KEY

AP Biology Enzymes and Metabolism

Assessment (Quiz) Study Guide

The following questions are designed to prepare you for your quiz. Please complete! Thank you.

1. What is an **enzyme**? How do they affect chemical reactions within cells? A PROTEIN THAT ACTS AS A CATALYST; THEY INCREASE RATE OF CHEMICAL RXNS.
2. Diagram an enzyme in the space to the right.
   Include the **active site** and **allosteric site**. In addition, describe the function of the active site.

   ACTIVE SITE - SITE OF CHEMICAL RXN

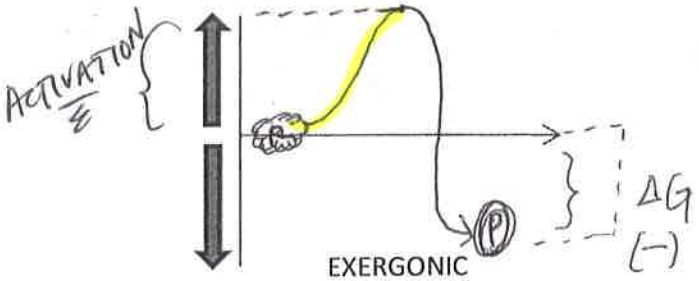
3. What is a **substrate**? Include a substrate on the diagram you drew above.
   REACTANT CONVERTED INTO A NEW PRODUCT(S) DURING AN ENZYME RXN.
4. What is an **inhibitor**? List two types of inhibitor molecules. Include diagrams of each above.
   A MOLECULE THAT STOPS THE ACTIVE SITE FROM WORKING. 1) COMPETITIVE 2) NONCOMPETITIVE
5. Enzyme inhibition is a critical part of cellular regulation. **List** and **describe** the following:
   Competitive inhibition, Noncompetitive inhibition, Irreversible inhibition, Feedback inhibition

   COMPETITIVE) OCCURS WHEN AN INHIBITOR BINDS TO THE ACTIVE SITE SO SUBSTRATE CAN NOT. THEREFORE, A REACTION CAN NOT OCCUR.

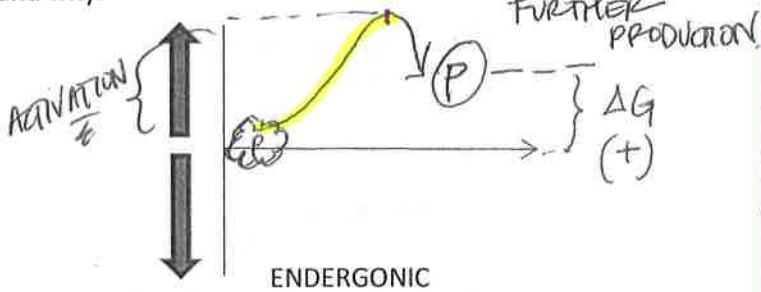
   NONCOMPETITIVE) AN ALLOSTERIC INHIBITOR BINDS TO AN ALLOSTERIC SITE, CHANGING SHAPE OF OVERALL ENZYME. THIS ALTERS THE ACTIVE SITE SO A SUBSTRATE CAN NOT BIND TO IT. THEREFORE, A RXN CAN NOT OCCUR.

   IRREVERSIBLE) AN INHIBITOR (COMPETITIVE OR NON) BINDS TO THE ACTIVE SITE / ALLOSTERIC SITE PERMANENTLY, SO ENZYME USELESS.

   FEEDBACK) A PRODUCT OF AN ENZYMATIC PATHWAY INHIBITS THE 1ST ENZYME IN A PATH, INHIBITING FURTHER PRODUCTION
6. Provide on the graphs below an **exergonic** reaction and **an endergonic** reaction. Include the reactant(s) and product(s). In addition, show the change in free energy and explain whether the change in free energy (ΔG)is positive or negative and why.



NEGATIVE b/c PRODUCTS STORE/CONTAIN LESS ΔG/ ENERGY THAN REACTANTS



POSITIVE b/c PRODUCTS STORE/CONTAIN MORE ΔG/ ENERGY THAN REACTANTS

7. Differentiate between **exergonic** and **endergonic** reactions. Which results in a negative (-) change in free energy? Which is positive (+)?

EXERGONIC RELEASE ENERGY; RESULTS IN A NEG (−) FREE ENERGY CHANGE

ENDERGONIC ABSORB ENERGY; RESULTS IN POS (+) FREE ENERGY CHANGE

8. On your graphs above, highlight the activation energy required to initiate both endergonic and exergonic reactions. Define **activation energy**: ENERGY REQUIRED TO START A RXN

9. What is an **anabolic** pathway? ONE IN WHICH ENERGY IS ABSORBED - USED IN SYNTHESIS

What is a **catabolic** pathway? ONE IN WHICH ENERGY IS RELEASED. - USED IN HYDROLYSIS / DIGESTION

How do these relate to endergonic and exergonic reactions?

ANABOLIC = ENDERGONIC CATABOLIC = EXERGONIC

10. In detail, describe feedback inhibition using the following visual: THIS IS AN ENZYMATIC PATH USED TO REGULATE

A ⟶ B ⟶ C ⟶ D ⟶ E

What is substance A?

A SUBSTRATE

What does substance E do?

INHIBITS THE FIRST ENZYME IN AN ALLOSTERIC PATHWAY, THUS SHUTTING DOWN FURTHER PRODUCTION OF E.

11. Define **energy.** Compare **potential** energy to **kinetic** energy.

ABILITY TO DO WORK

PE = STORED E

KE = ENERGY OF MOTION / MVMT.

12. Define **entropy**.

A SUM OF DISORDER OR CHAOS IN THE UNIVERSE

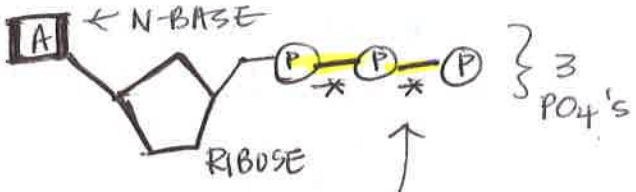
13. Define **energy coupling**. Which molecule in our cells is used in this process?

USING ENERGY FROM EXERGONIC RXNS TO DRIVE ENDERGONIC RXN's

14. Describe the structure and function of ATP.

Include a diagram in the space provided.

FUNCTION = ENERGY COUPLING IN CELLS



Where is the energy stored within this molecule? Highlight this on your diagram. *

PHOSPHATE BONDS BONDS BT THE TERMINAL (OUTER) (P) AND THE 2ND; BT THE 2ND/1ST

E = ENERGY!

15. Differentiate between **stable** and **nonstable** chemical reactions.

STABLE - MOLECULES RELEASE LESS FREE E, SO LESS WORK CAN BE DONE.

UNSTABLE - GREATER WORK CAPACITY BC MORE FREE E AVAILABLE

16. Are human cells considered open or closed systems? Explain.

OPEN BC WE REQUIRE OUTSIDE ENERGY TO KEEP OUR SYSTEM FUNCTIONAL & WE RELEASE OUTPUT INTO THE ENVIRONMENT

<u>You will have one short answer/essay question.</u>

Please focus on competitive and noncompetitive inhibition. How would you explain these regulatory mechanisms? What molecules are involved?