability to maintain organized structures and carry out life processes.

(C) (1 pt) **Represent** a reaction energy diagram showing two coupled reactions -- one that releases energy and one that requires energy -- with labeled reactants, products, activation energy for each reaction, and arrows showing the direction of energy transfer.

Draw your diagram here.

(D) (1 pt) **Explain** how variation in the activation energy required by a key digestive enzyme among individuals in a population could lead to differences in competitive ability when food is scarce.

3.3.A.2, EK 3.1.A.1